T. B. A. G.

`a (t)ext (b)ased (a)dventure (g)ame language`

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1 Introduction

1.1 Motivation and Background

Text-based adventure games were first introduced in the late 1970's, and while gameplay technology and graphics have evolved considerably since then, these games still remain popular and new ones are continuously being developed. These games may differ on some details, but many of them operate on similar principles - there is a map that a player explores which may contain different rooms, and the rooms may contain various non-player-characters and items with which the player can interact. As the player explores the world, he or she triggers different events. Because of these commonalities among different games, there is no doubt similarity in the development process. We propose developing TBAG, a language that makes it easy to build game elements and describe event-driven game logic.

1.2 Language Description

TBAG is designed to make text-based game creation a simple process. Developers who are familiar with the typical structure of a text-based RPG (role playing game) will find the structure of a TBAG program intuitive. As with most games modeling a roleplay structure, users can define the structures "Room," "Item" and "NPC" (non-player character) unique to their game, then populate those structures as they wish. Subsequent to the data setup portion of the program, the user can then create some global variables which they can reference later.

An event-driven system is the primary unique feature of our language. Event handling is expressed in our language via a series of predicates attached to handlers that will be executed if the associated predicate evaluates to true. This style of handling gameplay makes game development simple, as the actions to take simply depend on the truth values of the predicates. Within this model the user can use predefined functions to easily present choices to a player, change the state of the game, and implement logic such as moving between rooms with ease. The user can also define their own functions to be used within the event-driven component.

In the end product, the player sees the game evolving and their choices expanding or changing depending on their previous input. What drives the change of state behind the scenes is an event loop that is always checking the predicates and executing the handlers if their associated predicate evaluates to true. We envision that this language style will significantly speed up the time it takes for the user to create their own text-based adventure games.

1.3 Style

For the purposes of this report, we refer to the “user” as the programmer who uses the TBAG language. We refer to the “player” as the end user who would play a game written in the TBAG language.

2 Tutorial

2.1 Simple Data Types and Syntax

TBAG uses a simple C-like syntax with curly braces indicating scope, parentheses for expressions and argument passing, and semicolons ending statements. There are 3 primitive data types: ints, booleans, and strings. The complex data type for use in the TBAG language is an array. Below is a series of statements demonstrating how to use these data types:

```
int a = 0;
boolean honest = true;
string message = "hello";
int [10] i;
i[0] = a;
```

2.2 Simple Program Structure Example

Every TBAG game lives in a single .tbag file and must include at least one event handler. The example below is a simple GCD program written in TBAG:

```
int a = 8;
int b = 36;

a == b {
       print(a);
       endgame;
}

a > b {
       a = a - b;
}

a < b {
       b = b - a;
}
```

2.3 Complex Data Types and Program Structure Example

TBAG has the built-in structure of a Room, NPC, and Item. To use them, the user must first define each with fields. Subsequent instances of rooms, npcs, and items will only have access to those pre-defined fields. The “name” field is built into Rooms. Using rooms also requires that the user declares at least two rooms, an adjacency between them, and a start room. Items and NPCs are defined and declared similarly, with no such requirement for adjacency or start.

Some built-in functions and keywords allow for easy manipulation of Rooms in the event-driven model. The “currentRoom” keyword maps to the current room that the player finds themselves in. The “->” operator takes a room, and allows the Player to “go to” that room. The getInputFromOptions() function takes one or more strings that will display input options to the player. Finally, the “input” keyword is a reserved variable of type string that captures player choice. Here is an example program showing the more complicated program structure with a game using Rooms:

```
room {
        string description;
        boolean visited;
}

room Home {
        name = "Home";
        description = "My House";
        visited = false;
}

room Work {
        name = "Work"
        description = "My Work";
        visited = false;
}

Home <-> Work; /* specify adjacency */

start {Work}

boolean madeItHome = false;

currentRoom == Work {
        currentRoom.visited = true;
        print("Currently in: ");
        print(currentRoom.name);
        getInputFromOptions("Home");
        ->input
}
```

```
        currentRoom == Home {
                currentRoom.visited = true;
                print("Currently in: ");
                print(currentRoom.name);
                madeItHome = true;
        }

        madeItHome{
                print("Good job making it home!");
                endgame;
        }
```

2.4 Dealing with User Input

The getInputFromOptions function can be used to get input from the player. The general structure for calling the getInputFromOptions is as follows:

```
        getInputFromOptions("Closet", "LivingRoom");
```

At runtime, this function will prompts the user to enter “Closet” or “LivingRoom”. When a player enters acceptable input, that input is saved into the reserved variable input. If the user wishes to simply present all adjacent rooms as options, they may use the getInputAdjacentRooms function, which requires one argument:

```
        getInputAdjacentRooms(Room myRoom);
```

This will present the rooms adjacent to the myRoom as options and save their choice to the reserved variable input.

2.5 Compiling and Running a TBAG program

To compile and run a .tbag file, simply feed the file name as input to the “run_tbag.sh” script, as follows:

```
        ./run_tbag hello_world.tbag
```

The file will be compiled and the executable will be run.

2.6 Important Reminder

TBAG is a language for game development, so most importantly, remember to have fun!

3 Language Reference Manual

3.1 Lexical Elements

3.1.1 Identifiers

Identifiers are strings used for naming variables, functions, and instances of convenience structs (rooms, items, and NPCs). These identifiers are case sensitive. They can consist of letters, digits, and underscores, but should always start with a letter. These rules are described by the definitions involving regular expressions below:

identifier	:= (letter) (letter | digit | underscore)*
digit	:= ‘0’ - ‘9’
letter	:= uppercase_letter | lowercase_letter
uppercase_letter	:= ‘A’ - ‘Z’
lowercase_letter	:= ‘a’ - ‘z’

3.1.2 Keywords

These keywords are reserved for use in the language and cannot be used as identifiers. These keywords are case sensitive.

int	room	if	true	func
string	item	else	false	print
boolean	start	while	AND	endgame
void	npc	return	OR	currentRoom
	neg		NOT	

3.1.3 Literals

Literals are constant string, numeric, or boolean values, such as “hello”, 66, or false. Each literal is immutable and has a specific data type corresponding to one of the primitive types mentioned in the previous sentence. No type casting is allowed. Trying to assign a literal to a variable of mismatching type will cause an error.

3.1.3.1 String Literals

String literals are a sequence of zero or more non-double-quote characters and/or escaped characters, enclosed in double quotes.

An escaped character is a character that immediately follow a backslash '\'. The backslash signals to the compiler to interpret the escaped character in a special way, according to the following table:

Escape Sequence	Description
\"	Insert a double quote at this point.
\\	Insert a backslash at this point.
\n	Insert a newline at this point.
\t	Insert a tab at this point.
\r	Insert a carriage return at this point.
\b	Insert a backspace at this point.
\f	Insert a formfeed at this point.

Examples: "happy"; "I'm a sentence.\n This sentence will start on a new line."

3.1.3.2 Integer Literals

Integer literals are whole numbers represented by a sequence of one or more digits from 0-9. Integers are assumed to be in decimal (base 10) format. Precede an integer with "neg " to denote a negative number. Absence of the "neg" keyword denotes a positive integer.

Examples: 42; neg 666

3.1.3.3 Boolean Literals

A boolean literal represents a truth value and can have the value *true* or *false* (case sensitive).

Examples (exhaustive list): true; false

3.1.4 Operators

Operators are tokens that are utilized for performing actions on different elements. Common operations performed by such operators are addition, subtraction, and other mathematical processes. These will be discussed further in section 3.

Example: +

3.1.5 Delimiters

Delimiters are special tokens that:

1. separate other tokens
2. tell the compiler how to interpret associated tokens.

3.1.5.1 Parentheses and Braces

Parentheses are used to force evaluation of parts of a program in a specific order. They are also used to enclose arguments for a function.

3.1.5.2 Commas

Commas are used to separate function arguments.

3.1.5.3 Brackets

Brackets are used for array initialization, assignment, and access.

3.1.5.4 Semicolon

A semicolon is used to terminate a sequence of code.

3.1.5.5 Curly Braces

Curly braces are used to enclose function definitions, blocks of code (including predicate handlers), room/item/NPC struct definitions, room/item/NPC data, and the starting room. In general, blocks enclosed within curly braces do not need to be terminated with semicolons.

3.1.5.6 Periods

Periods are used for accessing fields of a room, item, or NPC.

3.1.6 Whitespace

Whitespace (unless used in a string literal) is used to separate tokens, but has no special meaning otherwise. List of whitespace characters: spaces, tabs, newlines, vertical tabs, and formfeed characters.

3.2 Data Types

TBAG is statically typed. The types of all variables are known at compile time and cannot be changed.

3.2.1 Primitive Data Types

3.2.1.1 int

These are 32-bit signed integers that can range from −2,147,483,648 to 2,147,483,647.

3.2.1.2 string

All text values will be of this type.

3.2.1.3 boolean

A truth value that can be either *true* or *false*.

3.2.1.4 void

Used only as a return type in a function definition; specifying void as the return type of a function means that the function does not return anything.

3.2.2 Non-Primitive Data Types

3.2.2.1 Arrays

Arrays are ordered, fixed-size lists that can be used to hold both primitive and non-primitive data-types. All elements of an array must be of the same type. An array must be initialized with its size.

3.2.2.1.1 Declaring Arrays

You can declare an array by indicating the type of the elements that the array will contain, followed by brackets enclosing the number of elements an array will hold, followed by an identifier for the array. For example:

```
int[5] myArray;
```

declares an array named myArray that can hold 5 integers.

3.2.2.1.2 Accessing and setting array elements

Array elements can be accessed by providing the desired index of the element in the array you wish to access enclosed within brackets next to the identifier of the array. For example:

```
myArray[1];
```

returns the element in myArray at index 1. Array elements can be set by accessing the element via the desired index in which to place the item and then assigning the desired value to the entry. For example:

```
myArray[1] = 4;
```

sets the element in myArray at index 1 to 4.

3.2.2.1.3 Array length

To get an array's length, simply call the arrLen function on the array. For example:

```
int size = arrLen(my_array);
```

3.2.2.2 Rooms

A room is a structure that represents a location in the game that the player can go to or be in.

3.2.2.2.1 Defining rooms

The structure of a room can differ from program to program, but must be the same within one .tbag file. It is defined in a TBAG program by a “room” keyword followed by a block of declarations that contain that room’s fields and the types of those fields, similar to struct declarations in C. A “name” field with type string is automatically defined for you by the compiler. Example for declaring room structure:

```
room {
        string description;
        boolean visited;
}
```

Note that if you wish to use rooms within your program, you must define a room structure. If you wish to have rooms with only *name* fields, you must still include a room definition, but you can leave it blank. For example:

```
room {}
```

means that all the rooms in this particular file will only include the automatically defined *name* field.

3.2.2.2.2 Initialization of data for rooms

To define data for a particular room, use a “room” keyword followed by a block of assignments to the fields defined in the room definition. For example, given the above room definition, this is how to create a room with identifier *home*, name “home”, description “My House”, and visited = false:

```
room home {
        name = "home";
        description = "My House";
        visited = false;
}
```

Repeat as needed to create additional rooms. Note that you could assign a value to the *name* field even though such a field was not declared in the example room definition in the previous section. This is because a *name* field is automatically defined by the compiler for you. Note that if you wish to use rooms in your program, you must have at least two rooms per TBAG file.

3.2.2.2.3 Setting adjacencies

You can specify that two rooms are adjacent. This does not mean that the player can only access room1's adjacent rooms if he/she is in room1. Declaring adjacencies are just a convenience for you so you can do things like present a room's adjacencies to the player as options.

To specify that two rooms are adjacent, use the "<->" operator like so:

```
room1 <-> room2;
```

This will specify that room1 is adjacent to room2.

Note that if you wish to use rooms in your program, you must define at least one adjacency relationship.

3.2.2.2.4 Moving between Rooms

To move between rooms, use the goto function (->). For example:

```
->livingRoom
```

would move a player to the previously defined livingRoom.

3.2.2.2.5 Identifying the currentRoom

The currentRoom keyword identifies the location of the player in the game. You can use this variable to determine the current room, e.g.:

```
currentRoom == livingRoom
```

However, currentRoom should not be used to assign the location (the go-to -> operator should be used for that instead).

3.2.2.2.6 Start location

Start declarations are required when a user incorporates rooms into their program. This start declaration, which comes immediately after the adjacency declarations, sets the location (currentRoom) of the player to start the game. To specify this start room, utilize the following syntax:

```
start {Home}
```

where “Home” is a room that has been declared previously in the program.

3.2.2.3 NPCs and Items

NPC stands for non-player character. Like a room, this is also a structure with fields that you can define, modify, and access. Including NPCs is optional. Like rooms and NPCs, items are structs that you can configure for your convenience. The item datatype serves the same purpose as the NPC: to define structs that hold data. Even though items and NPCs work the same way, they are different data types because they are conceptually separate, allowing you to neatly categorize data in your program.

3.2.2.3.1 Defining NPCs and Items

Define the structure of an NPC and Item the same way you define the structure of a room. With NPCs and items, however, no *name* field is automatically defined for you so you must define that yourself. Example NPC and item definition:

```
npc {
        string name;
        boolean friendly;
}

item {
        string name;
        int usefulness;
}
```

The above block of code means that NPCs in the program will have a string-typed *name* field and a boolean-typed *friendly* field. Items will have a string-typed *name* field and an integer-typed *usefulness* field.

3.2.2.3.2 Initialization of data for NPCs and Items

Defining data for an NPC and Item works the same way as defining data for a room, using the “npc” and “item” keywords instead of the “room” keyword.

```
	npc home {
		name = "Greg";
		friendly = false;
	}

	item wheelbarrow {
		name = "wheelbarrow";
		usefulness = 10;
	}
```

3.3 Expressions and Operators

3.3.1 Expressions

Expressions are made up of one or more operands and zero or more operators. Innermost expressions are evaluated first, as determined by grouping into parentheses, and operator precedence helps determine order of evaluation. Expressions are otherwise evaluated left to right.

3.3.2 Operators

The table below presents the language operators (including assignment operators, mathematical operators, logical operators, and comparison operators), descriptions, and associativity rules. Operator precedence is highest at the top and lowest at the bottom of the table.

Operator	Description	Associativity
.	Element Access	Left-to-Right
NOT	Logical Not	Right-to-Left
* /	Multiplication, division	Left-to-right
+ -	Addition, subtraction	
< <=	Inequality Operators: Less Than, Less Than Or Equal	
> >=	Inequality Operators: Greater Than, Greater Than Or Equal	
== != ~~	Equal, Non-Equal, String Equal	

AND	Logical And	
OR	Logical Or	
=	Assignment	Right-to-left

3.4 Statements

3.4.1 The if Statement

The if statement is used to execute a statement if a specified condition is met. If the specified condition is not met, the statement is skipped over. The general form of an if statement is as follows:

```
if (condition) {
        action1;
}
else {
        defaultaction;
}
```

“if” must be followed with “else,” although the else may have no statement associated with it:

```
if (condition) {
        action1;
}
        else {
}
```

3.4.2 The while Statement

The while statement is used to execute a block of code continuously in a loop until the specified condition is no longer met. If the condition is not met upon initially reaching the while loop, the code is never executed. The general structure of a while loop is as follows:

```
while (condition) {
     action1;
```

```
            action2;
            action3;
        }
```

3.5 Functions

3.5.1 Function Definitions

Function definitions consist of an initial keyword “func,” a return type, a function identifier, a set of parameters and their types, and then a block of code to execute when that function is called with the specified parameters. An example of an addition function definition is as follows:

```
        func int sum (int a, int b){
               return a + b;
        }
```

3.5.2 Calling Functions

A function can be called its identifier followed by its params in parentheses.
for example:

```
        sum(1, 2);
```

3.6 Program Structure and Scope

3.6.1 Program Structure

A TBAG program must live entirely within one source file.

The primary components of a TBAG program, in order, are

1. Import Library Statements
2. Room Definition
3. Room Declarations
4. Adjacency Declarations

5. Start Declaration
6. NPC Definition
7. NPC Declarations
8. Item Definition
9. Item Declarations
10. Global Variable Declarations
11. Event Driven Predicates and associated Handlers
12. Function Declarations

The language is set up in a way such that some of the primary components can be excluded and the program will still compile and run effectively. The 16 options for program structure are as follows, where each option lists the number associated with a primary component defined above:

All Components: 2,3,4,5,6,7,8,9,10,11,12
No Items: 2,3,4,5,6,7,10,11,12
No NPCs: 2,3,4,5,8,9,10,11,12
No Rooms: 6,7,8,9,10,11,12
No Items, No NPCs: 2,3,4,5,10,11,12
No Rooms, No Items: 6,7,10,11,12
No Rooms, No NPCs: 8,9,10,11,12
No Rooms, No NPCs, No Items: 10,11,12

And all of the above with and without import library statements (1).

This gives the user flexibility to use the language for all kinds of programs and games.

3.6.2 Event Driven System

The primary unique feature of the TBAG language is the event driven system, which is expressed using event handlers. Each handler consists of a predicate that evaluates to true or false, and an associated block of code that will run if the predicate evaluates to true. These event handlers will be continuously evaluated throughout gameplay in a loop. For example, in the handlers below:

```
currentRoom == livingRoom {
        print("welcome");
}

currentRoom == den {
        print("this does not print");
}
```

if the currentRoom were the livingRoom, the first predicate previous to the braces would be evaluated as true, and therefore the welcome message would be printed. However, the second predicate (currentRoom == den) would evaluated to false and therefore the message “this does not print” will not be printed.

Event andlers are evaluated based on the order they are defined in the program.

3.6.3 Ending the Game

There is only one way to terminate a program, and that is by specifying a location for the game to end within a handler of a predicate block. To do so, simply include the statement “endgame” where you wish to terminate the program. For example

```
currentRoom == finalRoom {
        endgame;
}
```

would end the game once the user enters the finalRoom.

3.6.4 Importing Libraries

Use the #import syntax at the top of a .tbag file to import TBAG libraries. A TBAG library is a file with extension .tbag that consists of a list of TBAG functions. To get access to a TBAG library’s functions, simply copy the library file to the lib/ folder if it’s not there already, then add the line “#import [libraryName]” to the top of any TBAG program that uses that library.

```
#import stdlib
#import typeConversionLib
```

The above syntax imports the stdlib library and the typeConversionLib library to the including file.

3.6.5 Scope

Any declarations made within the program that are not within one the block of an if statement, a while statement, and a function definition are available for reference any point later in the program. Declarations made within blocks of an if statement, a while statement, or a function definition are only available for reference within that block. Declarations are never visible to any code that comes before it in the program.

3.7 Built-in Functions

3.7.1 The print function

The print function can be used to print out strings, integers, and booleans to the command line. The general structure for calling the print function is as follows:

```
print("welcome to the jungle");
print(666);
```

Anything within the parentheses will be printed; it must be of type string, integer, or boolean. Note that if a user wishes to print on a new line, a new line must be explicitly specified.

3.7.2 The getInputFromOptions function

The getInputFromOptions function can be used to get input from the user. The general structure for calling the getInputFromOptions is as follows:

```
getInputFromOptions("Closet", "LivingRoom");
```

At runtime, this function will prompts the user to enter “Closet” or “LivingRoom”. When an acceptable input is entered, that input will be saved into the reserved variable input.

3.7.3 The getInputAdjacentRooms function

If the programmer wishes to simply present all adjacent rooms as options, they may utilize the getInputAdjacentRooms function, which requires a single room argument:

```
getInputAdjacentRooms(currentRoom);
```

This will present the rooms adjacent to the current room as options and save their choice to the reserved variable input.

3.7.4 The arrLen function

The arrLen function can be used find out how many elements are in an array. The general structure for calling the arrLen function is as follows:

```
int len;
int[3] a;
len = arrLen(a);                     /* len is now 3 */
```

The sole argument of arrLen() is an array.

3.8 Context Free Grammar

program	→	rdef rdecl_list adecl_list start ndef ndecl_list idef idecl_list vdecl_list predicate_list
fdecl_list EOF	→	rdef rdecl_list adecl_list start ndef ndecl_list vdecl_list predicate_list fdecl_list EOF
	→	rdef rdecl_list adecl_list start idef idecl_list vdecl_list predicate_list fdecl_list EOF
	→	rdef rdecl_list adecl_list start vdecl_list predicate_list fdecl_list EOF
	→	ndef ndecl_list idef idecl_list vdecl_list predicate_list fdecl_list EOF
	→	ndef ndecl_list vdecl_list predicate_list fdecl_list EOF
	→	idef idecl_list vdecl_list predicate_list fdecl_list EOF
	→	vdecl_list predicate_list fdecl_list EOF
data_type	→	INT
	→	STRING
	→	VOID
	→	BOOLEAN
pred_stmt	→	expr LBRACE vdecl_list stmt_list RBRACE
predicate_list	→	/* nothing */
	→	predicate_list pred_stmt
fdecl_list	→	/* nothing */
	→	fdecl_list fdecl
fdecl	→	FUNC data_type ID LPAREN formals_opt RPAREN LBRACE vdecl_list stmt_list RBRACE
formals_opt	→	/* nothing */
	→	formal_list
formal_list	→	data_type ID
	→	formal_list COMMA data_type ID
actuals_opt	→	/* nothing */
	→	actuals_list
actuals_list	→	expr
	→	actuals_list COMMA expr
vdecl_list	→	/* nothing */
	→	vdecl_list vdecl
vdecl	→	data_type LBRACK expr RBRACK ID SEMI
	→	data_type ID SEMI
	→	data_type ID ASSIGN expr SEMI
rdef	→	ROOM LBRACE vdecl_list RBRACE
rdecl_list	→	rdecl rdecl
	→	rdecl_list rdecl
rdecl	→	ROOM ID LBRACE stmt_list RBRACE
start	→	START LBRACE ID RBRACE
adecl_list	→	adecl
	→	adecl_list adecl
adecl	→	adj_list SEMI
adj_list	→	ID ADJ ID
ndef	→	NPC LBRACE vdecl_list RBRACE
ndecl_list	→	/* nothing */
	→	ndecl_list ndecl
ndecl	→	NPC ID LBRACE stmt_list RBRACE
idef	→	ITEM LBRACE vdecl_list RBRACE
idecl_list	→	/* nothing */

	→	idecl_list idecl
idecl	→	ITEM ID LBRACE stmt_list RBRACE
stmt_list	→	/* nothing */
	→	stmt_list stmt
stmt	→	expr SEMI
	→	RETURN expr SEMI
	→	LBRACE stmt_list RBRACE
	→	IF LPAREN expr RPAREN stmt ELSE stmt
	→	WHILE LPAREN expr RPAREN stmt
	→	GOTO ID
expr	→	INT_LITERAL
	→	NEG INT_LITERAL
	→	STRING_LITERAL
	→	END
	→	BOOL_LITERAL
	→	ID
	→	expr PLUS expr
	→	expr MINUS expr
	→	expr TIMES expr
	→	expr DIVIDE expr
	→	expr EQ expr
	→	expr STREQ expr
	→	expr NEQ expr
	→	expr LT expr
	→	expr LEQ expr
	→	expr GT expr
	→	expr GEQ expr
	→	expr AND expr
	→	expr OR expr
	→	NOT expr
	→	ID ASSIGN expr
	→	ID LBRACK expr RBRACK ASSIGN expr
	→	ID LBRACK expr RBRACK
	→	ID LPAREN actuals_opt RPAREN
	→	LPAREN expr RPAREN
	→	ID ACCESS ID

4 Project Plan

4.1 Process used for planning, specification, development and testing

Our team met once a week as a team with our T.A. Lixin to gauge progress and discuss next steps and milestones. We met on an as-needed basis at least once a week, with those who could attending meetings and contributing to parts as necessary. We used GroupMe to coordinate day-to-day logistics and Google Drive and Github as version control for code and working documents.

Generally we identified specific roadblocks towards the next concrete task ahead of time and assigned the least busy person to get a head start on that task. Then that person(s) would disseminate their code, progress made, and lessons learned to the rest of the group members. We made an effort to have discrete but concrete tasks for each member of the team at all times, rotating heavier tasks as necessary depending on schedules. In the case where a task required more than a single person to accomplish, we used pair programming so one person would type up the code and debug while the other would read through existing past projects or class resources for analogous examples.

On November 18, the project managers met to come up with a projected internal timeline for when components of the code base were due to keep everyone on track. Of course with so many components that were co-dependent, difficulties arose in finishing one before working on another. When roadblocks occurred, we met as a team to work through them together. As outlined in the timeline, most if not all projected dates were not met, but the planning that occurred prior to executing tasks helped immensely with workflow.

In early December, we changed TA's and had to drastically alter the direction of our project, which pushed back deliverables significantly. After meeting with Professor Edwards, we added the event-driven component to our game which would make the TBAG language more algorithmically interesting and unique. As a result, code gen was finished mid-December and semantic checking was not finished until nearly a week later.

In theory, each team member was to thoroughly test their code against the test suite before making any pushes upstream to master. Due to the burden of working on the semantic checker, it fell to project manager Julie to write the success tests for a majority of the features. This first test suite was used during writing the code generator, then passed to semantic checking. Then semantic checking must pass the tests before merging back to the master code base. When semantic checking was passing most success cases, a full suite of fail tests were added to specifically check more fine-tuned semantic checking. The full test suite was not completed until December 21.

4.2 Style Guide

The following outlines our style guide for OCaml, version control, Bash, and Java.

4.2.1 OCaml

- snake_case
- 4 space indentation
- 76 character limit lines (wrap beyond)
- comments included if logic is at all confusing
- pattern matching: no pipe for first case, pipe for all remaining cases
- “then” should follow “if” in same line
- “in” should follow “let” in same line
- newlines between function definitions
- explicitly write out types for function arguments

4.2.2 Version Control (Git)

- Branch from master when implementing new features
- Commit often to allow for easy rollback of work if necessary
- Rebase from master before merge
- When ready to merge, open pull request
    - Have someone else review your pull request
- Merge back into master, ensure tests still passing
- Create new branch to incorporate new features, delete old

4.2.3 Bash

- separate actions into discrete statements where possible
- one line per statement
- one space between each token

4.2.4 Java

In regards to generating Java code, we tried to follow standard Java coding conventions.

4.3 Project timeline

Date (actual)	Date (projected)	Description
Sep 16	Sep 14	Finalize team members
Sep 30	Sep 30	Submit project proposal
Oct 19	Oct 26	Produce LRM
Oct 24	Oct 20	Produce CFG
Oct 25	--	First commit, creation of project directory
Oct 26	Oct 26	Submit LRM and CFG
Nov 8	Nov 7	Develop Scanner and Parser (preliminary) for existing CFG
Nov 12	Nov 16	Hello World compiles, Hello World regression test complete
Dec 3	Dec 1	Switch TAs
Dec 8	Dec 9	Produce Java Target
Dec 9	Nov 23	Produce SAST (preliminary)
	Dec 11	Produce JAST/Code_gen
Dec 20	Dec 11	Produce SAST/semantic checker
Dec 21	Dec 9	Produce Full Test Suite
Dec 21	Dec 11	Produce Full Sample Test Demo
Dec 21	Dec 21	Final Report
Dec 22	Dec 22	Final Presentation

4.4 Roles and Responsibilities

Our group had a flat hierarchical structure until mid-November, when we divided up roles with Julie as Project Manager, Brian as System Architect, Gregory as Language Guru, Maria as Tester, and Iris as Project Manager/Tester. However throughout the course of the project we had to switch to different tasks depending on differing needs at that moment. The final roles and deliverables contributed to by each member are as follows.

Julie Chien
Project Manager, Tester

- Project planning
- Preprocessor
- Language/feature design - event-driven system, built in functions, libraries
- Java prototypes for what compiled output should look like
- Success tests and gameplay/input tests
- Demo games

Brian Slakter
System Architect, Language Guru

- Scanner, parser
- Code gen, java builder
- Final Report

Gregory Chen
System Architect, Language Guru

- Designing the AST and CFG
- Scanner, parser
- Code gen, java builder

Maria van Keulen
System Architect, Tester

- Test suite script modeling Edwards's for Micro C
- Semantic checker modeling Edwards's slides
- Fail test suite

Iris Zhang
System Architect, Project Manager

- Semantic checker modeling Edwards's slides
- Final Report
- Final Presentation

4.5 Software development environment used

- Languages: OCaml, Java (library)
- Programming Editor: Sublime, vim
- Version Control: Git, Github
- Documentation: Google Drive

4.6 Project log

4.6.1 Events Log

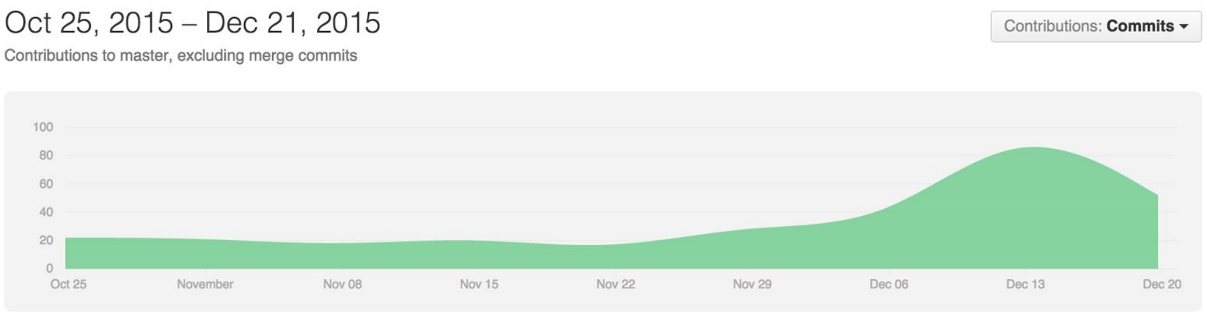
- September 16 - Met as group for the first time
- September 19 - Met as group with Edwards to discuss project idea
- September 20 - Met as group to discuss system architecture - finite state machine-based or action menu based
- September 21-30 - Develop project proposal
- October 19 - Brian writes LRM
- October 24 - Greg writes CFG
- November 8 - Greg writes Scanner and Parser for CFG
- November 12 - 17 - Brian writes basic code generation
- November 17 - Maria begins working on Test Suite
- November 17 - Julie begins working on Java Target Mockup
- November 17 - Iris begins working on Semantic Checker
- November 18 - Julie and Iris meet to discuss project plans, come up with project timeline and preliminary deadlines for team
- November 21 - Greg and Brian work on JAST
- November 23 - Greg and Brian met with Edwards, learned we were heading in the wrong direction and got suggestions for ways to improve our language and its complexity
- November 25 - Julie and Iris meet with Edwards to expanding our language idea, brainstormed new features
- November 27-28 - Julie developed ideas for event driven gameplay architecture, syntax, and implementation
- November 28 - Iris and Maria meet to work on semantic checker
- November 29 - Julie met with Edwards to get feedback on and further develop event driven gameplay design
- November 29 - Met as group to plan implementation of event-driven gameplay
- December 1 - Simple predicate / handler syntax
- December 3 - Team met with new TA David Arthur to get help with semantic analyzer and other implementation details
- December 3 - 14 - Language specific code generation (Brian and Greg)

- December 10 - 21 - Semantic Checker (Iris and Maria)
- December 14 - 16 - Julie writes success tests
- December 16 - Standard library started
- December 17 - 18 - LRM Revision
- December 20 - Julie implemented #import to import external .tbag libraries
- December 19 - 21 - Demo build, final report, bug fixes
- December 22 - Presentation

4.6.2 Git Commit History

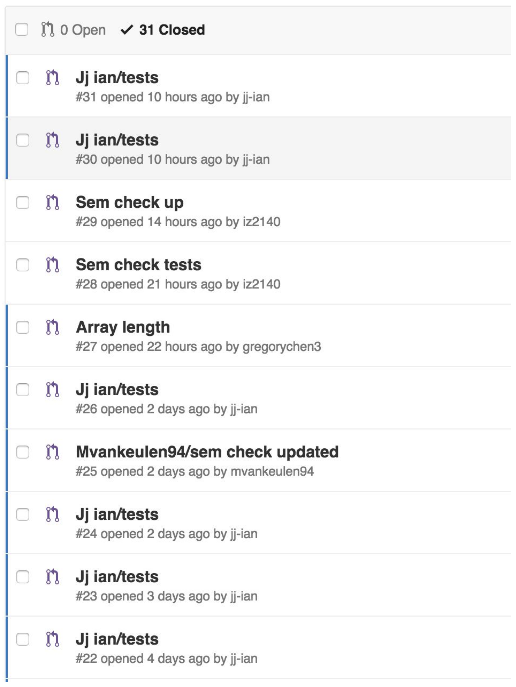
The team's Git handles:

- Julie: jj-ian
- Maria: mvankeulen94
- Greg: gregorychen3
- Iris: iz2140
- Brian: bslakter



The full commit history is included as Appendix 2.

4.6.3 Git Merge with Master History


0 Open ✓ 31 Closed

Jj ian/tests
#31 opened 10 hours ago by jj-ian

Jj ian/tests
#30 opened 10 hours ago by jj-ian

Sem check up
#29 opened 14 hours ago by iz2140

Sem check tests
#28 opened 21 hours ago by iz2140

Array length
#27 opened 22 hours ago by gregorychen3

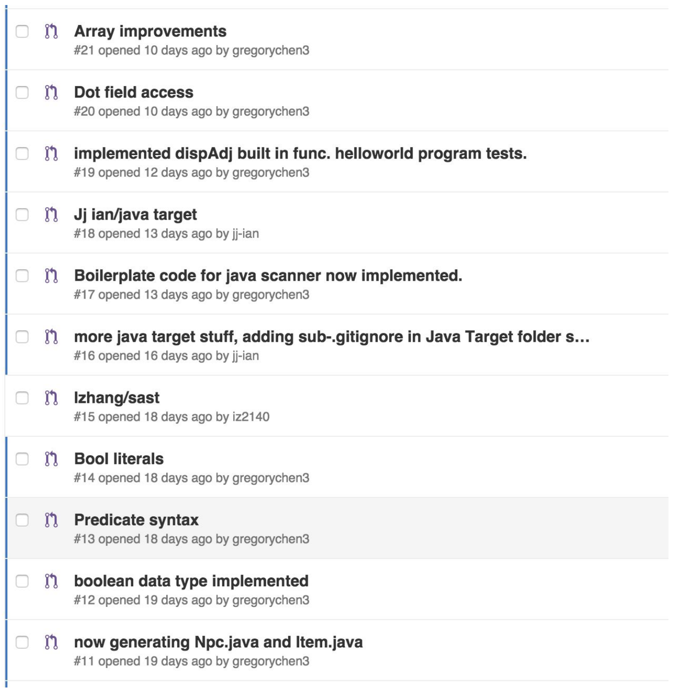
Jj ian/tests
#26 opened 2 days ago by jj-ian

Mvankeulen94/sem check updated
#25 opened 2 days ago by mvankeulen94

Jj ian/tests
#24 opened 2 days ago by jj-ian

Jj ian/tests
#23 opened 3 days ago by jj-ian

Jj ian/tests
#22 opened 4 days ago by jj-ian


Array improvements
#21 opened 10 days ago by gregorychen3

Dot field access
#20 opened 10 days ago by gregorychen3

implemented dispAdj built in func. helloworld program tests.
#19 opened 12 days ago by gregorychen3

Jj ian/java target
#18 opened 13 days ago by jj-ian

Boilerplate code for java scanner now implemented.
#17 opened 13 days ago by gregorychen3

more java target stuff, adding sub-.gitignore in Java Target folder s…
#16 opened 16 days ago by jj-ian

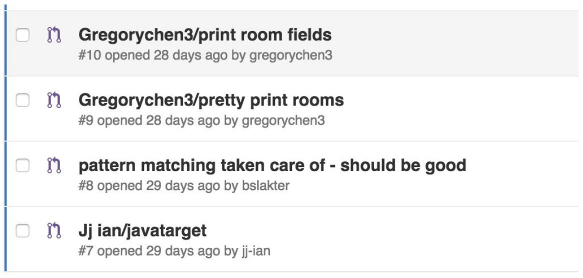
Izhang/sast
#15 opened 18 days ago by iz2140

Bool literals
#14 opened 18 days ago by gregorychen3

Predicate syntax
#13 opened 18 days ago by gregorychen3

boolean data type implemented
#12 opened 19 days ago by gregorychen3

now generating Npc.java and Item.java
#11 opened 19 days ago by gregorychen3

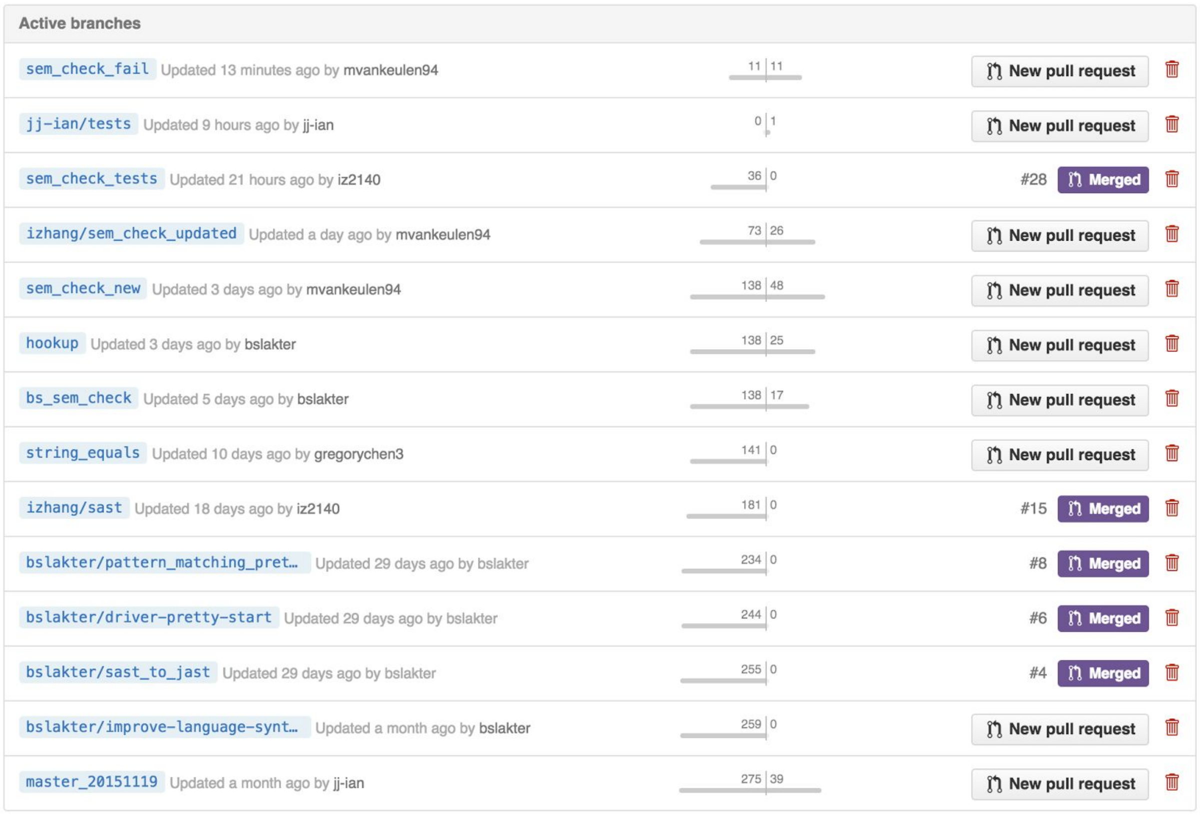

Gregorychen3/print room fields
#10 opened 28 days ago by gregorychen3

Gregorychen3/pretty print rooms
#9 opened 28 days ago by gregorychen3

pattern matching taken care of - should be good
#8 opened 29 days ago by bslakter

Jj ian/javatarget
#7 opened 29 days ago by jj-ian

4.6.4. Active Branches (as of December 21)



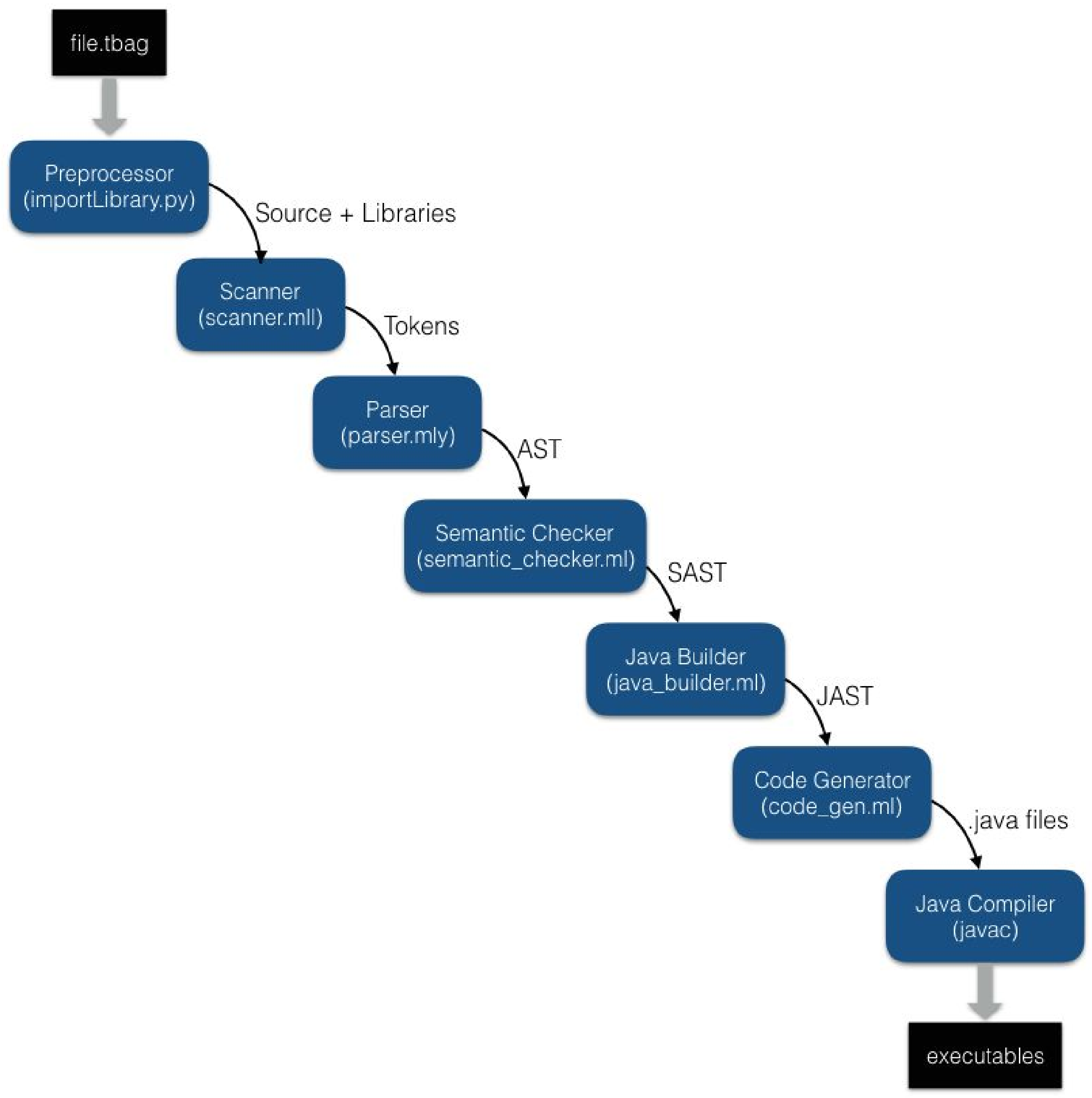
Active branches

sem_check_fail	Updated 13 minutes ago by mvankeulen94	11	11	New pull request
jj-ian/tests	Updated 9 hours ago by jj-ian	0	1	New pull request
sem_check_tests	Updated 21 hours ago by iz2140	36	0	#28 Merged
izhang/sem_check_updated	Updated a day ago by mvankeulen94	73	26	New pull request
sem_check_new	Updated 3 days ago by mvankeulen94	138	48	New pull request
hookup	Updated 3 days ago by bslakter	138	25	New pull request
bs_sem_check	Updated 5 days ago by bslakter	138	17	New pull request
string_equals	Updated 10 days ago by gregorychen3	141	0	New pull request
izhang/sast	Updated 18 days ago by iz2140	181	0	#15 Merged
bslakter/pattern_matching_pret…	Updated 29 days ago by bslakter	234	0	#8 Merged
bslakter/driver-pretty-start	Updated 29 days ago by bslakter	244	0	#6 Merged
bslakter/sast_to_jast	Updated 29 days ago by bslakter	255	0	#4 Merged
bslakter/improve-language-synt…	Updated a month ago by bslakter	259	0	New pull request
master_20151119	Updated a month ago by jj-ian	275	39	New pull request

5 Architectural Design

5.1 Overview

The TBAG compiler takes a .tbag file and feeds it through a series of steps that eventually converts this source code to compiled Java code. The end-to-end process, including running the resulting executables, can be performed in one step using the "run_tbag.sh" script, passing the tbag file created by the user as the one input to this script. Below is a diagram depicting this process, the details of which we will discuss further in the next few sections.


file.tbag
Preprocessor (importLibrary.py)
Source + Libraries
Scanner (scanner.mll)
Tokens
Parser (parser.mly)
AST
Semantic Checker (semantic_checker.ml)
SAST
Java Builder (java_builder.ml)
JAST
Code Generator (code_gen.ml)
.java files
Java Compiler (javac)
executables

5.2 Preprocessor

The preprocessor looks for #import [libraryName] statements in the .tbag file and copies the specified libraries into the functions section of a copy of the original .tbag file. The resultant file is then fed to the compiler.

Contributions from Julie.

5.3 Scanner

The scanner is responsible for reading in the tbag file and decomposing the full text of the source code into a series of prespecified tokens. The scanner continues to read input until it has recognized that a full token has been entered, and passes these token through to the parser. This reduces the work of the parser to simply understanding the structure of a program from tokens rather than a mass of source code.

Contributions from full team.

5.4 Parser

The parser receives tokens as input from the scanner. From these tokens, the parser will construct an Abstract Syntax Tree - a high-level representation of the program as a whole. Different subtrees within the overall AST will represent different components of the program, such as a function definition, variable declarations, etc. The grouping of tokens into these subtrees is defined by the CFG represented in the parser. The parser passes this constructed abstract syntax tree through to the next stage of compilation - the semantic checker.

Contributions from full team.

5.5 Semantic Checker

The semantic checker receives an abstract syntax tree as input from the parser. The semantic checker is a very important step in the compilation process, as it ensures that the program is correct beyond simple syntax check. The semantic checker walks through the syntax tree and confirms that the semantics of the program are correct. This step ensures that there are no type mismatch issues, references to undeclared variables or functions, and no issues with referencing elements out of scope. This step also checks the logic of the more TBAG-specific elements. For example, if a user defines a Room and its fields, the semantic checker will ensure that all these fields are initialized within declarations of room instances. The compilation process will only continue if the semantic checker has traversed the entire AST without recognizing any semantic errors. Otherwise, an error will be thrown informing the user of their mistake, and further compilation will halt.

Contributions from Iris, Maria.

5.6 Java Builder

The java builder receives a semantically checked abstract syntax tree as input from the semantic checker. Because the general structure of the .tbag program is different from that of the corresponding java program, this step takes the different components of the TBAG program and rearranges them in a way such that the subsequent step of code generation is a simple process. For example, room, item, and NPC definitions are separated out as these will become separate java classes. All other code is grouped into the Driver.java class, from which the program will be run. The room, item, and NPC declarations will be grouped with the event-driven portion as these will both end up in the main method of the Driver class. The newly organized Java Abstract Syntax Tree is then passed through to the code_gen to produce java code.

Contributions from Brian, Greg.

5.7 Code Generator

The code generator receives a java abstract syntax tree as input from the java builder. This step will produce 4 distinct classes. The room definition logic is used to create the Room.java class, NPC defintion logic is used to build the Npc.java class, and the item definition logic is used to create the Item.java class. All other portions of the program will be placed in the main class, Driver.java. The generation of code for Driver.java is broken down into 3 main parts: creation of global variables, creation of the main method, and creation of additional functions that may be called by statements within the main method. The main method is created by declaring instances of the user-defined rooms, adjacencies, start location, items, NPCs, and placing the event-driven logic into a while loop. Some additional library functions are also placed below the user-defined functions to allow for use of these functions in the main class as well. From this code generation step, we output these 4 java files that will then be compiled via the java compiler, and then the Driver may be executed to begin gameplay.

Contributions from Brian, Greg.

6 Testing

6.1 Representative Language Programs

6.1.1 GCD

6.1.1.1 GCD Source

```
int a = 8;
int b = 36;

a == b {
        print(a);
        endgame;
}

a > b {
        a = a - b;
}

a < b {
        b = b - a;
}
```

6.1.1.2 GCD Target

```
import java.util.*;

public class Driver {

        public static Scanner scanner;
        public static Room currentRoom;
        public static String input = "";
        public static HashMap<String, Room> roomMap = new HashMap<String, Room>();
        public static int b = 8;
        public static int a = 36;
        public static void main(String[] args) {
                scanner = new Scanner(System.in);
                currentRoom = null;
                while (true) {
                        if(a==b){
                                System.out.print(a);
                                break;
                        }
                        if(a>b){
                                a = a-b;
                        }
                        if(a<b){
                                b = b-a;
                        }
                }
                scanner.close();
        }
        // this is what happens when u do player->room
        public static void movePlayerToRoom(Object room) {
                if (room instanceof Room) {
                        currentRoom = (Room) room;
                }
                else {
                        Room update = roomMap.get(room);
                        currentRoom = update;
                }

        }

        // Prompts player for input and sets global var "input" to whatever player submitted,
provided it's a valid input.
        // If invalid inputs are entered, it'll reprompt until player enters a valid input.

        // Arguments:
        // String[] acceptableInputs -- the list of acceptable inputs
        public static void promptForInput(String[] acceptableInputs) {
                System.out.println("Choose from one of the following options:");
                for (String option : acceptableInputs) {
                        System.out.print(option + "     ");
                }
                System.out.println();
                // loop until player enters valid input

                input = scanner.nextLine();
                System.out.println("Input: " + input);
                while(!Arrays.asList(acceptableInputs).contains(input)) {
                        System.out.println("Invalid Input. Try again.");
                        input = scanner.nextLine();
                        System.out.println("Input: " + input);

                }
                System.out.println();
                System.out.println();

        }

        // Gets all the adjacencies for the room entered as argument and displays these
adjacencies to player.
        // Prompts player for input and sets global var "input" to whatever player submitted,
provided it's a valid adjacency.
        // If invalid inputs are entered, it'll reprompt until player enters a valid input.
        // pretty much exactly same as promptForInputs(), except it takes in a room as an
argument instead of a list of strings
        public static void getInputAdjacentRooms(Room room) {
                String[] acceptableInputs = new String[room.adjRooms.size()];
                int i = 0;
                for(Room r : room.adjRooms) {
                        acceptableInputs[i] = r.name;
                        i++;
                }

                System.out.println("Choose from one of the following options:");
                for (String option : acceptableInputs) {
                        System.out.print(option + "     ");
                }
                System.out.println();
                // loop until player enters valid input
                input = scanner.nextLine();
                System.out.println("Input: " + input);
                while(!Arrays.asList(acceptableInputs).contains(input)) {
                       System.out.println("Invalid Input. Try again.");
                       input = scanner.nextLine();
                       System.out.println("Input: " + input);

                }
                System.out.println();
                System.out.println();
       }
}
```

Note that the Java target code has been indented for readability; the actual compiler output is not so nicely indented.

6.1.2 Mini-game

6.1.2.1 Mini-game Source

```
#import stdlib
#import typeConversionLib

room {}

room Closet { name = "Closet"; }
room Bedroom { name = "Bedroom"; }
room Wall {    name = "Wall"; }
room Kitchen { name = "Kitchen"; }

Closet <-> Bedroom;
Closet <-> Wall;
Kitchen <-> Wall;
Kitchen <-> Bedroom;

start { Closet }

npc { string roomName; }

npc Cat { roomName = "Bedroom"; }

item { string roomName; }

item Cheese { roomName = "Kitchen"; }

boolean started = false;
boolean cheeseEaten = false;

NOT started {
       strPrintLine("You're a mouse.");
       started = true;
}

true {
       printCurrentRoomInfo();
       getInputAdjacentRooms(currentRoom);
```

```
        ->input
}

currentRoom.name ~~ Cat.roomName {
        print("You got eaten by the cat.");
        endgame;
}

currentRoom.name ~~ Cheese.roomName AND NOT cheeseEaten {
        print("Nice!! You ate the cheese!");
        cheeseEaten = true;
}

func void printCurrentRoomInfo() {
        print("Currently in: ");
        print(currentRoom.name);
        print("\n");
}
```

6.1.2.2 Mini-game Target

```
import java.util.*;

public class Driver {

        public static Scanner scanner;
        public static Room currentRoom;
        public static String input = "";
        public static HashMap<String, Room> roomMap = new HashMap<String, Room>();
        public static boolean cheeseEaten = false;
        public static boolean started = false;
        public static void main(String[] args) {
                scanner = new Scanner(System.in);
                Room Kitchen = new Room();
                roomMap.put("Kitchen", Kitchen);
                Kitchen.name = "Kitchen";

                Room Wall = new Room();
                roomMap.put("Wall", Wall);
                Wall.name = "Wall";

                Room Closet = new Room();
                roomMap.put("Closet", Closet);
                Closet.name = "Closet";

                Room Bedroom = new Room();
                roomMap.put("Bedroom", Bedroom);
                Bedroom.name = "Bedroom";

                Bedroom.setAdjacent(Kitchen);
                Wall.setAdjacent(Kitchen);
                Wall.setAdjacent(Closet);
                Bedroom.setAdjacent(Closet);
                currentRoom = Closet;
                Npc Cat = new Npc();
                Cat.roomName = "Bedroom";

                Item Cheese = new Item();
                Cheese.roomName = "Kitchen";

                while (true) {
                       if(!started){
                              strPrintLine("You're a mouse.");
                              started = true;
                       }
                       if(true){
                              printCurrentRoomInfo();
                              getInputAdjacentRooms(currentRoom);
                              movePlayerToRoom(input);
                       }
                       if(currentRoom.name.equals(Cat.roomName)){
                              System.out.print("You got eaten by the cat.");
                              break;
                       }
                       if(currentRoom.name.equals(Cheese.roomName)&&!cheeseEaten){
                              System.out.print("Nice!! You ate the cheese!");
                              cheeseEaten = true;
                       }
                }
                scanner.close();
        }

        public static void intPrintLine(int a){
                System.out.print(a);
                System.out.print("\n");
        }
        public static void strPrintLine(String s){
                System.out.print(s);
                System.out.print("\n");
        }
        public static void boolPrintLine(boolean b){
                System.out.print(b);
                System.out.print("\n");
        }
        public static int intFromLetter(String letter){
                if (letter.equals("A")) {return 0;
                }else{}if (letter.equals("B")) {return 1;
                }else{}if (letter.equals("C")) {return 2;
                }else{}if (letter.equals("D")) {return 3;
                }else{}if (letter.equals("E")) {return 4;
                }else{}if (letter.equals("F")) {return 5;
                }else{}if (letter.equals("G")) {return 6;
                }else{}if (letter.equals("H")) {return 7;
                }else{}if (letter.equals("I")) {return 8;
                }else{}if (letter.equals("J")) {return 9;
                }else{}if (letter.equals("K")) {return 10;
                }else{}if (letter.equals("L")) {return 11;
                }else{}if (letter.equals("M")) {return 12;
                }else{}if (letter.equals("N")) {return 13;
                }else{}if (letter.equals("O")) {return 14;
                }else{}if (letter.equals("P")) {return 15;
                }else{}if (letter.equals("Q")) {return 16;
                }else{}if (letter.equals("R")) {return 17;
```

```
		}else{}if (letter.equals("S")) {return 18;
		}else{}if (letter.equals("T")) {return 19;
		}else{}if (letter.equals("U")) {return 20;
		}else{}if (letter.equals("V")) {return 21;
		}else{}if (letter.equals("W")) {return 22;
		}else{}if (letter.equals("X")) {return 23;
		}else{}if (letter.equals("Y")) {return 24;
		}else{}if (letter.equals("Z")) {return 25;
		}else{}return -1;
	}
	public static String letterFromInt(int i){
		if (i==0) {return "A";
		}else{}if (i==1) {return "B";
		}else{}if (i==2) {return "C";
		}else{}if (i==3) {return "D";
		}else{}if (i==4) {return "E";
		}else{}if (i==5) {return "F";
		}else{}if (i==6) {return "G";
		}else{}if (i==7) {return "H";
		}else{}if (i==8) {return "I";
		}else{}if (i==9) {return "J";
		}else{}if (i==10) {return "K";
		}else{}if (i==11) {return "L";
		}else{}if (i==12) {return "M";
		}else{}if (i==13) {return "N";
		}else{}if (i==14) {return "O";
		}else{}if (i==15) {return "P";
		}else{}if (i==16) {return "Q";
		}else{}if (i==17) {return "R";
		}else{}if (i==18) {return "S";
		}else{}if (i==19) {return "T";
		}else{}if (i==20) {return "U";
		}else{}if (i==21) {return "V";
		}else{}if (i==22) {return "W";
		}else{}if (i==23) {return "X";
		}else{}if (i==24) {return "Y";
		}else{}if (i==25) {return "Z";
		}else{}return "_";
	}

	public static void printCurrentRoomInfo(){
		System.out.print("Currently in: ");
		System.out.print(currentRoom.name);
		System.out.print("\n");
	}

		// this is what happens when u do player->room
	public static void movePlayerToRoom(Object room) {
		if (room instanceof Room) {
			currentRoom = (Room) room;
		}
		else {
			Room update = roomMap.get(room);
			currentRoom = update;
		}

	}

		// Prompts player for input and sets global var "input" to whatever player
submitted, provided it's a valid input.
```

```
		// If invalid inputs are entered, it'll reprompt until player enters a valid
input.

		// Arguments:
		// String[] acceptableInputs -- the list of acceptable inputs
	public static void promptForInput(String[] acceptableInputs) {
		System.out.println("Choose from one of the following options:");
		for (String option : acceptableInputs) {
			System.out.print(option + "    ");
		}
		System.out.println();
			// loop until player enters valid input

		input = scanner.nextLine();
		System.out.println("Input: " + input);
		while(!Arrays.asList(acceptableInputs).contains(input)) {
			System.out.println("Invalid Input. Try again.");
			input = scanner.nextLine();
			System.out.println("Input: " + input);

		}
		System.out.println();
		System.out.println();

	}

		// Gets all the adjacencies for the room entered as argument and displays
these adjacencies to player.
		// Prompts player for input and sets global var "input" to whatever player
submitted, provided it's a valid adjacency.
		// If invalid inputs are entered, it'll reprompt until player enters a valid
input.
		// pretty much exactly same as promptForInputs(), except it takes in a room
as an argument instead of a list of strings
	public static void getInputAdjacentRooms(Room room) {
		String[] acceptableInputs = new String[room.adjRooms.size()];
		int i = 0;
		for(Room r : room.adjRooms) {
			acceptableInputs[i] = r.name;
			i++;
		}

		System.out.println("Choose from one of the following options:");
		for (String option : acceptableInputs) {
			System.out.print(option + "    ");
		}
		System.out.println();

			// loop until player enters valid input
		input = scanner.nextLine();
		System.out.println("Input: " + input);
		while(!Arrays.asList(acceptableInputs).contains(input)) {
			System.out.println("Invalid Input. Try again.");
			input = scanner.nextLine();
			System.out.println("Input: " + input);

		}
		System.out.println();
		System.out.println();
	}
```

```
}
```

Note that the Java target code has been indented for readability; the actual compiler output is not so nicely indented.

6.2 Testing Suite and Justification

Our test cases are separated into the following two groups: success tests and fail tests. Success tests are used to ensure that compiled TBAG programs are correctly operational, given the language specifications. Additionally, success tests are used to ensure that the semantic checker does not mistakenly throw errors for semantically correct programs. Fail tests are used to ensure that the semantic checker properly identifies semantic errors in TBAG programs and prohibits semantically incorrect programs from compiling. We named success tests with the prefix "test_" and fail tests with "fail_". All tests and their .out files can be found in the test/ directory.

6.2.1 Success Tests

The success tests were chosen to check the functionality of standard language aspects such as functions, variables, and loops in addition to TBAG-specific aspects such as room/item/npc usage and event handlers. The test cases for the aspects of the language that are consistent with microC were inspired by the tests for microC. Most features were tested at least twice; once with handlers and once with functions (e.g. test_gcd_func.tbag and test_gcd.handler1.tbag) . The success tests evaluate both simple and complex source programs in order to ensure that simple operations as well as full game playthroughs work as expected.

Contributions: Julie

test_0npc_0item_2rooms.out
test_0npc_0item_2rooms.tbag
test_0npc_1item_0rooms.out
test_0npc_1item_0rooms.tbag
test_0npc_1item_2rooms.out
test_0npc_1item_2rooms.tbag
test_1npc_0item_0rooms.out
test_1npc_0item_0rooms.tbag
test_1npc_0item_2rooms.out
test_1npc_0item_2rooms.tbag
test_1npc_1item_0rooms.out
test_1npc_1item_0rooms.tbag
test_1npc_1item_2rooms.out
test_1npc_1item_2rooms.tbag
test_add.out
test_add.tbag
test_fib_func.out
test_fib_func.tbag
test_func.out
test_func.tbag
test_func2.out
test_func2.tbag
test_gcd_func.out
test_gcd_func.tbag
test_gcd_func2.out
test_gcd_func2.tbag
test_gcd_handler1.out
test_gcd_handler1.tbag
test_gcd_handler2.out
test_gcd_handler2.tbag
test_gcd_handler3.out
test_gcd_handler3.tbag
test_if_func4.tbag
test_if_handler3.out
test_if_handler3.tbag
test_local_var_func.out
test_local_var_func.tbag
test_if_func.out
test_if_func.tbag
test_if_func2.out
test_if_func2.tbag
test_if_func3.out
test_if_func3.tbag
test_if_func4.out
test_local_var_handler.out
test_local_var_handler.tbag
test_loop_event.out
test_loop_event.tbag

test_arith1.out
test_arith1.tbag
test_arith2.out
test_arith2.tbag
test_arr_len_1.out
test_arr_len_1.tbag
test_array_decl_with_int_expr.out
test_array_decl_with_int_expr.tbag
test_array_in_func.out
test_array_in_func.tbag
test_array_in_handler.out
test_array_in_handler.tbag
test_call_stdlib_from_func.out
test_call_stdlib_from_func.tbag
test_fib_event.out
test_fib_event.tbag
test_gcd_handler4.out
test_gcd_handler4.tbag
test_global_array_in_handler.out
test_global_array_in_handler.tbag
test_global_var_func.out
test_global_var_func.tbag
test_global_var_handler.out
test_global_var_handler.tbag
test_handler1.out
test_handler1.tbag
test_handler2.out
test_handler2.tbag
test_helloworld.out
test_helloworld.tbag
test_helloworld_func.out
test_helloworld_func.tbag
test_loop_while_func.out
test_loop_while_func.tbag
test_loop_while_handler.out
test_loop_while_handler.tbag
test_ops.out
test_ops.tbag
test_room_data_w_blank_rdecl.out
test_room_data_w_blank_rdecl.tbag
test_stdlib.out
test_stdlib.tbag
test_string_literals.out
test_string_literals.tbag
test_subtract.out
test_subtract.tbag

6.2.2 Fail Tests

The fail tests were chosen by reading through the semantic checker program and identifying all areas where the semantic checker needs to throw an error. Using the success tests as templates, we modified variable declarations and assignments, function calls and definitions, room/item/npc-related elements, operator usage, predicate statements, and other additional aspects to purposefully attempt throwing the expected errors. Successful compilations of programs that were expected to throw errors and unsuccessful compilations of semantically correct programs indicated issues with our semantic checker, which we proceeded to fix.

*Contributions: Maria, Iris**

fail_arr_assign.out
fail_arr_assign.tbag
fail_arr_assign2.out
fail_arr_assign2.tbag
fail_arr_assign3.out
fail_arr_assign3.tbag
fail_arr_assign4.out
fail_arr_assign4.tbag
fail_arr_decl.out
fail_arr_decl.tbag
fail_arr_decl2.out
fail_arr_decl2.tbag
fail_arr_len.out
fail_arr_len.tbag
fail_arr_len2.out
fail_id_func.out
fail_id_func.tbag
fail_if.out
fail_if.tbag
fail_item_decl.out
fail_item_decl.tbag
fail_item_decl2.out
fail_item_decl2.tbag
fail_item_def.out
fail_item_def.tbag
fail_notexist_id.out
fail_notexist_id.tbag
fail_notexist_var.out
fail_notexist_var.tbag
fail_npc_decl.out
fail_ops9.tbag
fail_pred_expr.out*
fail_pred_expr.tbag*
fail_rec_func.out
fail_rec_func.tbag
fail_room_decl.out*
fail_room_decl.tbag*
fail_room_decl2.out
fail_room_decl2.tbag
fail_room_def.out
fail_room_def.tbag
fail_undef_room.out
fail_undef_room.tbag
fail_var_assign.out
fail_var_assign.tbag

fail_arr_len2.tbag
fail_exist_var.out
fail_exist_var.tbag
fail_fdecl_args.tbag
fail_func_call.out
fail_func_call.tbag
fail_func_call2.out
fail_func_call2.tbag
fail_func_call3.out
fail_func_call3.tbag
fail_func_decl.out
fail_func_decl.tbag
fail_func_decl2.out
fail_func_decl2.tbag
fail_func_decl3.out
fail_func_decl3.tbag
fail_func_var_decl.out*
fail_func_var_decl.tbag*
fail_gifa.out
fail_gifa.tbag
fail_gifo.out
fail_gifo.tbag
fail_npc_decl.tbag
fail_npc_decl2.out
fail_npc_decl2.tbag
fail_npc_def.out
fail_npc_def.tbag
fail_ops.out
fail_ops.tbag
fail_ops2.out
fail_ops2.tbag
fail_ops3.out
fail_ops3.tbag
fail_ops4.out
fail_ops4.tbag
fail_ops5.out
fail_ops5.tbag
fail_ops6.out
fail_ops6.tbag
fail_ops7.out
fail_ops7.tbag
fail_ops8.out
fail_ops8.tbag
fail_ops9.out
fail_var_assign2.out
fail_var_assign2.tbag
fail_var_decl.out
fail_var_decl.tbag
fail_var_decl2.out
fail_var_decl2.tbag
fail_var_init.out
fail_var_init.tbag
fail_vdecl_exists.out*
fail_vdecl_exists.tbag*
fail_vdecl_ref.out*
fail_vdecl_ref.tbag*
fail_void_arr.out
fail_void_arr.tbag
fail_void_var.out
fail_void_var.tbag
fail_void_var2.out
fail_void_var2.tbag
fail_while.out
fail_while.tbag

6.2.3. Input Tests

Input tests were written to test player input and handling of player input. They also demonstrated fuller functionality of game logic, including moving through rooms, room adjacencies, standard library calls, and built-in functions. The .in files contain simulated player input.

Contributions: Julie

test_game_go_outside_input.in
test_game_go_outside_input.out
test_game_go_outside_input.tbag
test_game_hangman_input.in
test_game_hangman_input.out
test_game_hangman_input.tbag
test_game_mouse_cat_input.in
test_game_mouse_cat_input.out
test_game_mouse_cat_input.tbag

6.3 Testing Automation and Scripts

To automate the testing of our code, we used Professor Edwards's MicroC test runner script as a template and modified the appropriate sections to fit our build flow. In the following description we will use "test script" to refer to the combination of our primary test runner script as well as any helper scripts that we wrote.

Our test script proceeds as follows:

- *run_tests.sh* script attempts to test all .tbag source files prefaced with “test_” and “fail_” in the subdirectory “tests”. This subdirectory should be in the same directory as the test script, since a relative path is used to refer to the tests directory.
- To run a subset of the tests, the user can supply as command line arguments the names of the specific source files
- When the script begins to perform a test for a particular source file, a message of the form “-n <basename>” is outputted to the terminal screen, where <basename> represents the name of the source file with the “.tbag” extension removed.
- If a source file successfully compiles, the test script proceeds to run the compiled Java output. If a source file fails to compile, the test script saves the compilation error that was produced.

A test is deemed successful if the expected output of the test matches up with the output that was produced by the script, which is saved into a file named <basename>.out. If the program successfully compiles, <basename>.out contains the runtime output of the Java program. If the program fails with a compiler error, <basename>.out contains the compiler error. The output comparison procedure is consistent with that of the original microC test script.

Since our language supports games with user input, we needed to modify the test script to pass input to the running Java program. If a user intends to test a program that accepts user input, the user must include the substring “_input” inside the file name. When the test script processes tests with source files of that format, it feeds a file named <basename>.in, which must be supplied by the user inside the tests subdirectory, into the running Java program. The <basename>.in file should contain all desired inputs to the program, with each input separated by a newline.

Finally, our test script also includes our predefined TBAG library functions in the source file that gets passed to the compiler. There are additional features included in Professor Edwards’s test script that we incorporated into our own test script for completeness, such as command line options and the usage of a log file, but we did not use these features during our testing.

Contributions: Maria

7 Lessons Learned

7.1 Brian Slakter

I learned a number of lessons through my work on this project. First of all, OCaml is awesome! I was a bit confused by the style at first, but I then realized how intuitive the idea of pattern matching is. When coding up solutions to interview questions involving lists, there are 3 cases that almost always require different actions - an empty list, a list with only one element, and a list with more than one element. Pattern matching makes thinking about these cases very intuitive, and forces you to break down the problem in this exact way. Second of all, stepping back to think about the process as a whole is a very important step that should take place early on in the project. We spent a lot of time in the weeds of our code, but understanding how the different components of the compiler fit together was not fully realized until later in the project, which caused us to make some changes. Finally, start early!

7.2 Gregory Chen

Starting early is definitely the most important take away, but it was difficult to know what exactly to be doing early on. This where I think it is important to be looking at previous years' projects' code. This helps with finding a high level direction early on, which is extremely important. For example, if I had known how different pieces of the compiler were ultimately going to communicate, things would have been smoother. Furthermore, it is important to pay close attention early on to the professor's distinction between a translator and a true compiler. Another important lesson that is better learned early than late is to meet with the professor occasionally in addition to the assigned TA.

7.3 Julie Chien

1. Meet with Professor Edwards early on to make sure your language idea and implementation plan are actually good. If you're like most of us, you probably don't know enough about language design to successfully assess the quality of your idea. I was often surprised by what was considered a "good" idea and what wasn't.
2. Related to #1 -- If you are thinking about making a major change to your project (such as your compiled language choice), run it by Professor Edwards first to make sure it won't kill your project for reasons that you may not be able to perceive with your current knowledge.
3. If you're using Git, work on new branches when you're implementing features, then merge back into master when your feature is complete and passes all tests. Know how to rebase. I learned about rebasing in this project and it was super useful.
4. Everyone tells you to start early, but "early" is a subjective term so I'll break it down concretely. It's not really possible to start THAT early because you don't learn enough to write most of your compiler until the last month or so of the semester. That is fine as long as you prepare accordingly. Start learning OCaml at least a week before the first homework is due.

After you turn in your LRM, get your scanner and parser out of the way immediately -- within 3-5 days. Codegen and Semcheck are the most difficult pieces of the project, so give yourself at least that whole last month to work on them. Start writing tests as soon as you have a functional compiler; it'll save you time in the long run.

5. Be careful if you're compiling to Java. If you're doing this, make sure the language you're designing isn't too similar to Java.

7.4 Iris Zhang

The most important lesson: compilers should not be taken for granted. Thorough error checking and descriptive, useful error reporting is so important, and the majority of the gnarly work is done by the semantic checker so definitely get an early start on it. Built in functions are a huge pain to implement and I see why languages can have tens of thousands of lines for their compiler. If I took a wild guess I would say we wrote about 5-10% of a truly complete production-ready semantic checker. I will never again complain about a wordy fussy language. They impose order and logic on the AST, which makes everything down the pipeline easier to handle.

Get input from a lot of different sources (most importantly the professor) early on. Plan ahead. Even when those plans don't work out, the insight you gain about workflow and how different people tend to work better together/apart is crucial to pulling through at the end.

Diminishing returns is a thing. Get enough sleep!

7.5 Maria van Keulen

In other CS classes, you may use compilers to catch certain errors in your source code. In this class, you use your language's source code to catch errors in your compiler. Flesh out your regression test suite as soon as you can. During the process of writing our semantic checker and integrating it into the rest of the build procedure, our solid success test suite was super helpful in making sure we didn't break anything along the way.

Also, write code in pairs. You may spend several hours investigating an error to no avail, only to have someone else look at it and identify the problem within a matter of minutes.

Finally, try not to panic if things don't go according to plan. We overcame a number of obstacles through our willingness to take alternative routes when our original ones weren't working.

8 Acknowledgements

We would like to thank our TA for going above and beyond to help us out with this project. He took us on late into the semester as an extra team, but treated us like we had been assigned to him from the beginning. We would also like to thank our professor for taking the time to meet with us weekly, especially late into the semester, to help get our team on the right track.

9 Appendix

9.1 Source Code

9.1.1 Preprocessor (importLibrary.py)

```
#!/usr/bin/env python

# looks for instances of "#import libraryName.tbag" in command line arg and copies library
files into another file called prog_w_stdlib.tbag
# Author: Julie Chien
# 11/20/2015

import re
import fileinput
import shutil
import sys

tbagFileName = sys.argv[1]
tempFileName = 'prog_w_stdlib.tbag'

#copy file to temp file
shutil.copyfile(tbagFileName, tempFileName)

# search for lines starting with #import
linePattern = re.compile(r'#import (\w+)')

tbagFile = open(tbagFileName, 'r')

libraries = []

for line in tbagFile:
    matches = linePattern.findall(line)
    for libName in matches:
        libraries.append(libName)

if len(libraries) > 0:
        lineToReplace = "#import " + libraries[0]

        libTxtToPasteIn = ""

        for libName in libraries:
                libFileName = "lib/" + libName + ".tbag"
                with open(libFileName, 'r') as myfile:
                        data=myfile.read()
                libTxtToPasteIn += data

        # if function is found in file, paste imported libraries before function block
        funcfound = False
        for line in fileinput.input(tempFileName, inplace=True):
                if funcfound == False:
                        if "func " in line:
                                line = line.replace("func ", libTxtToPasteIn + "func ")
                                funcfound = True
                print(line)

        # if no function is found, paste imported libraries to end of file
        if funcfound == False:
                with open(tempFileName, 'a') as f:
                        f.write(libTxtToPasteIn)

        for line in fileinput.input(tempFileName, inplace=True):
                if not re.search(linePattern, line):
                        print(line)
```

9.1.1 Scanner (scanner.mll)

```
(* Authors: All *)

{ open Parser }

rule token = parse
        [' ' '\t' '\r' '\n'] { token lexbuf }   (* Whitespace *)
        | "/*"                                   { comment lexbuf }
        | "func"                                 { FUNC }
        | "room"                                 { ROOM }
        | "start"                                { START }
        | "endgame"                              { END }
        | "<->"                                  { ADJ }
        | "->"                                   { GOTO }
        | "npc"                                  { NPC }
        | "item"                                 { ITEM }
        | '('                                    { LPAREN }
        | ')'                                    { RPAREN }
        | '{'                                    { LBRACE }
        | '}'                                    { RBRACE }
        | '['                                    { LBRACK }
        | ']'                                    { RBRACK }
        | ','                                    { COMMA }
        | '+'                                    { PLUS }         (* operators*)
        | '-'                                    { MINUS }
        | '*'                                    { TIMES }
        | '/'                                    { DIVIDE }
        | "=="                                   { EQ }
        | "~~"                                   { STREQ }
        | "!="                                   { NEQ }
        | '<'                                    { LT }
        | "<="                                   { LEQ }
        | '>'                                    { GT }
        | ">="                                   { GEQ }
        | '='                                    { ASSIGN }
        | ';'                               { SEMI }
        | '.'                                   { ACCESS }
        | "int"                                    { INT }
        | "string"                              { STRING }
        | "neg"                                 { NEG }
        | "void"                                { VOID }
        | "boolean"                             { BOOLEAN }
        | "if"                                  { IF }
        | "else"                                { ELSE }
        | "while"                               { WHILE }
        | "return"                              { RETURN }
        | "AND"                                 { AND }
        | "OR"                                  { OR }
        | "NOT"                                 { NOT }
        | "true"                                as lxm { BOOL_LITERAL(bool_of_string lxm) }
        | "false"                               as lxm { BOOL_LITERAL(bool_of_string lxm) }
        | ['0'-'9']+                            as lxm { INT_LITERAL(int_of_string lxm) }
        | '"'('\\'_|[^'"'])*'"'                 as str { STRING_LITERAL(str) }
        | ['a'-'z' 'A'-'Z']['a'-'z' 'A'-'Z' '0'-'9' '_']*        as lxm { ID(lxm) }
        | eof                                   { EOF }

        and comment = parse
        "*/"                            { token lexbuf }   (* End of comment *)
        | _                             { comment lexbuf }  (* eat everything else *)
```

9.1.2 Parser (parser.mly)

```
/* Authors: All */

%{ open Ast %}

%token SEMI LPAREN RPAREN LBRACE RBRACE LBRACK RBRACK COMMA
%token FUNC ROOM ADJ GOTO ITEM NPC START END NEG
%token ASSIGN EQ STREQ NEQ LT LEQ GT GEQ AND OR NOT ACCESS
%token PLUS MINUS TIMES DIVIDE
%token IF ELSE WHILE RETURN
%token INT STRING VOID BOOLEAN
%token <int> INT_LITERAL
%token <string> STRING_LITERAL
%token <bool> BOOL_LITERAL
%token <string> ID
%token EOF

%right ASSIGN
%left OR
%left AND
%left EQ NEQ STREQ
%left LT GT LEQ GEQ
%left PLUS MINUS
%left TIMES DIVIDE
%right NOT
%left ACCESS

%start program
%type <Ast.program> program

%%
```

```
program:
        /* rooms, npcs, items */
        rdef rdecl_list adecl_list start ndef ndecl_list idef idecl_list vdecl_list
        predicate_list fdecl_list EOF
                { ($1, $2, $3, $4, $5, $6, $7, $8, $9, List.rev $10, List.rev $11) }
        | /* rooms, npcs, !items */
        rdef rdecl_list adecl_list start ndef ndecl_list vdecl_list
        predicate_list fdecl_list EOF
                { ($1, $2, $3, $4, $5, $6, [], [], $7, List.rev $8, List.rev $9) }
        | /* rooms, !npcs, items */
        rdef rdecl_list adecl_list start idef idecl_list vdecl_list
        predicate_list fdecl_list EOF
                { ($1, $2, $3, $4, [], [], $5, $6, $7, List.rev $8, List.rev $9) }
        | /* rooms, !npcs, !items */
        rdef rdecl_list adecl_list start vdecl_list predicate_list fdecl_list EOF
                { ($1, $2, $3, $4, [], [], [], [], $5, List.rev $6, List.rev $7) }
        | /* !rooms, npcs, items */
        ndef ndecl_list idef idecl_list vdecl_list predicate_list fdecl_list EOF
                { ([], [], [], "null", $1, $2, $3, $4, $5, List.rev $6, List.rev $7) }
        | /* !rooms, npcs, !items */
        ndef ndecl_list  vdecl_list predicate_list fdecl_list EOF
                { ([], [], [], "null", $1, $2, [], [], $3, List.rev $4, List.rev $5) }
        | /* !rooms, !npcs, items */
        idef idecl_list vdecl_list predicate_list fdecl_list EOF
                { ([], [], [], "null", [], [], $1, $2, $3, List.rev $4, List.rev $5) }
        | /* !rooms, !npcs, !items */
        vdecl_list predicate_list fdecl_list EOF
                { ([], [], [], "null", [], [], [], [], $1, List.rev $2, List.rev $3) }

data_type:
        INT                                     { Int }
        | STRING                                { String }
        | VOID                                  { Void }
        | BOOLEAN                               { Boolean }

pred_stmt:
        expr LBRACE vdecl_list stmt_list RBRACE
        { {
                pred = $1;
                locals = List.rev $3;
                body = List.rev $4;
        } }

predicate_list:
        /* nothing */                           { [] }
        | predicate_list pred_stmt              { $2 :: $1 }


fdecl_list:
        /* nothing */                           { [] }
        | fdecl_list fdecl                      { $2 :: $1 }

fdecl:
        FUNC data_type ID LPAREN formals_opt RPAREN LBRACE vdecl_list stmt_list RBRACE
        { {
                freturntype = $2;
                fname = $3;
                formals = $5;
                locals = List.rev $8;
                body = List.rev $9
        } }

formals_opt:
        /* nothing */                           { [] }
        | formal_list                           { List.rev $1 }

formal_list:
        data_type ID                            { [Var($1, $2)] }
        | formal_list COMMA data_type ID        { Var($3, $4) :: $1 }

actuals_opt:
        /* nothing */                           { [] }
        | actuals_list                          { List.rev $1 }

actuals_list:
        expr                                    { [$1] }
        | actuals_list COMMA expr               { $3 :: $1 }

vdecl_list:
        /* nothing */                           { [] }
        | vdecl_list vdecl                      { $2 :: $1 }

vdecl:
        data_type LBRACK expr RBRACK ID SEMI    { Array_decl($1, $3, $5) }
        | data_type ID SEMI                     { Var($1, $2) }
        | data_type ID ASSIGN expr SEMI         { VarInit($1, $2, $4) }

rdef:
        ROOM LBRACE vdecl_list RBRACE           { $3 }

rdecl_list:
        rdecl rdecl                             { [$1; $2] }
        | rdecl_list rdecl                      { $2 :: $1 }

rdecl:
        ROOM ID LBRACE stmt_list RBRACE
        { {
                rname = $2;
                rbody = List.rev $4
        } }

start:
        START LBRACE ID RBRACE                  { $3 }

adecl_list:
        adecl                                   { [$1] }
        | adecl_list adecl                      { $2 :: $1 }

adecl:
        adj_list SEMI                           { List.rev $1 }

adj_list:
        ID ADJ ID                               { [$1; $3] }

ndef:
        NPC LBRACE vdecl_list RBRACE            { $3 }

ndecl_list:
        /* nothing */                       { [] }
        | ndecl_list ndecl                  { $2 :: $1 }

ndecl:
        NPC ID LBRACE stmt_list RBRACE
        { {
                nname = $2;
                nbody = List.rev $4
        } }

idef:
        ITEM LBRACE vdecl_list RBRACE       { $3 }

idecl_list:
        /* nothing */                       { [] }
        | idecl_list idecl                  { $2 :: $1 }

idecl:
        ITEM ID LBRACE stmt_list RBRACE
        { {
                iname = $2;
                ibody = List.rev $4
        } }

stmt_list:
        /* nothing */                       { [] }
        | stmt_list stmt                    { $2 :: $1 }

stmt:
        expr SEMI                           { Expr($1) }
        | RETURN expr SEMI                  { Return($2) }
        | LBRACE stmt_list RBRACE           { Block(List.rev $2) }
        | IF LPAREN expr RPAREN stmt ELSE stmt  { If($3, $5, $7) }
        | WHILE LPAREN expr RPAREN stmt     { While($3, $5) }
        | GOTO ID                           { Goto($2) }
/*
int_opt:
        INT_LITERAL                         { $1 }
*/

expr:
        INT_LITERAL                         { IntLiteral($1) }
        | NEG INT_LITERAL                   { NegIntLiteral($2) }
        | STRING_LITERAL                    { StrLiteral($1) }
        | END                               { End }
        | BOOL_LITERAL                      { BoolLiteral($1) }
        | ID                                { Id($1) }
        | expr PLUS expr                    { Binop($1, Add, $3) }
        | expr MINUS expr                   { Binop($1, Sub, $3) }
        | expr TIMES expr                   { Binop($1, Mult, $3) }
        | expr DIVIDE expr                  { Binop($1, Div, $3) }
        | expr EQ expr                      { Binop($1, Equal, $3) }
        | expr STREQ expr                   { Binop($1, StrEqual, $3)}
        | expr NEQ expr                     { Binop($1, Neq, $3) }
        | expr LT expr                      { Binop($1, Less, $3) }
        | expr LEQ expr                     { Binop($1, Leq, $3) }
        | expr GT expr                      { Binop($1, Greater, $3) }
        | expr GEQ expr                     { Binop($1, Geq, $3) }
        | expr AND expr                     { Binop($1, And, $3)}
        | expr OR expr                      { Binop($1, Or, $3)}
        | NOT expr                              { Boolneg(Not, $2)}
        | ID ASSIGN expr                        { Assign($1, $3) }
        | ID LBRACK expr RBRACK ASSIGN expr     { ArrayAssign($1, $3, $6) }
        | ID LBRACK expr RBRACK                 { ArrayAccess($1, $3) }
        | ID LPAREN actuals_opt RPAREN          { Call ($1, $3) }
        | LPAREN expr RPAREN                    { $2 }
        | ID ACCESS ID                          { Access ($1, $3) }
```

9.1.3 AST (ast.mli)

```
(* Authors: All *)

type op = Add | Sub | Mult | Div | Equal | StrEqual | Neq | Less | Leq | Greater | Geq | And
| Or | Not

type variable_type =
        Int
        | String
        | Void
        | Array of variable_type * int
        | Boolean

type expr =
        IntLiteral of int
        | NegIntLiteral of int
        | StrLiteral of string
        | BoolLiteral of bool
        | Id of string
        | Assign of string * expr
        | ArrayAssign of string * expr * expr
        | ArrayAccess of string * expr
        | Binop of expr * op * expr
        | Boolneg of op * expr
        | Call of string * expr list
        | Access of string * string
        | End

type var_decl =
        Array_decl of variable_type * expr * string
        | Var of variable_type * string
        | VarInit of variable_type * string * expr

type stmt =
        Block of stmt list
        | Expr of expr
        | Return of expr
        | If of expr * stmt * stmt
        | While of expr * stmt
        | Goto of string

type room_def = var_decl list

type room_decl =
        {
                rname: string;
                rbody: stmt list;
        }

type start = string

type adj_decl = string list

type pred_stmt =
        {
                pred: expr;
                locals: var_decl list;
                body: stmt list;
        }

type func_decl =
        {
                freturntype: variable_type;
                fname : string;
                formals : var_decl list;
                locals: var_decl list;
                body : stmt list;
        }

type npc_def = var_decl list

type npc_decl =
        {
                nname: string;
                nbody: stmt list;
        }

type item_def = var_decl list

type item_decl =
        {
                iname: string;
                ibody: stmt list;
        }

type basic_program = func_decl list

type simple_program = room_decl list *
                      func_decl list

type room_program = room_def *
                    room_decl list *
                    func_decl list

type program =  room_def *
                room_decl list *
                adj_decl list *
                start *
                npc_def *
                npc_decl list *
                item_def *
                item_decl list *
                var_decl list *
                pred_stmt list *
                func_decl list
```

9.1.4 Semantic Checker (semantic_checker.ml)

```
(* Authors: Iris, Maria *)
open Ast

(* environment *)
type symbol_table = {
    parent : symbol_table option;
    mutable variables : var_decl list;
}

type translation_environment = {
    scope : symbol_table;
    mutable return_type: variable_type;
    mutable current_func: func_decl option;
    mutable functions : func_decl list;
    mutable room_def: var_decl list;
    mutable rooms: room_decl list;
    mutable npc_def: var_decl list;
    mutable npcs: npc_decl list;
    mutable item_def: var_decl list;
    mutable items: item_decl list;
    mutable pred_stmts : pred_stmt list;
}

(* helper functions *)
let check_type_not_void (v : Ast.variable_type) = match v with
      Ast.Int -> Ast.Int
    | Ast.String -> Ast.String
    | Ast.Boolean -> Ast.Boolean
    | Ast.Array(v, i) -> Ast.Array(v, i)
    | _ -> raise (Failure ("Invalid variable type used"))
    (* vars can't be declared as "void" *)

let get_var_type_name var_decl =
    begin match var_decl with
    Array_decl(t, _, s) -> (t, s)
    | Var(t, s) -> (t, s)
    | VarInit(t, s, _) -> (t, s)
    end

let var_is_array var_decl =
    begin match var_decl with
    Array_decl(_, _, _) -> true
    | Var(_, _) -> false
    | VarInit(_, _, _) -> false
    end

let expr_is_strlit expr =
    begin match expr with
     StrLiteral(_) -> true
   | _ -> false
    end

(* type enforcement functions *)
```

```
let require_integers tlist str =
    let _ = List.map(
        fun t ->  match t with
            Int -> true
          | _ -> raise (Failure(str))
    ) tlist in
    true

let require_strings tlist str =
    let _ = List.map(
        fun t ->  match t with
            String -> true
          | _ -> raise (Failure(str))
    ) tlist in
    true


let require_voids tlist str =
    let _ = List.map(
        fun t ->  match t with
            Void -> true
          | _ -> raise (Failure(str))
    ) tlist in
    true

let require_bools tlist str =
    let _ = List.map(
        fun t ->  match t with
            Boolean -> true
          | _ -> raise (Failure(str))
    ) tlist in
    true

let require_eq tlist str =
    let typ = List.hd tlist in
    let _ = List.map(
        fun t -> if typ <> t then raise (Failure(str))
    ) tlist in
    true


(* find functions *)
let rec find_variable (scope : symbol_table) name =
    try
        (* do match with the different types of variables in the List.find
         * function *)
        List.find ( fun var_decl ->
            begin match var_decl with
            Array_decl(_, _, s) -> s = name
            | Var(_, s) -> s = name
            | VarInit(_, s, _) -> s = name
            end ) scope.variables
    with Not_found ->
        match scope.parent with
          Some(parent) -> find_variable parent name
          | _ -> raise Not_found

let get_var_if_exists (scope : symbol_table) name =
    let var_decl = (try find_variable scope name with
    Not_found -> raise (Failure ("undeclared identifier " ^
                    name))) in var_decl
```

```
let find_room (env: translation_environment) (name) =
    try
        List.find (fun room_decl -> room_decl.rname = name) env.rooms
    with Not_found-> raise Not_found


let find_room_field (env: translation_environment) fieldName =
     let field_decl = (try (List.find ( fun var_decl -> begin match var_decl with
                                       Var(t, s) -> s = fieldName
                                       |_ -> raise (Failure "should never reach here")
                                       end ) env.room_def )
                        with
                            Not_found -> raise(Failure "room field referenced does not
exist."))
     in let (typ, n) = get_var_type_name field_decl in
     (typ, n)

let find_npc (env: translation_environment) (name) =
    try
        List.find (fun npc_decl -> npc_decl.nname = name) env.npcs
    with Not_found-> raise Not_found

let find_npc_field (env: translation_environment) fieldName =
     let field_decl = (try (List.find ( fun var_decl -> begin match var_decl with
                                       Var(t, s) -> s = fieldName
                                       |_ -> raise (Failure "should never reach here")
                                       end ) env.npc_def )
                        with
                            Not_found -> raise(Failure "npc field referenced does not
exist."))
     in let (typ, n) = get_var_type_name field_decl in
     (typ, n)

let find_item (env: translation_environment) (name) =
    try
        List.find (fun item_decl -> item_decl.iname = name) env.items
    with Not_found-> raise Not_found

let find_item_field (env: translation_environment) fieldName =
     let field_decl = (try (List.find ( fun var_decl -> begin match var_decl with
                                       Var(t, s) -> s = fieldName
                                       |_ -> raise (Failure "should never reach here")
                                       end ) env.item_def )
                        with
                            Not_found -> raise(Failure "item field referenced does not
exist."))
     in let (typ, n) = get_var_type_name field_decl in
     (typ, n)

(* check that op matches with types of t1, t2 and return type of result *)
let get_binop_type op t1 t2 =
    begin match op with
        (Add | Sub | Mult | Div)  ->
            let _ = require_integers [t1;t2] "Types to arithmetic operators +, -, *, /
            must both be Int" in
            Int
      | (Equal | Neq) ->
              let _ =
                  (try require_integers[t1;t2]  ""
                   with _ -> try require_bools[t1;t2] ""
```

```
                        with _ -> require_voids[t1;t2] "Types to equality operators ==, !=
                         must be the same and be integers, booleans, or
                         rooms" ) in
              Boolean

     | (Less | Leq | Greater | Geq) ->
             let _ = require_integers [t1;t2] "Types to integer comparison
                         operators <, <=, >, >= must be integers" in
             Boolean
     | StrEqual ->
             let _ = require_strings [t1;t2] "Types to ~~ must both be String"
             in Boolean
     | (And | Or) ->
             let _ = require_bools [t1;t2] "Types to binary boolean operators AND, OR must
both be Boolean" in
             Boolean
     | _ -> raise (Failure "Should not reach here")
    end

(* Expr checking *)
let rec check_expr env = function
        Ast.IntLiteral(v) -> (Ast.IntLiteral(v), Ast.Int)
        | Ast.NegIntLiteral(v) -> (Ast.NegIntLiteral(v), Ast.Int)
        | Ast.StrLiteral(v) -> (Ast.StrLiteral(v), Ast.String)
        | Ast.BoolLiteral(v) -> (Ast.BoolLiteral(v), Ast.Boolean)
        | Ast.Id(vname) ->
                let vdecl = (try
                find_variable env.scope vname
                with Not_found ->
                    let _ = (try find_room env vname with
                    Not_found -> raise (Failure ("undeclared identifier " ^
                    vname))) in
                    Var(Ast.Void, vname)) in
                let (typ, vname) = get_var_type_name vdecl
                in (Ast.Id(vname), typ)
        | Ast.Binop(e1, op, e2) ->
                let (e1, t1) = check_expr env e1
                and (e2, t2) = check_expr env e2 in
                (Ast.Binop(e1, op, e2), get_binop_type op t1 t2)
        | Ast.Assign(name, expr) ->
                let vdecl = get_var_if_exists env.scope name in
                let (vtyp, name) = get_var_type_name vdecl in
                let (expr, etyp) = check_expr env expr in
                if not (var_is_array vdecl) then
                    let _ = require_eq [vtyp;etyp] "Type mismatch in assignment statement"
in (Ast.Assign(name, expr), vtyp)
                else raise (Failure "Left hand side of assignment statement must
                be a non-array variable")
        | Ast.ArrayAssign(name, expr1, expr2) ->
                let vdecl = get_var_if_exists env.scope name in
                let (typ, name) = get_var_type_name vdecl in
                let (pos, postyp) = check_expr env expr1 in
                let (expr, exprtyp) = check_expr env expr2 in
                let _ = require_integers [postyp] "Positional array access specifier must be
an
                    Integer" in
                    if var_is_array vdecl then
                        let _ = require_eq [typ;exprtyp] "Right hand side of assignment
statement does
                    not match type of array" in
```

```
                        (Ast.ArrayAssign(name, pos, expr), typ)
                    else raise (Failure "Left hand side of array assignment must
                    be an array")
        | Ast.ArrayAccess(name, expr) ->
                let vdecl = get_var_if_exists env.scope name in
                let (typ, name) = get_var_type_name vdecl in
                let (pos, postyp) = check_expr env expr in
                let _ = require_integers [postyp] "Positional array access specifier must be
an
                    Integer" in
                if var_is_array vdecl then (Ast.ArrayAccess(name, expr), typ)
                else raise (Failure "Array access must be used on an array
type")
        | Ast.Boolneg(op, expr) ->
                let (expr, typ) = check_expr env expr in
                let _ = require_bools [typ] "Type to unary boolean NOT operator must be
                    boolean" in
                (Ast.Boolneg(op, expr), typ)
       | Ast.Call(fname, expr_list) ->
                if fname = "arrLen" && List.length expr_list = 1 then
                    let arr_name =
                      let e = List.hd expr_list in
                      begin match e with
                        Ast.Id(vname) -> vname
                      | _ -> raise (Failure("arrLen expects an array
                      argument"))
                        end in
                     let arr_decl = get_var_if_exists env.scope arr_name in
                     if var_is_array arr_decl then
                    (Ast.Call(fname, expr_list), Ast.Int)
                     else raise (Failure "arrLen expects an array
                      argument")
                 else if fname = "getInputFromOptions" && List.length expr_list
                 >= 1 then
                     let _ = List.map(
                         fun e -> if not (expr_is_strlit e) then raise
(Failure("getInputFromOptions expects
                      one or more string arguments"))) expr_list in
                    (Ast.Call(fname, expr_list), Ast.Void)
                 else if fname = "getInputAdjacentRooms" && List.length expr_list = 1 then
                     let rname =
                      begin match List.hd expr_list with
                        Ast.Id(r) -> r
                      | _ -> raise (Failure("getInputAdjacentRooms expects a room
argument"))
                        end in
                       let _ = (try find_room env rname with
                             Not_found -> raise (Failure ("undeclared identifier " ^ rname)))
in
                        (Ast.Call(fname, expr_list), Ast.Void)
                 else
                     let fdecl = (try find_function_with_exprs env fname expr_list
                             with Not_found -> begin match env.current_func with
                             Some(current_func) ->
                                if (current_func.fname = fname &&
                                check_matching_args env current_func.formals
                                expr_list) then current_func
                                else
                                    raise (Failure ("Function " ^ fname ^ " does
                                    not exist with the given parameters."))
```

```
                            |_-> raise (Failure ("Function " ^ fname ^ " does
                            not exist with the given parameters."))end) in
                let typ = fdecl.freturntype in
                    (Ast.Call(fname, expr_list), typ)
        | Ast.End -> (Ast.End, Ast.Int) (* This type is meaningless *)
        | Ast.Access(name, field) ->
            try let _ =  find_room env name in
                let (ftyp, fname) = find_room_field env field in
                    (Ast.Access(name, field), ftyp)
            with Not_found ->
                try let _ = find_npc env name in
                    let (ftyp, fname) = find_npc_field env field in
                        (Ast.Access(name, field), ftyp)
                with Not_found ->
                    try let _ = find_item env name in
                        let (ftyp, fname) = find_item_field env field in
                            (Ast.Access(name, field), ftyp)
                    with Not_found ->
                        raise(Failure("Trying to access field " ^ field ^ ", which does not
exist for that structure."))

(* check formal arg list with expr list of called function *)
and check_matching_args_helper (env: translation_environment) ref_vars target_exprs =
    let result = true in
    let _ = (try List.map2 (
        fun r t -> let (rtyp, rname) = get_var_type_name r in
                   let (texpr, ttyp) = check_expr env t in
                   try require_eq [ttyp;rtyp] "";
                   with _ -> raise Not_found) ref_vars target_exprs
    with Invalid_argument(_) -> raise Not_found) in result

and check_matching_args (env: translation_environment) ref_vars target_exprs =
    let result = (try check_matching_args_helper env ref_vars target_exprs with
    Not_found -> false) in result

and find_function_with_exprs (env : translation_environment) name expr_list =
    try
        List.find( fun func_decl -> func_decl.fname = name &&
        check_matching_args env func_decl.formals expr_list) env.functions
    with Not_found -> raise Not_found

let check_matching_decls_helper (env: translation_environment) ref_vars target_decls =
    let result = true in
    let _ = (try List.map2 (
        fun r t -> let (rtyp, rname) = get_var_type_name r in
                   let (ttyp, tname) = get_var_type_name t in
                   try require_eq [ttyp;rtyp] "";
                   with _ -> raise Not_found) ref_vars target_decls
    with Invalid_argument(_) -> raise Not_found) in result


let check_matching_decls (env: translation_environment) ref_vars target_decls =
    let result = (try check_matching_decls_helper env ref_vars target_decls with
    Not_found -> false) in result

let find_function_with_decls (env : translation_environment) name decl_list =
    try
        List.find( fun func_decl -> func_decl.fname = name &&
        check_matching_decls env func_decl.formals decl_list) env.functions
    with Not_found -> raise Not_found
```

```
(* Stmt checking*)
let rec check_stmt env = function
        Block(stmt_list) -> Block(check_stmts env stmt_list)
        | Expr(expr) -> let (expr, _) = check_expr env expr in Expr(expr)
        | Return(expr) -> let (expr, typ) = check_expr env expr in
          let _ = require_eq [typ;env.return_type] "Return type of expression does not match 
return 
type of function" in
          Return(expr)
        | If(expr, stmt1, stmt2) ->
            let (expr, typ) = check_expr env expr in
            let _ = require_bools [typ] "Expression in if statement conditional must be 
    of type Boolean" in
            If(expr, check_stmt env stmt1, check_stmt env stmt2)
        | While(expr, stmt) ->
            let (expr, typ) = check_expr env expr in
            let _ = require_bools [typ] "Expression in while statement conditional must be 
    of type Boolean" in
            While(expr, check_stmt env stmt)
        | Goto(rname) ->
            let rdecl = try find_room env rname with
                    Not_found -> raise( Failure "Goto parameter name not a valid room.")
            in Goto(rdecl.rname)

and check_stmts (env: translation_environment) stmt_list =
    let stmt_list = List.map (fun s -> check_stmt env s) stmt_list in
    stmt_list

(* Variable checking, both global and local *)
let check_var_decl (env: translation_environment) vdecl =
        let (typ, vname) = get_var_type_name vdecl in
        try let _ = find_variable env.scope vname in raise(Failure ("Variable with name " ^ 
vname ^ 
        " exists."))
        with Not_found ->
            (* add this var to the variables list of this environment *)
            (* also check that the expr type matches up with the type of the var
             * *)
            (* check that type is valid*)
            match vdecl with
            Array_decl(typ, expr, name) ->
                    let (expr, exprtyp) = check_expr env expr in
                    let _ = require_integers [exprtyp] "Array size must be integer" in
                    let typ = check_type_not_void typ in
                    (env.scope.variables <- Array_decl (typ,expr,name)::env.scope.variables; 
Array_decl (typ,expr,name))
              | Var(typ, name) -> let typ = check_type_not_void typ in
                     env.scope.variables <- Var(typ, name)::env.scope.variables; Var(typ, 
name)
              | VarInit(typ, name, expr) -> let typ = check_type_not_void typ in
                    let (expr, exprtyp) = check_expr env expr in
                    let _ = require_eq [exprtyp;typ] "Type mismatch in variable 
initialization" in
                         (env.scope.variables <- VarInit 
(exprtyp,name,expr)::env.scope.variables; VarInit (exprtyp, name,expr))

let check_var_decls (env: translation_environment) var_decls =
    let var_decls = List.map(fun vdecl -> check_var_decl env vdecl) var_decls in
    var_decls
```

```
(* Function checking*)
let check_func_decl (env: translation_environment) func_decl =
    try let _ = find_function_with_decls env func_decl.fname func_decl.formals in
    raise(Failure ("Function with name " ^ func_decl.fname ^ " and given
    argument types exists"))
    with Not_found ->
        let scope' = { parent = Some(env.scope); variables = [];} in
        let env' = { env with scope = scope'; return_type =
            func_decl.freturntype; current_func = Some(func_decl)} in
        let fformals = check_var_decls env' func_decl.formals in
        let flocals = check_var_decls env' func_decl.locals in
        let fbody = func_decl.body in
        let fbody = check_stmts env' fbody in
        let ffreturntype = func_decl.freturntype in
        let new_func_decl = { func_decl with  body = fbody; locals = flocals;
        formals = fformals; freturntype = ffreturntype; } in
        env.functions <- new_func_decl::env.functions ; new_func_decl

let check_func_decls env func_decls =
    let func_decls = List.map (fun f -> check_func_decl env f) func_decls in
    func_decls

(* Room checking*)
let process_room_field (field: Ast.var_decl) (env: translation_environment) = match field
with
    Ast.Var(typ, name) ->
        let t = check_type_not_void typ in
            if (List.exists ( fun var_decl -> begin match var_decl with
                                                Var(_, s) -> s = name
                                                |_ -> raise (Failure "should never reach here")
                                                end ) env.room_def )
            then
                raise (Failure "room fields names cannot repeat.")
            else
                env.room_def <- Ast.Var(t, name):: env.room_def; (* side effect add room
field to room_table *)
            Ast.Var(t, name) (*return this*)
    | _ -> raise (Failure "room field not correct format. declare a type and name.")


let process_room_decl_body (env: translation_environment) (rfa: Ast.stmt) = begin match rfa
with
    Ast.Expr(roomAssign) -> begin match roomAssign with (* check that the expr is in the
form of an assign*)
        Ast.Assign(fieldname, expr) ->
            let rdecl =
            (try List.find(fun rdecl -> begin match rdecl with
                    Array_decl(_, _, s) -> "0" = fieldname
                    | Var(t, s) -> s = fieldname
                    | VarInit(_, s, _) -> "0" = fieldname end) env.room_def
            with
                Not_found-> raise (Failure "field name in room decl does not
                exist.")) in
            let (room_decl_typ, _) = get_var_type_name rdecl in
            (*CHECKING FOR ROOM DECL BODY EXPR RETURN TYPE HERE*)
            let (_, typ) = check_expr env expr in
            let _ = require_eq [typ;room_decl_typ] "room decl body does not match field
type" in
            rfa (*return this*)
        | _ -> raise (Failure "room assignment not correct format.") end
    | _ -> raise (Failure "room assignment not correct format.") end


let check_room_decl (env: translation_environment) (room: Ast.room_decl) =
    let name = room.rname in
    let body = room.rbody in (* body is a list of stmts*)
        try let _ = find_room env name in raise(Failure ("Room with name " ^ name ^ " 
already exists."))
        with Not_found ->
        let checked_body = List.map ( fun unchecked -> process_room_decl_body env unchecked) 
body in
        (* check that number of fields in room_def match with number of fields in room 
decl*)
        let num_stmts = List.length(checked_body) in
            if (num_stmts <> List.length(env.room_def)) then
                raise (Failure "number of room decl fields do not match definition.")
            else
                (* add the room_decls to the scope*)
                let checked_room_decl = { rname = name; rbody = checked_body } in
                env.rooms <- checked_room_decl::env.rooms;
                checked_room_decl (* return this *)

let check_room_decls (env: translation_environment) rooms =
        let checked_room_decls = List.map (fun unchecked -> check_room_decl env unchecked) 
rooms in
        checked_room_decls


let check_room_def (env: translation_environment) (r: Ast.room_def) =
    try
        let checked_fields = List.map ( fun room_field -> process_room_field room_field env) 
r in
        checked_fields
    with
    | _ -> raise (Failure "room defs didn't check out")

(* NPC checking*)
let process_npc_field (field: Ast.var_decl) (env: translation_environment) = match field 
with
    Ast.Var(typ, name) ->
        let t = check_type_not_void typ in
            if (List.exists ( fun var_decl -> begin match var_decl with
                                        Var(_, s) -> s = name
                                        |_ -> raise (Failure "should never reach here")
                                        end ) env.npc_def )
            then
                raise (Failure "npc fields names cannot repeat.")
            else
                env.npc_def <- Ast.Var(t, name):: env.npc_def; (* side effect add room field 
to room_table *)
            Ast.Var(t, name) (*return this*)
    | _ -> raise (Failure "npc field not correct format. declare a type and name.")


let process_npc_decl_body (env: translation_environment) (nfa: Ast.stmt) = begin match nfa 
with
    Ast.Expr(npcAssign) -> begin match npcAssign with (* check that the expr is in the form 
of an assign*)
        Ast.Assign(fieldname, expr) ->
            let ndecl =
                (try List.find(fun ndecl -> begin match ndecl with
                    Array_decl(_, _, s) -> "0" = fieldname
                    | Var(t, s) -> s = fieldname
                    | VarInit(_, s, _) -> "0" = fieldname end) env.npc_def
                 with
                Not_found-> raise (Failure "field name in npc decl does not 
                exist.")) in
            let (npc_decl_typ, _) = get_var_type_name ndecl in
            let (_, typ) = check_expr env expr in
                let _ = require_eq [typ;npc_decl_typ] "npc decl body does not match field 
type" in
                nfa (*return this*)
        | _ -> raise (Failure "npc assignment not correct format.") end
    | _ -> raise (Failure "npc assignment not correct format.") end


let check_npc_decl (env: translation_environment) (npc: Ast.npc_decl) =
    let name = npc.nname in
    let body = npc.nbody in (* body is a list of stmts*)
        try let _ = find_npc env name in raise(Failure ("NPC with name " ^ name ^ " already 
exists."))
        with Not_found ->
        let checked_body = List.map ( fun unchecked -> process_npc_decl_body env unchecked) 
body in
        (* check that number of fields in room_def match with number of fields in room 
decl*)
        let num_stmts = List.length(checked_body) in
            if (num_stmts <> List.length(env.npc_def)) then
                raise (Failure "number of npc decl fields do not match definition.")
            else
                (* add the room_decls to the scope*)
                let checked_npc_decl = { nname = name; nbody = checked_body } in
                env.npcs <- checked_npc_decl::env.npcs;
                checked_npc_decl (* return this *)

let check_npc_decls (env: translation_environment) npcs =
        let checked_npc_decls = List.map (fun unchecked -> check_npc_decl env unchecked) 
npcs in
        checked_npc_decls


let check_npc_def (env: translation_environment) (n: Ast.npc_def) =
        let checked_fields = List.map ( fun npc_field -> process_npc_field npc_field env) n 
in
        checked_fields


(* Item checking*)
let process_item_field (field: Ast.var_decl) (env: translation_environment) = match field 
with
    Ast.Var(typ, name) ->
        let t = check_type_not_void typ in
            if (List.exists ( fun var_decl -> begin match var_decl with
                                            Var(_, s) -> s = name
                                            |_ -> raise (Failure "should never reach here")
                                            end ) env.item_def )
            then
                raise (Failure "item fields names cannot repeat.")
            else
                env.item_def <- Ast.Var(t, name):: env.item_def; (* side effect add item
field to item_table *)
            Ast.Var(t, name) (*return this*)
    | _ -> raise (Failure "item field not correct format. declare a type and name.")

let process_item_decl_body (env: translation_environment) (ifa: Ast.stmt) = begin match ifa
with
    Ast.Expr(itemAssign) -> begin match itemAssign with (* check that the expr is in the
form of an assign*)
        Ast.Assign(fieldname, expr) ->
            let idecl =
                (try List.find(fun idecl -> begin match idecl with
                    Array_decl(_, _, s) -> "0" = fieldname
                    | Var(t, s) -> s = fieldname
                    | VarInit(_, s, _) -> "0" = fieldname end) env.item_def
                    with Not_found -> raise (Failure "field name in npc decl does not
                exist.")) in
            let (item_decl_typ, _) = get_var_type_name idecl in
            let (_, typ) = check_expr env expr in
            let _ = require_eq[typ;item_decl_typ] "item decl body does not match field type"
in
            ifa (*return this*)
        | _ -> raise (Failure "item assignment not correct format.") end
    | _ -> raise (Failure "item assignment not correct format.") end


let check_item_decl (env: translation_environment) (item: Ast.item_decl) =
    let name = item.iname in
    let body = item.ibody in (* body is a list of stmts*)
        try let _ = find_item env name in raise(Failure ("Item with name " ^ name ^ "
already exists."))
        with Not_found ->
        let checked_body = List.map ( fun unchecked -> process_item_decl_body env unchecked)
body in
        (* check that number of fields in room_def match with number of fields in room
decl*)
        let num_stmts = List.length(checked_body) in
            if (num_stmts <> List.length(env.item_def)) then
                raise (Failure "number of item decl fields do not match definition.")
            else
                (* add the room_decls to the scope*)
                let checked_item_decl = { iname = name; ibody = checked_body } in
                env.items <- checked_item_decl::env.items;
                checked_item_decl (* return this *)

let check_item_decls (env: translation_environment) items =
        let checked_item_decls = List.map (fun unchecked -> check_item_decl env unchecked)
items in
        checked_item_decls


let check_item_def (env: translation_environment) (i: Ast.item_def) =
        let checked_fields = List.map ( fun item_field -> process_item_field item_field env)
i in
        checked_fields


(* Predicate checking *)
let check_pred_stmt (env: translation_environment) pstmt =
    (* check that the expr is a boolean expr, check all var decls, check all
     * stmts in body *)
    let scope' = { parent = Some(env.scope); variables = [];} in
    let env' = { env with scope = scope'; functions =
        env.functions; room_def = env.room_def; pred_stmts =
            env.pred_stmts; rooms = env.rooms } in
    let (checked_pred, typ) = check_expr env pstmt.pred in
    let _ = require_bools [typ] "Expression in predicate statement conditional must be
    of type Boolean" in
    let checked_locals = check_var_decls env' pstmt.locals in
    let checked_body = check_stmts env' pstmt.body in
    let new_pstmt = {pred = checked_pred; locals = checked_locals; body =
        checked_body;} in
    env.pred_stmts <- new_pstmt::env.pred_stmts ; new_pstmt

let check_pred_stmts (env: translation_environment) pstmts =
    let new_pstmts = List.map (fun s -> check_pred_stmt env s) pstmts in
    new_pstmts

(* Adjacency checking *)
let find_adjacency (env : translation_environment) adj =
    if (List.exists (fun rdecl -> rdecl.rname = (List.nth adj 0)) env.rooms &&
        List.exists (fun rdecl -> rdecl.rname = (List.nth adj 1)) env.rooms) then
        adj
    else raise (Failure "One of rooms in adjacency list not declared")


let check_adj_decls (env: translation_environment) adecls =
    try
        let checked_adjs = List.map ( fun adecl -> find_adjacency env adecl) adecls in
        checked_adjs
    with
    | _ -> raise (Failure "adjacencies didn't check out")

(* Entrance point that transforms Ast into semantically correct Ast *)
let check_program (p : Ast.program) =
       let print_int = { freturntype = Void; fname = "print"; formals =
           [Var(Ast.Int, "arg")]; locals = []; body = [];} in
       let print_bool = { freturntype = Void; fname = "print"; formals =
           [Var(Ast.Boolean, "arg")];locals = []; body = [];} in
       let print_str = { freturntype = Void; fname = "print"; formals =
           [Var(Ast.String, "arg")]; locals = []; body = [];} in
       let print_funcs = [print_int; print_bool; print_str] in
       (* adding name type String as default field in room_def*)
       let name_field = Ast.Var(String, "name") in
       (* adding currentRoom as a global variable*)
       let current_room = { rname = "currentRoom" ; rbody = []} in
       let input = Var(Ast.String, "input") in
       let dummy_room = { rname = "input" ; rbody = [] } in
       let dummy_npc = { nname = "input"; nbody = [] } in
       let dummy_item = { iname = "input"; ibody = [] } in
       let symbol_table = { parent = None; variables = [input];} in
       let env = { scope = symbol_table; return_type =
           Ast.Int; functions = print_funcs; room_def = [name_field]; rooms = [current_room;
dummy_room]; npc_def = []; npcs = [dummy_npc];
           item_def = []; items = [dummy_item]; pred_stmts = []; current_func = None } in
        let (room_def, room_decls, adj_decls, start, npc_def, npc_decls, item_def,
            item_decls, var_decls, pred_stmts, funcs) = p in
       let checked_room_def = check_room_def env room_def in
       let checked_room_decls = check_room_decls env room_decls in
       let checked_npc_def = check_npc_def env npc_def in
       let checked_npc_decls = check_npc_decls env npc_decls in
```

```
        let checked_item_def = check_item_def env item_def in
        let checked_item_decls = check_item_decls env item_decls in
        let checked_adj_decls = check_adj_decls env adj_decls in
        let checked_var_decls = check_var_decls env var_decls in
        let checked_funcs = check_func_decls env funcs in
        let checked_pred_stmts = check_pred_stmts env pred_stmts in
    (checked_room_def, checked_room_decls, checked_adj_decls, start, checked_npc_def,
checked_npc_decls, checked_item_def,
    checked_item_decls, checked_var_decls, checked_pred_stmts, checked_funcs)
```

9.1.5 Java Builder (java_builder.ml)

```
(* Authors: Brian, Greg *)

open Jast
open Ast
open Printf

(* http://langref.org/fantom+ocaml+erlang/files/reading/read-into-string *)
let load_file f =
  let ic = open_in f in
  let n = in_channel_length ic in
  let s = Bytes.create n in
  really_input ic s 0 n;
  close_in ic;
  (s)

let build_main (preds, rooms, adjacencies, start, npcs, items) =
    { predicates = preds; rdecls = rooms; adecls = adjacencies; start = start; ndecls =
npcs; idecls = items;}

let build_driver (vars, preds, functions, rooms, adjacencies, start, npcs, items) =
    let main = build_main (preds, rooms, adjacencies, start, npcs, items) in
    let default_funcs = load_file("java_lib/driver_functions.txt") in
               (vars, main, functions, default_funcs)

let rearrange (program) =
       let (room_def, room_decl_list, adj_decl_list, start, npc_def, npc_decl_list,
                item_def, item_decl_list, vdecl_list, predicate_list, func_decl_list) =
program in
       let driver = build_driver (vdecl_list, predicate_list, func_decl_list,
room_decl_list, adj_decl_list, start,
                npc_decl_list, item_decl_list) in
       (driver, room_def, npc_def, item_def)
```

9.1.6 JAST (jast.mli)

```
(* Authors: Greg, Brian *)
```

```
open Ast

type main_method =
{
    predicates: pred_stmt list;
    rdecls: room_decl list;
       adecls: adj_decl list;
       start: start;
       ndecls: npc_decl list;
       idecls: item_decl list;
}

type other_classes = room_def * item_def * npc_def

type driver_class = var_decl list * main_method * func_decl list

type program = driver_class * other_classes
```

9.1.7 Code Generator (code_gen.ml)

```
(* Authors: Brian, Greg *)

open Printf
open Jast
open Ast

let driver_file = "Driver.java"
let room_file = "Room.java"
let npc_file = "Npc.java"
let item_file = "Item.java"

let rec data_type = function
        String                         -> "String"
        | Int                          -> "int"
        | Void                         -> "void"
        | Array(var_type, size)        -> data_type var_type ^ "[" ^ string_of_int size ^
"]"
        | Boolean                      -> "boolean"

let operator = function
        Add                            -> "+"
        | Sub                          -> "-"
        | Mult                         -> "*"
        | Div                          -> "/"
        | Equal                        -> "=="
        | Neq                          -> "!="
        | Less                         -> "<"
        | Leq                          -> "<="
        | Greater                      -> ">"
        | Geq                          -> ">="
        | And                         -> "&&"
        | Or                          -> "||"
        | Not                         -> "!"
        | StrEqual                    -> ".equals("

let check_str_eq = function
        StrEqual         -> true
        | _              -> false

let rec expression = function
        StrLiteral(str)               -> str
        | IntLiteral(i)               -> string_of_int i
        | NegIntLiteral(i)            -> "-" ^ string_of_int i
        | BoolLiteral(boolean)        -> string_of_bool boolean
        | Id(id)                      -> id
        | Access(id, field)           -> id ^ "." ^ field
        | Assign(id, expr)            -> id ^ " = " ^ (expression expr)
        | ArrayAssign(id, loc, expr)  -> id ^ "[" ^ (expression loc) ^ "] = " ^
(expression expr)
        | ArrayAccess(id, loc)        -> id ^ "[" ^ (expression loc) ^ "]"
        | Binop(expr1, op, expr2)     -> if check_str_eq op then ((expression expr1)
                                           ^ (operator op) ^ (expression expr2)) ^ ")"
                                         else ((expression expr1) ^ (operator op) ^
(expression expr2))
        | Boolneg(op, expr)           -> ((operator op) ^ (expression expr))
        | Call(fname, arg)            ->
               let rec expr_list = function
               []                         -> ""
               | [solo]                   -> (expression solo)
               | hd::tl                   -> ((expression hd) ^ "," ^ (expr_list tl))
               in (
                       (
                        if fname = "getInputFromOptions" then
                                "promptForInput(new String[]{" ^ expr_list arg ^ "})"
                        else if fname = "getInputAdjacentRooms" then
                                "getInputForAdjacentRooms(currentRoom)"
                        else if fname = "print" then
                                ("System.out.print" ^ "(" ^ expr_list arg ^ ")")
                        else if fname = "arrLen" then
                                ((expr_list arg) ^ ".length")
                        else fname ^ "(" ^ expr_list arg ^ ")"
                    )
                )
        | End                         -> "break"

let expression_with_semi (expr) = ((expression expr) ^ ";\n")


let rec statement_list = function
        []               -> ""
        | hd::tl         ->
               let rec statement = function
                         Block(stmt_list)         -> "{" ^ (statement_list stmt_list) ^ "}"
                       | Expr(expr)             -> (expression_with_semi expr)
                       | Return(expr)           -> ("return " ^ expression_with_semi expr)
                       | If(expr, stmt1, stmt2) -> "if (" ^ (expression expr) ^ ") "
                                                     ^ (statement stmt1) ^ "else" ^
(statement stmt2)
                       | While(expr, stmt)      -> "while (" ^ (expression expr) ^ ") " ^
(statement stmt)
```

```
                | Goto(str)              -> "movePlayerToRoom(" ^ str ^ ");\n"
              in ((statement hd) ^ (statement_list tl))

let formal = function
        Var(datatype, id)               -> ((data_type datatype) ^ " " ^ id)
        | _                             -> ""

let rec formals_list = function
        []                              -> ""
        | [solo]                        -> formal solo
        | hd::tl                        -> ((formal hd) ^ "," ^ (formals_list tl))

let local = function
        Array_decl(var_type, expr, str) -> ((data_type var_type) ^ "[] " ^ str ^ "= new " ^
                                             (data_type var_type) ^ "[" ^ (expression
expr) ^ "]")
        | Var(var_type, str)            -> ((data_type var_type) ^ " " ^ str)
        | VarInit(var_type, str, expr)  -> ((data_type var_type) ^ " " ^ str ^
                                             " = " ^ (expression expr))

let rec locals_list = function
        []              ->      ""
        | hd::tl        ->      ((local hd) ^ ";\n" ^ (locals_list tl))

let vdecl = function
        Array_decl(var_type, expr, str) -> ((data_type var_type) ^ "[] " ^
                                             str ^ "= new " ^ (data_type var_type) ^ "["
^ (expression expr) ^ "];")
        | Var(vtype, id)                -> (data_type vtype) ^ " " ^ id ^ ";\n"
        | VarInit(vtype, id, expr)      -> (data_type vtype) ^ " " ^ id ^ " = "
                ^ expression_with_semi expr

let rec vdecl_list = function
        []              -> ""
        | hd::tl        -> "\t" ^ (vdecl hd) ^ (vdecl_list tl)

let global_vdecl = function
        Array_decl(var_type, expr, str) ->      ("static " ^ (data_type var_type) ^ "[] " ^
                                                str ^ "= new " ^ (data_type
                                                var_type) ^ "[" ^ (expression
                                                expr) ^ "];\n")
        | Var(vtype, id)                ->      "public static " ^ (data_type vtype) ^ " " ^
id ^ ";\n"
        | VarInit(vtype, id, expr)      ->      "public static " ^ (data_type vtype) ^ " " ^
id ^
                " = " ^ expression_with_semi expr

let rec global_vdecl_list  = function
        []              ->      ""
        | hd::tl        ->      "\t" ^ (global_vdecl hd) ^ (global_vdecl_list tl)

let func_decl f =
        ("public static " ^ (data_type f.freturntype) ^ " " ^ f.fname ^ "("
        ^ (formals_list f.formals) ^ "){\n" ^ (locals_list f.locals) ^
        (statement_list f.body) ^ "\t}\n")

let rec func_decl_list = function
        []              -> ""
        | hd::tl        -> "\t" ^ ((func_decl hd) ^ "\t" ^ (func_decl_list tl)) ^ "\n"
```

```
let rec room_props_list proplist prefix = match proplist with
        []              -> ""
        | hd::tl        -> prefix ^ "." ^ (statement_list [hd]) ^ (room_props_list tl
prefix)

let room_decl r =
        "Room " ^ r.rname ^ " = new Room();\n\troomMap.put(\"" ^ r.rname ^"\", "
        ^ r.rname ^ ");\n" ^ (room_props_list r.rbody r.rname)

let rec room_decl_list = function
        []              -> ""
        | hd::tl        -> "\t\t" ^ ((room_decl hd) ^ "\n" ^ (room_decl_list tl))

let adj_decl = function
        []              -> ""
        | hd::tl        -> hd ^ ".setAdjacent(" ^ (List.hd tl) ^ ");"

let rec adj_decl_list = function
        []              -> ""
        | hd::tl        -> "\t\t" ^ ((adj_decl hd) ^ "\t" ^ (adj_decl_list tl)) ^ "\n"

let start_decl s =
    "\t\tcurrentRoom = " ^ s ^ ";\n"

let pred_stmt s =
        "if(" ^ (expression s.pred) ^ "){\n" ^ vdecl_list s.locals ^ statement_list s.body ^
"}"

let rec pred_stmt_list = function
        []              -> ""
        | hd::tl        -> "\t" ^ ((pred_stmt hd) ^ "\n\t" ^ (pred_stmt_list tl)) ^ "\n"

let rec npc_props_list proplist prefix = match proplist with
        []              -> ""
        | hd::tl        -> prefix ^ "." ^ (statement_list [hd]) ^ (npc_props_list tl prefix)

let npc_decl n =
        "Npc " ^ n.nname ^ " = new Npc();\n\t\t" ^ (npc_props_list n.nbody n.nname)

let rec npc_decl_list = function
        []              -> ""
        | hd::tl        -> "\t\t" ^ ((npc_decl hd) ^ "\n" ^ (npc_decl_list tl))

let rec item_props_list proplist prefix = match proplist with
        []              -> ""
        | hd::tl        -> prefix ^ "." ^ (statement_list [hd]) ^ (item_props_list tl
prefix)

let item_decl i =
        "Item " ^ i.iname ^ " = new Item();\n\t\t" ^ (item_props_list i.ibody i.iname)

let rec item_decl_list = function
        []              -> ""
        | hd::tl        -> "\t\t" ^ ((item_decl hd) ^ "\n" ^ (item_decl_list tl))

let default_globals =
    "
    public static Scanner scanner;
    public static Room currentRoom;
    public static String input = \"\";
    public static HashMap<String, Room> roomMap = new HashMap<String, Room>();
    "

let driver_code (driver_class) =
        let (vars, main, fdecls, lib_funcs) = driver_class in
        "import java.util.*;\n\npublic class Driver {\n\n\t " ^
        default_globals ^
        global_vdecl_list vars ^
        "public static void main(String[] args) {\n\t" ^
        "scanner = new Scanner(System.in);\n\t" ^
        room_decl_list main.rdecls ^
        adj_decl_list main.adecls ^
        start_decl main.start ^
        npc_decl_list main.ndecls ^
        item_decl_list main.idecls ^
        "while (true) {\n" ^
        pred_stmt_list main.predicates ^
        "}\n\t" ^ "scanner.close();\n}\n\n" ^
        func_decl_list fdecls ^
        lib_funcs ^
        "}\n"

let room_constructor = "\n\tpublic Room(){\n\t\tadjRooms = new ArrayList<Room>();\n\t}\n"

let room_adj_functions = "\tpublic void setAdjacent(Room room){\n\t\t" ^
                                "adjRooms.add(room);\n\t\troom.adjRooms.add(this);\n\t}\n\n"
^
                                "\tpublic boolean isAdjacent(Room room){\n\t\t" ^
                                "return adjRooms.contains(room);\n\t}\n\t\t"

let room_adj_field = "\tpublic ArrayList<Room> adjRooms;"

let room_code (room_def) =
        "import java.util.*;\n\npublic class Room {\n\tString name;\n\t" ^
        (vdecl_list room_def) ^ room_adj_field ^ "\n" ^ room_constructor ^
        "\n" ^ room_adj_functions ^ "\n}\n"

let npc_code (npc_def) =
        "public class Npc {\n\n" ^ (vdecl_list npc_def) ^ "\n}\n"

let item_code (item_def) =
        "public class Item {\n\n" ^ (vdecl_list item_def) ^ "\n}\n"

let pretty_print (driver_class, room_def, npc_def, item_def) =
        let oc = open_out driver_file in
        fprintf oc "%s" (driver_code driver_class);
        close_out oc;
        let oc = open_out room_file in
        fprintf oc "%s" (room_code room_def);
        close_out oc;
        let oc = open_out npc_file in
        fprintf oc "%s" (npc_code npc_def);
        close_out oc;
        let oc = open_out item_file in
        fprintf oc "%s" (item_code item_def);
        close_out oc;
```

9.1.8 End-to-end Runner (tbag.ml)

```
(* Authors: Brian *)
open Printf

let _ =
        let lexbuf = Lexing.from_channel stdin in
        let program = Parser.program Scanner.token lexbuf in
        let checked_program = Semantic_checker.check_program program in
        let jast_program = Java_builder.rearrange checked_program in
        Code_gen.pretty_print jast_program;
```

9.1.9 Compile and Run Script (run_tbag.sh)

```
#!/bin/bash
#Authors: Brian
python scripts/importLibrary.py $1

./tbag < prog_w_stdlib.tbag
rm prog_w_stdlib.tbag
javac Driver.java
javac Room.java
java Driver
```

9.1.9 Test Script (run_tests.sh)

```
#!/bin/sh
# Inspired by Professor
# Authors: Maria
# Inspired by Professor Edwards’s microC script
TBAG="./java_tbag.sh"

# Set time limit for all operations
ulimit -t 30

globallog=testall.log
rm -f $globallog
error=0
globalerror=0

keep=0

Usage() {
    echo "Usage: run_tests.sh [options] [.tbag files]"
    echo "-k    Keep intermediate files"
    echo "-h    Print this help"
    exit 1
}
```

```
SignalError() {
    if [ $error -eq 0 ] ; then
       echo "FAILED"
       error=1
    fi
    echo "  $1"
}

# Compare <outfile> <reffile> <difffile>
# Compares the outfile with reffile.  Differences, if any, written to difffile
Compare() {
    generatedfiles="$generatedfiles $3"
    echo diff -b $1 $2 ">" $3 1>&2
    diff -b "$1" "$2" > "$3" 2>&1 || {
       SignalError "$1 differs"
       echo "FAILED $1 differs from $2" 1>&2
    }
}

# Run <args>
# Report the command, run it, and report any errors
Run() {
    echo $* 1>&2
    eval $* || {
       SignalError "$1 failed on $*"
       return 1
    }
}

Check() {
    error=0
    basename=`echo $1 | sed 's/.*\\///
                             s/.tbag//'`
    reffile=`echo $1 | sed 's/.tbag$//'`
    basedir="`echo $1 | sed 's/\/[^\/]*$//'`/."

    echo -n "$basename..."

    echo 1>&2
    echo "###### Testing $basename" 1>&2

    generatedfiles=""

    generatedfiles="$generatedfiles ${basename}.out" &&
    Run "$TBAG" $1 ">" ${basename}.out &&
    Compare ${basename}.out ${reffile}.out ${basename}.diff


    # Report the status and clean up the generated files
    if [ $error -eq 0 ] ; then
       if [ $keep -eq 0 ] ; then
           rm -f $generatedfiles
       fi
       echo "OK"
       echo "###### SUCCESS" 1>&2
    else
       echo "###### FAILED" 1>&2
       globalerror=$error
    fi
}

while getopts kdpsh c; do
    case $c in
       k) # Keep intermediate files
           keep=1
           ;;
       h) # Help
           Usage
           ;;
    esac
done

shift `expr $OPTIND - 1`

if [ $# -ge 1 ]
then
    files=$@
else
    files="tests/fail_*.tbag tests/test_*.tbag"
fi

for file in $files
do
    case $file in
       *test_*)
           Check $file 2>> $globallog
           ;;
       *fail_*)
           Check $file 2>> $globallog
           ;;
       *)
           echo "unknown file type $file"
           globalerror=1
           ;;
    esac
done

exit $globalerror
```

9.1.10 Helper script for testing (java_tbag.sh)

```
#!/bin/sh
# Contributions from Maria, Julie

basename=`echo $1 | sed 's/.*\\///
                         s/.tbag//'`
inputtestsdirectory="tests/"
driverfile="Driver.java"

# clean up all existing .java files
rm -f Driver.java Item.java Npc.java Room.java *.class
```

```
# add tbag standard library to the end of the file
python scripts/importLibrary.py $1

./tbag < prog_w_stdlib.tbag > ${basename}_compiler_output.txt 2>&1
rm prog_w_stdlib.tbag

if [ -f $driverfile ]; then

    javac Driver.java

    if [[ ${basename} = *"_input"* ]]
    then
        java Driver < "$inputtestsdirectory"${basename}.in
    else
        java Driver
    fi
else
    cat ${basename}_compiler_output.txt
fi

rm ${basename}_compiler_output.txt
rm -f Driver.java Item.java Npc.java Room.java *.class
```

9.1.11 Makefile

```
# authors: all

default: compiler

compiler: scanner parser semantic_checker java_builder code_gen tbagger
      ocamlc -o tbag scanner.cmo parser.cmo java_builder.cmo code_gen.cmo
semantic_checker.cmo tbag.cmo

tbagger:
      ocamlc -c tbag.ml;

code_gen:
      ocamlc -c code_gen.ml

java_builder: jast
      ocamlc -c java_builder.ml
```

```
scanner: parser
	ocamllex scanner.mll; ocamlc -o scanner scanner.ml

parser: jast
	ocamlyacc parser.mly; ocamlc -c parser.mli; ocamlc -c parser.ml

jast: ast
	ocamlc -c jast.mli

semantic_checker: ast scanner
	ocamlc -c semantic_checker.ml

ast:
	ocamlc -c ast.mli

.PHONY: clean
clean:
	rm -f scanner.ml parser.ml parser.mli *.cmo *.cmi scanner a.out *.cmx
scannertraced* *.o *.class tbag *.java
```

9.1.12 Standard TBAG library (stdlib.tbag)

```
/* Authors: Julie */
func void intPrintLine(int a) {
      print(a);
      print("\n");
}

func void strPrintLine(string s) {
      print(s);
      print("\n");
}

func void boolPrintLine(boolean b) {
      print(b);
      print("\n");
}
```

9.1.13 Type conversion TBAG library (stdlib.tbag)

```
/* Authors: Julie */
func int intFromLetter(string letter) {
      if (letter ~~ "A") { return 0; } else {}
      if (letter ~~ "B") { return 1; } else {}
      if (letter ~~ "C") { return 2; } else {}
      if (letter ~~ "D") { return 3; } else {}
      if (letter ~~ "E") { return 4; } else {}
      if (letter ~~ "F") { return 5; } else {}
      if (letter ~~ "G") { return 6; } else {}
      if (letter ~~ "H") { return 7; } else {}
      if (letter ~~ "I") { return 8; } else {}
      if (letter ~~ "J") { return 9; } else {}
      if (letter ~~ "K") { return 10; } else {}
      if (letter ~~ "L") { return 11; } else {}
      if (letter ~~ "M") { return 12; } else {}
      if (letter ~~ "N") { return 13; } else {}
      if (letter ~~ "O") { return 14; } else {}
      if (letter ~~ "P") { return 15; } else {}
      if (letter ~~ "Q") { return 16; } else {}
      if (letter ~~ "R") { return 17; } else {}
      if (letter ~~ "S") { return 18; } else {}
      if (letter ~~ "T") { return 19; } else {}
```

```
	if (letter ~~ "U") { return 20; } else {}
	if (letter ~~ "V") { return 21; } else {}
	if (letter ~~ "W") { return 22; } else {}
	if (letter ~~ "X") { return 23; } else {}
	if (letter ~~ "Y") { return 24; } else {}
	if (letter ~~ "Z") { return 25; } else {}
	return neg 1;
}

func string letterFromInt(int i) {
	if (i == 0) { return "A"; } else {}
	if (i == 1) { return "B"; } else {}
	if (i == 2) { return "C"; } else {}
	if (i == 3) { return "D"; } else {}
	if (i == 4) { return "E"; } else {}
	if (i == 5) { return "F"; } else {}
	if (i == 6) { return "G"; } else {}
	if (i == 7) { return "H"; } else {}
	if (i == 8) { return "I"; } else {}
	if (i == 9) { return "J"; } else {}
	if (i == 10) { return "K"; } else {}
	if (i == 11) { return "L"; } else {}
	if (i == 12) { return "M"; } else {}
	if (i == 13) { return "N"; } else {}
	if (i == 14) { return "O"; } else {}
	if (i == 15) { return "P"; } else {}
	if (i == 16) { return "Q"; } else {}
	if (i == 17) { return "R"; } else {}
	if (i == 18) { return "S"; } else {}
	if (i == 19) { return "T"; } else {}
	if (i == 20) { return "U"; } else {}
	if (i == 21) { return "V"; } else {}
	if (i == 22) { return "W"; } else {}
	if (i == 23) { return "X"; } else {}
	if (i == 24) { return "Y"; } else {}
	if (i == 25) { return "Z"; } else {}
	return "_";
}
```

9.1.14 Driver functions (driver_functions.txt)

```
/* Authors: Julie */
	// this is what happens when u do player->room
	public static void movePlayerToRoom(Object room) {
		if (room instanceof Room) {
			currentRoom = (Room) room;
		}
		else {
			Room update = roomMap.get(room);
			currentRoom = update;
		}

	}

	// Prompts player for input and sets global var "input" to whatever
player submitted, provided it's a valid input.
	// If invalid inputs are entered, it'll reprompt until player enters
a valid input.

	// Arguments:
	// String[] acceptableInputs -- the list of acceptable inputs
	public static void promptForInput(String[] acceptableInputs) {
		System.out.println("Choose from one of the following options:");
		for (String option : acceptableInputs) {
			System.out.print(option + "    ");
		}
		System.out.println();
		// loop until player enters valid input

		input = scanner.nextLine();
		System.out.println("Input: " + input);
		while(!Arrays.asList(acceptableInputs).contains(input)) {
			System.out.println("Invalid Input. Try again.");
			input = scanner.nextLine();
			System.out.println("Input: " + input);

		}
		System.out.println();
		System.out.println();

	}

	// Gets all the adjacencies for the room entered as argument and
displays these adjacencies to player.
```

```
      // Prompts player for input and sets global var "input" to whatever
player submitted, provided it's a valid adjacency.
      // If invalid inputs are entered, it'll reprompt until player enters
a valid input.
      // pretty much exactly same as promptForInputs(), except it takes in
a room as an argument instead of a list of strings
            public static void getInputAdjacentRooms(Room room) {
            String[] acceptableInputs = new String[room.adjRooms.size()];
            int i = 0;
            for(Room r : room.adjRooms) {
                  acceptableInputs[i] = r.name;
                  i++;
            }

            System.out.println("Choose from one of the following options:");
            for (String option : acceptableInputs) {
                  System.out.print(option + "    ");
            }
            System.out.println();

            // loop until player enters valid input
            input = scanner.nextLine();
            System.out.println("Input: " + input);
            while(!Arrays.asList(acceptableInputs).contains(input)) {
                  System.out.println("Invalid Input. Try again.");
                  input = scanner.nextLine();
                  System.out.println("Input: " + input);

            }
            System.out.println();
            System.out.println();
      }
```

9.1.15 Test suite

```
fail_arr_assign.tbag:

/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar() {
        int [10] i;
        i ["hello"] = 3;
        return 0;
}
```

fail_arr_assign.out:

```
Fatal error: exception Failure("Positional array access specifier must be
an
                    Integer")
```

fail_arr_assign2.tbag:

```
/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar() {
        int [10] i;
        i [0] = "hello";
        return 0;
}
```

fail_arr_assign2.out:

```
Fatal error: exception Failure("Right hand side of assignment statement
does
                    not match type of array")
```

fail_arr_assign3.tbag:

```
/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar() {
        int i;
        i [0] = 4;
        return 0;
}

fail_arr_assign3.out:

Fatal error: exception Failure("Left hand side of array assignment must
                    be an array")

fail_arr_assign4.tbag:

/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar() {
        int i;
        int j = i [0];
        return 0;
}

fail_arr_assign4.out:

Fatal error: exception Failure("Array access must be used on an array
type")

fail_arr_decl.tbag:

/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar() {
        int ["hello"] i;
        return 0;
}

fail_arr_decl.out:
```

```
Fatal error: exception Failure("Array size must be integer")
```

fail_arr_decl2.tbag:

```
/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar() {
        void [10] i;
        return 0;
}
```

fail_arr_decl2.out:

```
Fatal error: exception Failure("Invalid variable type used")
```

fail_arr_len.tbag:

```
/* Authors: Maria */
true {
      int a;
      int len;
      len = arrLen(a);
      print(len);
      endgame;
}
```

fail_arr_len.out:

```
Fatal error: exception Failure("arrLen expects an array
                      argument")
```

fail_arr_len2.tbag:

```
/* Authors: Maria */
true {
      int a;
        int b;
      int len;
      len = arrLen(a, b);
      print(len);
      endgame;
}
```

fail_arr_len2.out:

```
Fatal error: exception Failure("Function arrLen does
                            not exist with the given parameters.")
```

fail_exist_var.tbag:

```
/* Authors: Maria */
int i = 0;

true {
      testvar();
      endgame;
}

func int testvar() {
        int i = 7;
      return 0;
}
```

fail_exist_var.out:

```
Fatal error: exception Failure("Variable with name i exists.")
```

fail_func_call.tbag:

```
/* Authors: Maria */
true {
        int x = gcd("yo", 14);
      endgame;
}

func int gcd(int a, int b) {
      while (a != b) {
            if (a > b) { a = a - b; }
            else { b = b - a; }
      }
      return a;
}
```

fail_func_call.out:

```
Fatal error: exception Failure("Function gcd does
                            not exist with the given parameters.")
```

fail_func_call2.tbag:

```
/* Authors: Maria */
true {
        int x = gcd(14);
      endgame;
}

func int gcd(int a, int b) {
      while (a != b) {
            if (a > b) { a = a - b; }
            else { b = b - a; }
      }
      return a;
}
```

fail_func_call2.out:

```
Fatal error: exception Failure("Function gcd does
                            not exist with the given parameters.")
```

fail_func_call3.tbag:

```
/* Authors: Maria */
true {
        int x = gcd("yo", 14);
      endgame;
}
```

fail_func_call3.out:

```
Fatal error: exception Failure("Function gcd does
                            not exist with the given parameters.")
```

fail_func_decl.tbag:

```
/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar() {
        int [10] i;
        return 0;
}

func int testvar() {
        int [10] i;
        return 0;
}
```

fail_func_decl.out:

```
Fatal error: exception Failure("Function with name testvar and given
    argument types exists")
```

fail_func_decl2.tbag:

```
/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar(int j) {
        int [10] i;
        return 0;
}

func int testvar(int k) {
        int [10] i;
        return 0;
}
```

fail_func_decl2.out:

```
Fatal error: exception Failure("Function with name testvar and given
    argument types exists")

fail_func_decl3.tbag:

/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar(int j) {
        int [10] i;
        return "hello";
}


fail_func_decl3.out:

Fatal error: exception Failure("Return type of expression does not match
return
type of function")

fail_func_var_decl.tbag:

/* Authors: Iris */
true {
        testvar();
        endgame;
}

func int testvar() {
        int i = 0;
        int i;
        return 0;
}

fail_func_var_decl.out:

Fatal error: exception Failure("Variable with name i exists.")

fail_gifa.tbag:

/* Authors: Maria */
```

```
}

room {}

room Closet {
      name = "Closet";
}

room Bedroom {
      name = "Bedroom";
}

Closet <-> Bedroom;

start { Closet }

npc {
      string name;
      string roomName;
      int hunger;
}

npc Cat {
      name = "Tubbs";
      roomName = "Bedroom";
      hunger = 5;
}

true {
      printCurrentRoomInfo();
      getInputAdjacentRooms(Outside);
      ->input
}

currentRoom.name ~~ Cat.roomName {
      print("you got eaten by the cat.\n");
      endgame;
}

func void printCurrentRoomInfo() {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
}
```

fail_gifa.out:

```
Fatal error: exception Failure("undeclared identifier Outside")
```

fail_gifo.tbag:

```
/* Authors: Maria */
room {}

room Closet {
      name = "Closet";
}

room Bedroom {
      name = "Bedroom";
}

Closet <-> Bedroom;

start { Bedroom }

currentRoom == Closet {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
      getInputFromOptions("Bedroom", 1);
      ->input
      print("\n");
        endgame;
}
```

fail_gifo.out:

```
Fatal error: exception Failure("getInputFromOptions expects
                      one or more string arguments")
```

fail_id_func.tbag:

```
/* Authors: Maria */
true {
        test();
        endgame;
}

func int test() {
        int a = 8;
        print(b);
}
```

```
fail_id_func.out:

Fatal error: exception Failure("undeclared identifier b")
```

```
fail_if.tbag:

/* Authors: Maria */
true {
      testif();
      endgame;
}


func int testif() {
      if ("hello") {
            print("true ");
      }
      else {}
      print("hi");
      return 0;
}
```

```
fail_if.out:

Fatal error: exception Failure("Expression in if statement conditional must
be
    of type Boolean")
```

```
fail_item_decl.tbag:

/* Authors: Maria */
room {}

room Closet {
      name = "Closet";
```

```
}

room Bedroom {
      name = "Bedroom";
}

Closet <-> Bedroom;

start { Closet }

item {
      string name;
      string roomName;
      int hunger;
}

item Cat {
      name = "Tubbs";
      roomName = "Bedroom";
}

boolean started = false;

NOT started {
      strPrintLine("You're a mouse.");
      started = true;
}

true {
      printCurrentRoomInfo();
      getInputAdjacentRooms(currentRoom);
      ->input
}

currentRoom.name ~~ Cat.roomName {
      print("you got eaten by the cat.\n");
      endgame;
}

func void printCurrentRoomInfo() {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
```

```
}
```

fail_item_decl.out:

```
Fatal error: exception Failure("number of item decl fields do not match
definition.")
```

fail_item_decl2.tbag:

```
/* Authors: Maria */
room {}

room Closet {
      name = "Closet";
}

room Bedroom {
      name = "Bedroom";
}

Closet <-> Bedroom;

start { Closet }

item {
      string name;
      string roomName;
      int hunger;
}

item Cat {
      name = "Tubbs";
      roomName = "Bedroom";
        swag = 9999;
}

boolean started = false;

NOT started {
      strPrintLine("You're a mouse.");
      started = true;
}
```

```
true {
      printCurrentRoomInfo();
      getInputAdjacentRooms(currentRoom);
      ->input
}

currentRoom.name ~~ Cat.roomName {
      print("you got eaten by the cat.\n");
      endgame;
}

func void printCurrentRoomInfo() {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
}
```

fail_item_decl2.out:

```
Fatal error: exception Failure("field name in npc decl does not
                exist.")
```

fail_item_def.tbag:

```
/* Authors: Maria */
room {}

room Closet {
      name = "Closet";
}

room Bedroom {
      name = "Bedroom";
}

Closet <-> Bedroom;

start { Closet }

item {
      string name;
      string roomName;
      void hunger;
}

item Cat {
      name = "Tubbs";
      roomName = "Bedroom";
      hunger = 5;
}

boolean started = false;

NOT started {
      strPrintLine("You're a mouse.");
      started = true;
}

true {
      printCurrentRoomInfo();
      getInputAdjacentRooms(currentRoom);
      ->input
}

currentRoom.name ~~ Cat.roomName {
      print("you got eaten by the cat.\n");
      endgame;
}

func void printCurrentRoomInfo() {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
}
```

fail_item_def.out:

```
Fatal error: exception Failure("Invalid variable type used")
```

fail_notexist_id.tbag:

```
/* Authors: Maria */
true {
      testvar();
      endgame;
}
```

```
func int testvar() {
        int x = i;
      return 0;
}
```

fail_notexist_id.out:

```
Fatal error: exception Failure("undeclared identifier i")
```

fail_notexist_var.tbag:

```
/* Authors: Maria */
true {
      testvar();
      endgame;
}

func int testvar() {
        i = 7;
      return 0;
}
```

fail_notexist_var.out:

```
Fatal error: exception Failure("undeclared identifier i")
```

fail_npc_decl.tbag:

```
/* Authors: Maria */
room {}

room Closet {
      name = "Closet";
}

room Bedroom {
      name = "Bedroom";
}

Closet <-> Bedroom;

start { Closet }
```

```
npc {
      string name;
      string roomName;
      int hunger;
}

npc Cat {
      name = "Tubbs";
      roomName = "Bedroom";
}

boolean started = false;

NOT started {
      strPrintLine("You're a mouse.");
      started = true;
}

true {
      printCurrentRoomInfo();
      getInputAdjacentRooms(currentRoom);
      ->input
}

currentRoom.name ~~ Cat.roomName {
      print("you got eaten by the cat.\n");
      endgame;
}

func void printCurrentRoomInfo() {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
}
```

fail_npc_decl.out:

```
Fatal error: exception Failure("number of npc decl fields do not match
definition.")
```

fail_npc_decl2.tbag:

```
/* Authors: Maria */
room {}

room Closet {
      name = "Closet";
}

room Bedroom {
      name = "Bedroom";
}

Closet <-> Bedroom;

start { Closet }

npc {
      string name;
      string roomName;
      int hunger;
}

npc Cat {
      name = "Tubbs";
      roomName = "Bedroom";
        swag = 9999;
}

boolean started = false;

NOT started {
      strPrintLine("You're a mouse.");
      started = true;
}

true {
      printCurrentRoomInfo();
      getInputAdjacentRooms(currentRoom);
      ->input
}

currentRoom.name ~~ Cat.roomName {
      print("you got eaten by the cat.\n");
      endgame;
}

func void printCurrentRoomInfo() {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
}
```

fail_npc_decl2.out:

```
Fatal error: exception Failure("field name in npc decl does not
                exist.")
```

fail_npc_def.tbag:

```
/* Authors: Maria */
room {}

room Closet {
      name = "Closet";
}

room Bedroom {
      name = "Bedroom";
}

Closet <-> Bedroom;

start { Closet }

npc {
      string name;
      string roomName;
      void hunger;
}

npc Cat {
      name = "Tubbs";
      roomName = "Bedroom";
      hunger = 5;
}

boolean started = false;
```

```
NOT started {
      strPrintLine("You're a mouse.");
      started = true;
}

true {
      printCurrentRoomInfo();
      getInputAdjacentRooms(currentRoom);
      ->input
}

currentRoom.name ~~ Cat.roomName {
      print("you got eaten by the cat.\n");
      endgame;
}

func void printCurrentRoomInfo() {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
}
```

fail_npc_def.out:

```
Fatal error: exception Failure("Invalid variable type used")
```

fail_ops.tbag:

```
/* Authors: Maria */
#import stdlib

true {
  printLine("hello" + 2);
  endgame;
}

func int printLine(string b) {
  print(b);
  print("\n");
  return 0;
}
```

```
fail_ops.out:

Fatal error: exception Failure("Types to arithmetic operators +, -, *, /
            must both be Int")

fail_ops2.tbag:

/* Authors: Maria */
true {
  printLine(1 == "hello");
  endgame;
}

func int printLine(boolean b) {
  print(b);
  print("\n");
  return 0;
}


fail_ops2.out:

Fatal error: exception Failure("Types to equality operators ==, !=
                            must be the same and be integers, booleans, or
                            rooms")

fail_ops3.tbag:

/* Authors: Maria */
true {
  printLine(true == "hello");
  endgame;
}

func int printLine(boolean b) {
  print(b);
  print("\n");
  return 0;
}


fail_ops3.out:
```

```
Fatal error: exception Failure("Types to equality operators ==, !=
                            must be the same and be integers, booleans, or
                            rooms")
```

fail_ops4.tbag:

```
/* Authors: Maria */
room {}

room Closet {
      name = "Closet";
}

room LivingRoom {
      name = "Living Room";
}

Closet <-> LivingRoom;

start { Closet }

currentRoom == "hello" {
      print("\n");
        endgame;
}
```

fail_ops4.out:

```
Fatal error: exception Failure("Types to equality operators ==, !=
                            must be the same and be integers, booleans, or
                            rooms")
```

fail_ops5.tbag:

```
/* Authors: Maria */
room {}

room Closet {
        name = "Closet";
}

room LivingRoom {
        name = "Living Room";
}

Closet <-> LivingRoom;

start { Closet }

currentRoom == "hello" {
        print("\n");
        endgame;
}
```

fail_ops5.out:

```
Fatal error: exception Failure("Types to equality operators ==, !=
                            must be the same and be integers, booleans, or
                            rooms")
```

fail_ops6.tbag:

```
/* Authors: Maria */
true {
  printLine(true > 1);
  endgame;
}

func int printLine(boolean b) {
  print(b);
  print("\n");
  return 0;
}
```

fail_ops6.out:

```
Fatal error: exception Failure("Types to integer comparison
                        operators <, <=, >, >= must be integers")
```

fail_ops7.tbag:

```
/* Authors: Maria */
true {
  printLine("hello" ~~ 1);
  endgame;
}

func int printLine(boolean b) {
  print(b);
  print("\n");
  return 0;
}
```

fail_ops7.out:

```
Fatal error: exception Failure("Types to ~~ must both be String")
```

fail_ops8.tbag:

```
/* Authors: Maria */
true {
  printLine("hello" AND 1);
  endgame;
}

func int printLine(boolean b) {
  print(b);
  print("\n");
  return 0;
}
```

fail_ops8.out:

```
Fatal error: exception Failure("Types to binary boolean operators AND, OR
must both be Boolean")
```

fail_ops9.tbag:

```
/* Authors: Maria */
true {
  printLine(NOT "hello");
  endgame;
}

func int printLine(boolean b) {
  print(b);
  print("\n");
  return 0;
}
```

fail_ops9.out:

```
Fatal error: exception Failure("Type to unary boolean NOT operator must be
                    boolean")
```

fail_pred_expr.tbag:

```
/* Authors: Iris */
a {
        endgame;
}

func int test() {
        int a = 8;
}
```

fail_pred_expr.out:

```
Fatal error: exception Failure("undeclared identifier a")
```

fail_rec_func.tbag:

```
/* Authors: Maria */
true {
      print(fib(5));
      endgame;
}

func int fib(int x) {
      if (x < 2) { return 1;}
      else { return fib("hello") + fib(x-2); }
}
```

fail_rec_func.out:

```
Fatal error: exception Failure("Function fib does
                                    not exist with the given parameters.")
```

fail_room_decl.tbag:

```
/* Authors: Iris */
room {
        int num_cats;
}

room Closet {
      name = "Closet";
}

room Bedroom {
      name = "Bedroom";
}


room LivingRoom {
      name = "Living Room";
}

room Outside {
      name = "Outside";
}

Closet <-> Bedroom;
Bedroom <-> LivingRoom;

start { Bedroom }

boolean madeItOutside = false;

currentRoom == Bedroom {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
      get_input_from_options("Closet", "LivingRoom");
      ->input
      print("\n");
}

currentRoom == Closet {
      string testName = currentRoom.name;
      print("Currently in: ");
      print(testName);
      print("\n");
      get_input_from_options("Bedroom");
      ->input
      print("\n");
}

currentRoom == LivingRoom {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
      get_input_from_options("Bedroom", "Outside");
      ->input
      print("\n");
}

currentRoom == Outside {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
      print("\n");
      madeItOutside = true;
}

madeItOutside {
      print("Good job making it outside, lazybones.");
      print("\n");
      endgame;
}
```

fail_room_decl.out:

```
Fatal error: exception Failure("number of room decl fields do not match
definition.")
```

fail_room_decl2.tbag:

```
/* Authors: Maria */
room {
        int num_cats;
}

room Closet {
      name = "Closet";
```

```
        num_dogs = 4;
}

room Bedroom {
      name = "Bedroom";
        num_dogs = 4;
}


room LivingRoom {
      name = "Living Room";
        num_dogs = 4;
}

room Outside {
      name = "Outside";
        num_dogs = 4;
}

Closet <-> Bedroom;
Bedroom <-> LivingRoom;

start { Bedroom }

boolean madeItOutside = false;

currentRoom == Bedroom {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
      get_input_from_options("Closet", "LivingRoom");
      ->input
      print("\n");
}

currentRoom == Closet {
      string testName = currentRoom.name;
      print("Currently in: ");
      print(testName);
      print("\n");
      get_input_from_options("Bedroom");
      ->input
      print("\n");
```

```
}

currentRoom == LivingRoom {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
      get_input_from_options("Bedroom", "Outside");
      ->input
      print("\n");
}

currentRoom == Outside {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
      print("\n");
      madeItOutside = true;
}

madeItOutside {
      print("Good job making it outside, lazybones.");
      print("\n");
      endgame;
}
```

fail_room_decl2.out:

```
Fatal error: exception Failure("field name in room decl does not
                exist.")
```

fail_room_def.tbag:

```
/* Authors: Maria */
room {
        string place;
        void nonsense;
}

room Test {
        name = "Test";
        place = "here";
        nonsense = huh;
}
```

```
room Test2 {
        name = "Test2";
        place = "there";
        nonsense = wha;
}

Test <-> Test2;

start { Test }

true {
        endgame;
}
```

fail_room_def.out:

```
Fatal error: exception Failure("room defs didn't check out")
```

fail_undef_room.tbag:

```
/* Authors: Maria */
room {}

room Closet {
      name = "Closet";
}

room Bedroom {
      name = "Bedroom";
}

Closet <-> Bedroom;

start { Bedroom }

currentRoom == LivingRoom {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
      get_input_from_options("Bedroom", "Closet");
      ->input
      print("\n");
```

```
        endgame;
}


fail_undef_room.out:

Fatal error: exception Failure("undeclared identifier LivingRoom")

fail_var_assign.tbag:

/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar() {
        int [10] i;
        i = 3;
        return 0;
}

fail_var_assign.out:

Fatal error: exception Failure("Left hand side of assignment statement must
                be a non-array variable")

fail_var_assign2.tbag:

/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar() {
        int i;
        string j = "hello";
        i = j;
        return 0;
}

fail_var_assign2.out:
```

```
Fatal error: exception Failure("Type mismatch in assignment statement")
```

fail_var_decl.tbag:

```
/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar() {
        void i;
        return 0;
}
```

fail_var_decl.out:

```
Fatal error: exception Failure("Invalid variable type used")
```

fail_var_decl2.tbag:

```
/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar() {
        void i = 2;
        return 0;
}
```

fail_var_decl2.out:

```
Fatal error: exception Failure("Invalid variable type used")
```

fail_var_init.tbag:

```
/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar() {
        int i = "hello";
        return 0;
}
```

fail_var_init.out:

```
Fatal error: exception Failure("Type mismatch in variable initialization")
```

fail_vdecl_exists.tbag:

```
/* Authors: Iris */
true{
      string a = "blah";
      string a = "huh";
}
```

fail_vdecl_exists.out:

```
Fatal error: exception Failure("Variable with name a exists.")
```

fail_vdecl_ref.tbag:

```
/* Authors: Iris */
true {
      a = "ha";
}
```

fail_vdecl_ref.out:

```
Fatal error: exception Failure("undeclared identifier a")
```

fail_void_arr.tbag:

```
/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar() {
        void [10] i;
        return 0;
}

fail_void_arr.out:

Fatal error: exception Failure("Invalid variable type used")

fail_void_var.tbag:

/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar() {
        void i;
        return 0;
}

fail_void_var.out:

Fatal error: exception Failure("Invalid variable type used")

fail_void_var2.tbag:

/* Authors: Maria */
true {
        testvar();
        endgame;
}

func int testvar() {
        void i = 7;
        return 0;
}

fail_void_var2.out:

Fatal error: exception Failure("Invalid variable type used")

fail_while.tbag:
```

```
/* Authors: Maria */
int i = 0;

true {
      whileTest();
      endgame;
}

func void whileTest() {
      while (i) {
            print(i);
            print("\n");
            i = i + 1;
      }
      print(666);
}
```

fail_while.out:

```
Fatal error: exception Failure("Expression in while statement conditional
must be
    of type Boolean")
```

test_0npc_0item_2rooms.tbag:

```
/* Authors: Julie */
room {
      int temperature;
}

room Space {
      name = "space";
      temperature = neg 1000;
}

room Sun {
      name = "surface of the sun";
      temperature = 99999;
}

Space <-> Sun;
```

```
start { Space }

currentRoom == Space {
      print("you are in ");
      print(currentRoom.name);
      print(". you're being launched into the surface of the sun\n");
      print("currently the temperature is ");
      print(currentRoom.temperature);
      print("\n");
      ->Sun
}

currentRoom == Sun {
      print("Now you're on the ");
      print(currentRoom.name);
      print(" the temp is ");
      print(currentRoom.temperature);
      endgame;
}
```

test_0npc_0item_2rooms.out:

```
you are in space. you're being launched into the surface of the sun
currently the temperature is -1000
Now you're on the surface of the sun the temp is 99999
```

test_0npc_1item_0rooms.tbag:

```
/* Authors: Julie */
item {
      string name;
}

item Purse {
      name = "fluffy purse";
}

true {
      print("You have a ");
      print(Purse.name);
      endgame;
}
```

test_0npc_1item_0rooms.out:

```
You have a fluffy purse
test_0npc_1item_2rooms.tbag:

/* Authors: Julie */
room {
      int temperature;
}

room Space {
      name = "space";
      temperature = neg 1000;
}

room Sun {
      name = "surface of the sun";
      temperature = 99999;
}

Space <-> Sun;

start { Space }

item {
      string name;
}

item Purse {
      name = "fluffy purse";
}

currentRoom == Space {
      print("you are in ");
      print(currentRoom.name);
      print(". you're being launched into the surface of the sun\n");
      print("currently the temperature is ");
      print(currentRoom.temperature);
      print("\n");
      ->Sun
}

currentRoom == Sun {
      print("Now you're on the ");
      print(currentRoom.name);
      print(" the temp is ");
      print(currentRoom.temperature);
      print(". You have a ");
      print(Purse.name);
      endgame;
}
```

test_0npc_1item_2rooms.out:

```
you are in space. you're being launched into the surface of the sun
currently the temperature is -1000
Now you're on the surface of the sun the temp is 99999. You have a fluffy
purse
```

test_1npc_0item_0rooms.tbag:

```
/* Authors: Julie */
npc {
      string name;
      string color;
}

npc Cat {
      name = "Tubbs";
      color = "white";
}

true {
      print("There's a cat here. Its name is ");
      print(Cat.name);
      print(" and it's ");
      print(Cat.color);

      endgame;
}
```

test_1npc_0item_0rooms.out:

```
There's a cat here. Its name is Tubbs and it's white
```

test_1npc_0item_2rooms.tbag:

```
/* Authors: Julie */
room {
      int temperature;
}

room Space {
      name = "space";
      temperature = neg 1000;
}

room Sun {
      name = "surface of the sun";
      temperature = 99999;
}

Space <-> Sun;

start { Space }

npc {
      string name;
      string color;
}

npc Cat {
      name = "Tubbs";
      color = "white";
}

currentRoom == Space {
      print("you are in ");
      print(currentRoom.name);
      print(". you're being launched into the surface of the sun\n");
      print("currently the temperature is ");
      print(currentRoom.temperature);
      print("\n");
      ->Sun
}

currentRoom == Sun {
      print("Now you're on the ");
      print(currentRoom.name);
      print("; the temp is ");
      print(currentRoom.temperature);
      print(". There's a cat here. Its name is ");
      print(Cat.name);
      print(" and it's ");
      print(Cat.color);

      endgame;
}
```

test_1npc_0item_2rooms.out:

```
you are in space. you're being launched into the surface of the sun
currently the temperature is -1000
Now you're on the surface of the sun; the temp is 99999. There's a cat
here. Its name is Tubbs and it's white
```

test_1npc_1item_0rooms.tbag:

```
/* Authors: Julie */
npc {
      string name;
      string color;
}

npc Cat {
      name = "Tubbs";
      color = "white";
}

item {
      string name;
}

item Purse {
      name = "fluffy purse";
}

true {
      print("You have a ");
      print(Purse.name);
      print(". There's a cat here. Its name is ");
      print(Cat.name);
      print(" and it's ");
      print(Cat.color);

      endgame;
}
```

test_1npc_1item_0rooms.out:

```
You have a fluffy purse. There's a cat here. Its name is Tubbs and it's
white
```

test_1npc_1item_2rooms.tbag:

```
/* Authors: Julie */
room {
      int temperature;
}

room Space {
      name = "space";
      temperature = neg 1000;
}

room Sun {
      name = "surface of the sun";
      temperature = 99999;
}

Space <-> Sun;

start { Space }

npc {
      string name;
      string color;
}

npc Cat {
      name = "Tubbs";
      color = "white";
}

item {
      string name;
}

item Purse {
      name = "fluffy purse";
}

currentRoom == Space {
      print("you are in ");
      print(currentRoom.name);
      print(". you're being launched into the surface of the sun\n");
      print("currently the temperature is ");
      print(currentRoom.temperature);
      print("\n");
      ->Sun
}

currentRoom == Sun {
      print("Now you're on the ");
      print(currentRoom.name);
      print("; the temp is ");
      print(currentRoom.temperature);
      print(". You have a ");
      print(Purse.name);
      print(". There's a cat here. Its name is ");
      print(Cat.name);
      print(" and it's ");
      print(Cat.color);

      endgame;
}
```

test_1npc_1item_2rooms.out:

```
you are in space. you're being launched into the surface of the sun
currently the temperature is -1000
Now you're on the surface of the sun; the temp is 99999. You have a fluffy
purse. There's a cat here. Its name is Tubbs and it's white
```

test_add.tbag:

```
/* Authors: Julie */
true {
      print(666+24);
      endgame;
}
```

test_add.out:

```
690
test_arith1.tbag:

/* Authors: Julie */
true {
      print(420 + 8 * 69 - 5);
      endgame;
}

test_arith1.out:

967
test_arith2.tbag:

/* Authors: Julie */
true {
      print(20 - 8 / 2 + 5);
      endgame;
}

test_arith2.out:

21
test_arr_len_1.tbag:

/* Authors: Greg */
true {
      int[3] a;
      int len;
      len = arrLen(a);
      print(len);
      endgame;
}

test_arr_len_1.out:

3
test_array_decl_with_int_expr.tbag:

/* Authors: Greg */
true {
      int[1+1+1] a;
      a[2] = 2;
```

```
	print(a[2]);
	endgame;
}

test_array_decl_with_int_expr.out:

2
test_array_in_func.tbag:

/* Authors: Greg */
true {
	testArr();
	endgame;
}

func void testArr() {
	int[1] a1;
	int[2] a2;
	a1[0] = 0;
	a2[0] = 0;
	a2[1] = 1;
	print(a1[0]);
	print(a2[0]);
	print(a2[1]);
}

test_array_in_func.out:

001
test_array_in_handler.tbag:

/* Authors: Greg */
true {
	int[1] a1;
	int[2] a2;
	a1[0] = 0;
	a2[0] = 0;
	a2[1] = 1;
	print(a1[0]);
	print(a2[0]);
	print(a2[1]);
	endgame;
}
```

test_array_in_handler.out:

```
001
```

test_call_stdlib_from_func.tbag:

```
/* Authors: Julie */
#import stdlib

true {
	test();
	endgame;
}

func void test() {
	strPrintLine("hi");
}
```

test_call_stdlib_from_func.out:

```
hi
```

test_fib_event.tbag:

```
/* Authors: Julie */
int fibTerm = 6;
int currentTerm = 0;
int fib1 = 0;
int fib2 = 1;
int tmp = 0;

currentTerm < fibTerm {
	print(fib2);
	tmp = fib1;
	fib1 = fib2;
	fib2 = tmp + fib2;
	currentTerm = currentTerm + 1;
}

currentTerm >= fibTerm {
	endgame;
}
```

```
}
```

test_fib_event.out:

```
112358
```

test_fib_func.tbag:

```
/* Authors: Julie */
/* Based on Seven Weeks of Cat Monarchy, a game created by Fathom and
Scuffy for the Ludum Dare 34 game jam. */
/* http://fathom.itch.io/seven-weeks-of-cat-monarchy */

true {
	print(fib(0));
	print(fib(1));
	print(fib(2));
	print(fib(3));
	print(fib(4));
	print(fib(5));
	endgame;
}

func int fib(int x) {
	if (x < 2) { return 1;}
	else { return fib(x-1) + fib(x-2); }
}
```

test_fib_func.out:

```
112358
```

test_func.tbag:

```
/* Authors: Julie */
true {
	int a;
	a = add(666, 3);
	print(a);
	endgame;
}

func int add(int a, int b) {
	return a + b;
}
```

test_func.out:

```
669
```

test_func2.tbag:

```
/* Authors: Julie */
true {
      printstuff(666, "hi", 69, "lol");
      endgame;
}

func int printstuff(int a, string b, int c, string d) {
      print(a);
      print(b);
      print(c);
      print(d);
      return 0;
}
```

test_func2.out:

```
666hi69lol
```

test_game_cat_kingdom_input.in:

```
East_Chamber
No
Great_Hall
West_Chamber
Yes
Great_Hall
West_Chamber
Yes
Great_Hall
East_Chamber
Yes
Great_Hall
Throne_Room
2
East_Chamber
Yes
Great_Hall
West_Chamber
Yes
```

```
Kitchen
Y
Z
Z
X
Y
Z
Z
Y
X
None
West_Chamber
Yes
Great_Hall
Throne_Room
1
East_Chamber
Yes
Great_Hall
Throne_Room
2
```

test_game_cat_kingdom_input.tbag:

```
/* Authors: Julie */
#import stdlib

room {}

room Great_Hall {  name = "Great_Hall"; }
room Throne_Room { name = "Throne_Room"; }
room East_Chamber { name = "East_Chamber"; }
room West_Chamber {    name = "West_Chamber"; }
room Kitchen { name = "Kitchen"; }

Throne_Room <-> Great_Hall;   West_Chamber <-> Great_Hall;
East_Chamber <-> Great_Hall;   West_Chamber <-> Kitchen;

start { Great_Hall }

npc {   int id; string name; string roomName; string message;
            string goodResponse; string evilResponse;
            string goodResult; string badResult;
}
```

```
npc Tubbs {
      id = 0;
      name = "King Tubbs";
      roomName = "East_Chamber";
      message = "hi";
      goodResponse = ""; evilResponse = ""; goodResult = ""; badResult =
"";
}

npc Pickles {
      id = 1;
      name = "Duke Pickles";
      roomName = "West_Chamber";
      message = "Your greatness, welcome to the treasury. I am your
financial advisor.\n I stand here amongst our hoard of cheese chunks to
determine the general \"cheesiness\" of our monarchy.\n Feel free to drop
in any time and ask how things are going, yes.\n";
      goodResponse = ""; evilResponse = ""; goodResult = ""; badResult =
"";
}

npc Marshmallow {
      id = 2;
      name = "Lady Marshmallow";
      roomName = "East_Chamber";
      message = "Hello, my new and temporary liege. I am your kingdom
advisor.\n It is my job to advise you on the health and happiness of your
kingdom.\n My own health and happiness is irrelevant.\n Please, see me
again some time.\n";
      goodResponse = ""; evilResponse = ""; goodResult = ""; badResult =
"";

}

npc Pumpkin {
      id = 3;
      name = "Pumpkin";
      roomName = "Throne_Room";
      message = "A cat baby is lost in the spooky forest!\nI know because
it sent me this baby note, via forest squirrel!\n";
      goodResponse = "I will organize a search party!\n";
      evilResponse = "I will organize a snake party!\n";
      goodResult = "They find a baby, and a dozen or so other babies.\n";
      badResult = "You party with some snakes. What a night! The baby is
never heard from again.\n";

}

npc Snowball {
      id = 4;
      name = "Snowball";
      roomName = "Throne_Room";
      message = "Hel... hello monarch!\nI'm...\nI'm very lonely.\nWould you
mind if I just stood in here for a few minutes?\nI'm sorry. I can
leave.\n";
      goodResponse = "Please, stay!\n";
      evilResponse = "LEAVE AT ONCE.\n";
      goodResult = "The cat leaves. You eat a royal pizza bagel.\n";
      badResult = "You both have pizza bagels for lunch.\n";


}

npc Patches {
      id = 5;
      name = "Patches";
      roomName = "Throne_Room";
      message = "Help! It's my son!\nHe is very sick!\nAnd stuck in a huge
bear mouth!\n";
      goodResponse = "Guards, help this cat's son!\n";
      evilResponse = "Guards, help the bear eat this cat's son!\n";
      goodResult = "Your guards manage to save most of the son.\n";
      badResult = "Your guards lose a little bit more of themselves.\n";

}

item {
      int initialAmount;
}

item BowlX {
      initialAmount = 5;
}

item BowlY {
      initialAmount = 7;
}

item BowlZ {
      initialAmount = 8;
}

/* to easily access the db */

string[10] catNames;
string[10] catRoomNames;
string[10] catMessages;
string[10] goodResponses;
string[10] evilResponses;
string[10] goodResults;
string[10] badResults;

string[5] requestTitleCard;


boolean started = false;
int week = 1;
boolean spokeToMarshmallow = false;
boolean spokeToPickles = false;
boolean rollOverWeek = true;
int stateOfKingdom = 5;
int cheeseCubeCount = 5;
int lengthSabbatical = 3;

boolean handleSubjects = false;

boolean dataInitialized = false;

boolean xyzPuzzleInProgress = false;
int bowlXAmount;
int bowlYAmount;
int bowlZAmount;


int xyzState = 1;

NOT dataInitialized {
      catNames[0] = Tubbs.name; catNames[1] = Pickles.name; catNames[2] =
Marshmallow.name;
      catNames[3] = Pumpkin.name; catNames[4] = Snowball.name; catNames[5]
= Patches.name;


      catRoomNames[0] = Tubbs.roomName; catRoomNames[1] = Pickles.roomName;
      catRoomNames[2] = Marshmallow.roomName; catRoomNames[3] =
Pumpkin.roomName;
      catRoomNames[4] = Snowball.roomName; catRoomNames[5] =
Patches.roomName;


      catMessages[0] = Tubbs.message; catMessages[1] = Pickles.message;
      catMessages[2] = Marshmallow.message; catMessages[3] =
Pumpkin.message;
      catMessages[4] = Snowball.message; catMessages[5] = Patches.message;

goodResponses[0] = Tubbs.goodResponse; goodResponses[1] =
Pickles.goodResponse;
goodResponses[2] = Marshmallow.goodResponse; goodResponses[3] =
Pumpkin.goodResponse;
goodResponses[4] = Snowball.goodResponse; goodResponses[5] =
Patches.goodResponse;

evilResponses[0] = Tubbs.evilResponse; evilResponses[1] =
Pickles.evilResponse;
evilResponses[2] = Marshmallow.evilResponse; evilResponses[3] =
Pumpkin.evilResponse;
evilResponses[4] = Snowball.evilResponse; evilResponses[5] =
Patches.evilResponse;

goodResults[0] = Tubbs.goodResult; goodResults[1] = Pickles.goodResult;
goodResults[2] = Marshmallow.goodResult; goodResults[3] =
Pumpkin.goodResult;
goodResults[4] = Snowball.goodResult; goodResults[5] = Patches.goodResult;

badResults[0] = Tubbs.badResult; badResults[1] = Pickles.badResult;
badResults[2] = Marshmallow.badResult; badResults[3] = Pumpkin.badResult;
badResults[4] = Snowball.badResult; badResults[5] = Patches.badResult;

requestTitleCard[1] = "YOUR CAT SUBJECTS HAVE SOME IMPORTANT
REQUESTS!\n\n";
```

```
requestTitleCard[2] = "GET READY FOR EVEN MORE REQUESTS FROM CAT
SUBJECTS!\n\n";
requestTitleCard[3] = "THE FINAL REQUESTS BEFORE YOUR REIGN IS AT AN
END!\n\n";

bowlXAmount = BowlX.initialAmount;
bowlYAmount = BowlY.initialAmount;
bowlZAmount = BowlZ.initialAmount;

dataInitialized = true;

}

NOT started {
      strPrintLine("King Tubbs, the great monarch of the Cat Kingdom, has
recently discovered a sunbeam of sensational quality!");
      print("He has, understandably, requested a ");
      print(lengthSabbatical);
      strPrintLine(" week sabbatical.");
      strPrintLine("It is up to you (as an Official Visiting Noblecat) to
lead the kingdom during that time.");
      strPrintLine("Speak to your advisors and then make some important
decisions!");
      strPrintLine("At the end of seven weeks you can see exactly what sort
of ruler you have been.");
      strPrintLine("THE CAT MONARCHY AWAITS YOUR STEADY LEADERSHIP!\n\n");
      started = true;
}

rollOverWeek {
      print("----------------------  WEEK ");   print(week);
      strPrintLine(" ----------------------\n\n");
      rollOverWeek = false;
}

currentRoom.name ~~ Pickles.roomName {
      print("Ah, here is your financial advisor ");
      print(Pickles.name);
      strPrintLine("!");
      strPrintLine("Do you want to talk to him?");
      getInputFromOptions("Yes", "No");
```

```
}

currentRoom.name ~~ Pickles.roomName AND input ~~ "Yes" {
      print(Pickles.name);
      strPrintLine(" says: ");
      if (NOT spokeToPickles) {
            strPrintLine(Pickles.message);
            spokeToPickles = true;
      } else {
            print("We have ");
            print(cheeseCubeCount);
            print(" cheese cubes!\n\n");
      }

}

currentRoom.name ~~ Marshmallow.roomName {
      print("In this room is your kingdom advisor ");
      print(Marshmallow.name);
      strPrintLine("!");
      strPrintLine("Do you want to talk to her?");
      getInputFromOptions("Yes", "No");

}

currentRoom.name ~~ Marshmallow.roomName AND input ~~ "Yes" {
      print(Marshmallow.name);
      strPrintLine(" says: ");
      if (NOT spokeToMarshmallow) {
            strPrintLine(Marshmallow.message);
            spokeToMarshmallow = true;
      } else {
            if (stateOfKingdom < 5) {
                  strPrintLine("There is 10% more crying in the kingdom
today. An acceptable amount, I suppose.\n");
            } else {
                  strPrintLine("I think things are... fine?\n");
            }
      }
}
NOT xyzPuzzleInProgress {
      printCurrentRoomInfo();
            getInputAdjacentRooms(currentRoom);
```

```
}

NOT xyzPuzzleInProgress AND NOT (input ~~ Throne_Room.name) {
      ->input
}

input ~~ Throne_Room.name {
      if (spokeToMarshmallow AND spokeToPickles) {
            -> input
      } else {
            strPrintLine("Before heading to the throne room to make today's
BIG DECISIONS, you should consider talking to your advisors to the east and
west!");
      }
}

currentRoom == Throne_Room {
      print(requestTitleCard[week]);
      handleSubjects = true;

}

handleSubjects {
      int subjectID = arbitrarySubjectID();
      print(catNames[subjectID]);
      strPrintLine(" says: ");
      strPrintLine(catMessages[subjectID]);
      print("1.  ");
      print(goodResponses[subjectID]);
      print("2.  ");
      strPrintLine(evilResponses[subjectID]);

      getInputFromOptions("1", "2");

      if (input ~~ "1") {
            strPrintLine(goodResults[subjectID]);
            stateOfKingdom = stateOfKingdom + 1;
            cheeseCubeCount = cheeseCubeCount - 1;
      } else {
            strPrintLine(badResults[subjectID]);
            stateOfKingdom = stateOfKingdom - 1;
            cheeseCubeCount = cheeseCubeCount + 1;
      }

      ->Great_Hall

      week = week + 1;
      handleSubjects = false;
      rollOverWeek = true;
}

currentRoom == Kitchen AND NOT xyzPuzzleInProgress {
      strPrintLine("You see three bowls of cat food, one labeled \"X\", one
labeled \"Y\", and one labeled \"Z\".");
      xyzPuzzleInProgress = true;
}

xyzPuzzleInProgress {
      strPrintLine("Which bowl do you want to eat from?");
            getInputFromOptions("X", "Y", "Z", "None");
}

currentRoom == Kitchen AND xyzPuzzleInProgress AND input ~~ "None" {
      xyzState = 1;
      xyzPuzzleInProgress = false;
}


xyzPuzzleInProgress AND input ~~ "X" {
      if (bowlXAmount > 0) {
            bowlXAmount = bowlXAmount - 1;
            print("Bowl X has ");   print(bowlXAmount);   print(" foods
left.\n\n");
                  xyzState = 2;
      } else {
            strPrintLine("There's no food left in this bowl.");
      }
}

xyzPuzzleInProgress AND input ~~ "Y" {
      if (bowlYAmount > 0 ) {
            bowlYAmount = bowlYAmount - 1;
            print("Bowl Y has ");   print(bowlYAmount);   print(" foods
left.\n\n");
```

```
            if (xyzState == 2) {
                  xyzState = 3;
            } else {
                  if (xyzState == 5) {
                        xyzState = 6;
                  } else {
                        xyzState = 1;}
                  }
            } else {
                  strPrintLine("There's no food left in this bowl.");

            }


      }

      xyzPuzzleInProgress AND input ~~ "Z" {
            if (bowlZAmount > 0) {
                  bowlZAmount = bowlZAmount - 1;
                  print("Bowl Z has ");   print(bowlZAmount);   print("
foods left.\n\n");

                  if (xyzState == 3) {
                        xyzState = 4;
                  } else {
                        if (xyzState == 4) {
                              xyzState = 5;
                        } else {
                              xyzState = 1;
                        }
                  }
            } else {
                  strPrintLine("There's no food left in this bowl.");

            }

}
xyzPuzzleInProgress AND xyzState == 6 {
      strPrintLine("YOU FOUND A SECRET TRAP DOOR!!! In it you find a stash
of 9,999 cheese cubes!!");
      cheeseCubeCount = cheeseCubeCount + 9999;
      xyzState = 1;
}
```

```
week > lengthSabbatical {
      strPrintLine("THE TRUE MONARCH HAS RETURNED FROM THE DIVINE
SUNBEAM!\nYour three weeks are complete, and the rightful ruler has
returned!\nLet us see how you did!\nProcessing... BEEP... BEEP BOP...");
      if (stateOfKingdom < 5) {
            strPrintLine("Everyone is dead or dying! What a complete terror
world you've made!");
      } else {}
      if (stateOfKingdom >= 5) {
            strPrintLine("Everyone seems super happy, for now!");
      } else {}

      if (cheeseCubeCount < 5) {
            strPrintLine("Wow, you also gave away all of the monarch's
cheese money! The monarchy is done with, I guess!");
      } else {}
      if (cheeseCubeCount >= 5) {
            strPrintLine("You've also made an unspendably huge fortune!");
      } else {}
      strPrintLine("I think that about wraps it up!");
      strPrintLine("Take care of yourself today!");
      strPrintLine("Thank you for playing, goodbye forever!");

      endgame;
}


func void printCurrentRoomInfo() {
      print("You're in the ");
      print(currentRoom.name);
      strPrintLine(".\n");
}

func int arbitrarySubjectID() {
      if (week == 1) { return 3; } else {}
      if (week == 2) { return 4; } else {}
      if (week == 3) { return 5; } else {}
      return neg 1;

}
```

```
test_game_cat_kingdom_input.out:

King Tubbs, the great monarch of the Cat Kingdom, has recently discovered a
sunbeam of sensational quality!
He has, understandably, requested a 3 week sabbatical.
It is up to you (as an Official Visiting Noblecat) to lead the kingdom
during that time.
Speak to your advisors and then make some important decisions!
At the end of seven weeks you can see exactly what sort of ruler you have
been.
THE CAT MONARCHY AWAITS YOUR STEADY LEADERSHIP!


----------------------  WEEK 1 ----------------------


You're in the Great_Hall.

Choose from one of the following options:
East_Chamber    West_Chamber    Throne_Room
Input: East_Chamber


In this room is your kingdom advisor Lady Marshmallow!
Do you want to talk to her?
Choose from one of the following options:
Yes    No
Input: No


You're in the East_Chamber.

Choose from one of the following options:
Great_Hall
Input: Great_Hall


You're in the Great_Hall.

Choose from one of the following options:
```

```
East_Chamber    West_Chamber    Throne_Room
Input: West_Chamber


Ah, here is your financial advisor Duke Pickles!
Do you want to talk to him?
Choose from one of the following options:
Yes    No
Input: Yes


Duke Pickles says:
Your greatness, welcome to the treasury. I am your financial advisor.
 I stand here amongst our hoard of cheese chunks to determine the general
"cheesiness" of our monarchy.
 Feel free to drop in any time and ask how things are going, yes.

You're in the West_Chamber.

Choose from one of the following options:
Kitchen    Great_Hall
Input: Great_Hall


You're in the Great_Hall.

Choose from one of the following options:
East_Chamber    West_Chamber    Throne_Room
Input: West_Chamber


Ah, here is your financial advisor Duke Pickles!
Do you want to talk to him?
Choose from one of the following options:
Yes    No
Input: Yes


Duke Pickles says:
We have 5 cheese cubes!

You're in the West_Chamber.
```

```
Choose from one of the following options:
Kitchen    Great_Hall
Input: Great_Hall


You're in the Great_Hall.

Choose from one of the following options:
East_Chamber    West_Chamber    Throne_Room
Input: East_Chamber


In this room is your kingdom advisor Lady Marshmallow!
Do you want to talk to her?
Choose from one of the following options:
Yes    No
Input: Yes


Lady Marshmallow says:
Hello, my new and temporary liege. I am your kingdom advisor.
 It is my job to advise you on the health and happiness of your kingdom.
 My own health and happiness is irrelevant.
 Please, see me again some time.

You're in the East_Chamber.

Choose from one of the following options:
Great_Hall
Input: Great_Hall


You're in the Great_Hall.

Choose from one of the following options:
East_Chamber    West_Chamber    Throne_Room
Input: Throne_Room


YOUR CAT SUBJECTS HAVE SOME IMPORTANT REQUESTS!

Pumpkin says:
A cat baby is lost in the spooky forest!
```

```
I know because it sent me this baby note, via forest squirrel!

1.  I will organize a search party!
2.  I will organize a snake party!

Choose from one of the following options:
1    2
Input: 2


You party with some snakes. What a night! The baby is never heard from
again.

----------------------  WEEK 2 ----------------------


You're in the Great_Hall.

Choose from one of the following options:
East_Chamber    West_Chamber    Throne_Room
Input: East_Chamber


In this room is your kingdom advisor Lady Marshmallow!
Do you want to talk to her?
Choose from one of the following options:
Yes    No
Input: Yes


Lady Marshmallow says:
There is 10% more crying in the kingdom today. An acceptable amount, I
suppose.

You're in the East_Chamber.

Choose from one of the following options:
Great_Hall
Input: Great_Hall


You're in the Great_Hall.
```

```
Choose from one of the following options:
East_Chamber    West_Chamber    Throne_Room
Input: West_Chamber


Ah, here is your financial advisor Duke Pickles!
Do you want to talk to him?
Choose from one of the following options:
Yes    No
Input: Yes


Duke Pickles says:
We have 6 cheese cubes!

You're in the West_Chamber.

Choose from one of the following options:
Kitchen    Great_Hall
Input: Kitchen


You see three bowls of cat food, one labeled "X", one labeled "Y", and one
labeled "Z".
Which bowl do you want to eat from?
Choose from one of the following options:
X    Y    Z    None
Input: Y


Bowl Y has 6 foods left.

Which bowl do you want to eat from?
Choose from one of the following options:
X    Y    Z    None
Input: Z


Bowl Z has 7 foods left.

Which bowl do you want to eat from?
Choose from one of the following options:
X    Y    Z    None
```

```
Input: Z


Bowl Z has 6 foods left.

Which bowl do you want to eat from?
Choose from one of the following options:
X    Y    Z    None
Input: X


Bowl X has 4 foods left.

Which bowl do you want to eat from?
Choose from one of the following options:
X    Y    Z    None
Input: Y


Bowl Y has 5 foods left.

Which bowl do you want to eat from?
Choose from one of the following options:
X    Y    Z    None
Input: Z


Bowl Z has 5 foods left.

Which bowl do you want to eat from?
Choose from one of the following options:
X    Y    Z    None
Input: Z


Bowl Z has 4 foods left.

Which bowl do you want to eat from?
Choose from one of the following options:
X    Y    Z    None
Input: Y
```

```
Bowl Y has 4 foods left.

YOU FOUND A SECRET TRAP DOOR!!! In it you find a stash of 9,999 cheese
cubes!!
Which bowl do you want to eat from?
Choose from one of the following options:
X    Y    Z    None
Input: X


Bowl X has 3 foods left.

Which bowl do you want to eat from?
Choose from one of the following options:
X    Y    Z    None
Input: None


You're in the Kitchen.

Choose from one of the following options:
West_Chamber
Input: West_Chamber


Ah, here is your financial advisor Duke Pickles!
Do you want to talk to him?
Choose from one of the following options:
Yes    No
Input: Yes


Duke Pickles says:
We have 10005 cheese cubes!

You're in the West_Chamber.

Choose from one of the following options:
Kitchen    Great_Hall
Input: Great_Hall


You're in the Great_Hall.
```

```
Choose from one of the following options:
East_Chamber    West_Chamber    Throne_Room
Input: Throne_Room


GET READY FOR EVEN MORE REQUESTS FROM CAT SUBJECTS!

Snowball says:
Hel... hello monarch!
I'm...
I'm very lonely.
Would you mind if I just stood in here for a few minutes?
I'm sorry. I can leave.

1.  Please, stay!
2.  LEAVE AT ONCE.

Choose from one of the following options:
1    2
Input: 1


The cat leaves. You eat a royal pizza bagel.

----------------------  WEEK 3 ----------------------


You're in the Great_Hall.

Choose from one of the following options:
East_Chamber    West_Chamber    Throne_Room
Input: East_Chamber


In this room is your kingdom advisor Lady Marshmallow!
Do you want to talk to her?
Choose from one of the following options:
Yes    No
Input: Yes


Lady Marshmallow says:
```

```
I think things are... fine?

You're in the East_Chamber.

Choose from one of the following options:
Great_Hall
Input: Great_Hall


You're in the Great_Hall.

Choose from one of the following options:
East_Chamber    West_Chamber    Throne_Room
Input: Throne_Room


THE FINAL REQUESTS BEFORE YOUR REIGN IS AT AN END!

Patches says:
Help! It's my son!
He is very sick!
And stuck in a huge bear mouth!

1.  Guards, help this cat's son!
2.  Guards, help the bear eat this cat's son!

Choose from one of the following options:
1    2
Input: 2


Your guards lose a little bit more of themselves.

THE TRUE MONARCH HAS RETURNED FROM THE DIVINE SUNBEAM!
Your three weeks are complete, and the rightful ruler has returned!
Let us see how you did!
Processing... BEEP... BEEP BOP...
Everyone is dead or dying! What a complete terror world you've made!
You've also made an unspendably huge fortune!
I think that about wraps it up!
Take care of yourself today!
Thank you for playing, goodbye forever!
```

test_game_go_outside_input.in:

```
LivingRoom
Outside
```

test_game_go_outside_input.tbag:

```
/* Authors: Greg, Julie */

room {}

room Closet {
      name = "Closet";
}

room Bedroom {
      name = "Bedroom";
}


room LivingRoom {
      name = "Living Room";
}

room Outside {
      name = "Outside";
}

Closet <-> Bedroom;
Bedroom <-> LivingRoom;

start { Bedroom }

boolean madeItOutside = false;

currentRoom == Bedroom {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
      getInputFromOptions("Closet", "LivingRoom");
      ->input
      print("\n");
}
```

```
currentRoom == Closet {
      string testName = currentRoom.name;
      print("Currently in: ");
      print(testName);
      print("\n");
      getInputFromOptions("Bedroom");
      ->input
      print("\n");
}

currentRoom == LivingRoom {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
      getInputFromOptions("Bedroom", "Outside");
      ->input
      print("\n");
}

currentRoom == Outside {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
      print("\n");
      madeItOutside = true;
}

madeItOutside {
      print("Good job making it outside, lazybones.");
      print("\n");
      endgame;
}
```

test_game_go_outside_input.out:

```
Currently in: Bedroom
Choose from one of the following options:
Closet    LivingRoom
Input: LivingRoom
```

```
Currently in: Living Room
Choose from one of the following options:
Bedroom    Outside
Input: Outside



Currently in: Outside

Good job making it outside, lazybones.
```

test_game_hangman_input.in:

```
M
D
T
I
E
H
B
C
R
F
G
K
```

test_game_hangman_input.tbag:

```
/* Authors: Julie */
#import stdlib
#import typeConversionLib

int guesses = 0;
int wrongGuesses = 0;
int guessesAllowed = 6;

boolean started = false;
string[10] answer;
boolean[26] guessed;


boolean updateAndDisplay = false;
boolean foundAll;
```

```
NOT started {
      answer[0] = "H";
      answer[1] = "I";
      answer[2] = "T";
      answer[3] = "C";
      answer[4] = "H";
      answer[5] = "H";
      answer[6] = "I";
      answer[7] = "K";
      answer[8] = "E";
      answer[9] = "R";


      started = true;
}

true {

      print("Guess a letter. ");
      getInputFromOptions("A", "B", "C", "D", "E", "F", "G", "H", "I", "J",
"K", "L", "M", "N", "O", "P", "Q", "R", "S", "T", "U", "V", "W", "X", "Y",
"Z");


}

letterIsInAnswer(input) {
      updateAndDisplay = true;
}

NOT letterIsInAnswer(input) {
      wrongGuesses = wrongGuesses + 1;
      updateAndDisplay = true;
}

updateAndDisplay {
      guessed[intFromLetter(input)] = true;
      guesses = guesses + 1;
      printHangMan(wrongGuesses);
      foundAll = checkAndPrintStatus();
      updateAndDisplay = false;
}
```

```
foundAll {
      strPrintLine("WOO!!!! YOU WON!!!!!!!!");
      endgame;
}

wrongGuesses >= guessesAllowed {
      strPrintLine("You lost, how embarrassing!!!");
      endgame;
}

func boolean letterIsInAnswer(string letter) {
      int i = 0;
      boolean found = false;
      while (i < arrLen(answer) AND found == false) {
            if (answer[i] ~~ letter) {
                  found = true;
            } else {}
            i = i + 1;
      }
      return found;
}

func void printHangMan(int wg) {
            print("\n");
            print("\n");
            print("\n");

      if (wg == 0) {
            print( " _________     \n");
            print( "|         |    \n");
            print( "|             \n");
            print( "|           \n");
            print( "|              \n");
            print( "|              \n");
            print( "|              \n");

      } else {}
      if (wg == 1) {
            print( " _________     \n");
            print( "|         |    \n");
            print( "|         O    \n");
            print( "|           \n");
            print( "|              \n");
            print( "|              \n");
            print( "|              \n");

      } else {}
      if (wg == 2) {
            print( " _________     \n");
            print( "|         |    \n");
            print( "|         O    \n");
            print( "|        /   \n");
            print( "|              \n");
            print( "|              \n");
            print( "|              \n");

      } else {}
      if (wg == 3) {
            print( " _________     \n");
            print( "|         |    \n");
            print( "|         O    \n");
            print( "|        /|   \n");
            print( "|              \n");
            print( "|              \n");
            print( "|              \n");

      } else {}
      if (wg == 4) {
            print( " _________     \n");
            print( "|         |    \n");
            print( "|         O    \n");
            print( "|        /|\\  \n");
            print( "|              \n");
            print( "|              \n");
            print( "|              \n");

      } else {}
      if (wg == 5) {
            print( " _________     \n");
            print( "|         |    \n");
            print( "|         O    \n");
            print( "|        /|\\  \n");
            print( "|        /     \n");
            print( "|              \n");
            print( "|              \n");
      } else {}
      if (wg == 6) {
            print( " _________     \n");
            print( "|         |    \n");
            print( "|         O    \n");
            print( "|        /|\\  \n");
            print( "|        / \\  \n");
            print( "|              \n");
            print( "|              \n");

      } else {}
                  print("\n");
            print("\n");
            print("\n");

}

func void printGuessedLetters() {
            int i = 0;

      print("Already Guessed : ");

            while (i < arrLen(guessed)) {
                  if (guessed[i] == true) {
                        print(letterFromInt(i));
                        print(" ");
                  } else {}
                  i = i + 1;
            }
}

func boolean checkAndPrintStatus() {
      int i = 0;
      boolean foundall = true;
      while (i < arrLen(answer)) {
            if (guessed[intFromLetter(answer[i])]) {
                  print(answer[i]);
                  print(" ");
            } else {
                  foundall = false;
                  print("_");
                  print(" ");
            }
            i = i + 1;
      }

      print("\n");
      print("\n");

      printGuessedLetters();

      print("\n");
      print("\n");
      print("\n");

      return foundall;
}
```

test_game_hangman_input.out:

```
Guess a letter. Choose from one of the following options:
A    B    C    D    E    F    G    H    I    J    K    L    M    N    O
P    Q    R    S    T    U    V    W    X    Y    Z
Input: M





 _________
|         |
|         O
|
|
|
|



_ _ _ _ _ _ _ _ _ _

Already Guessed : M
```

```
Guess a letter. Choose from one of the following options:
A    B    C    D    E    F    G    H    I    J    K    L    M    N    O
P    Q    R    S    T    U    V    W    X    Y    Z
Input: D




 _________
|         |
|         O
|        /
|
|
|



_ _ _ _ _ _ _ _ _ _

Already Guessed : D M


Guess a letter. Choose from one of the following options:
A    B    C    D    E    F    G    H    I    J    K    L    M    N    O
P    Q    R    S    T    U    V    W    X    Y    Z
Input: T




 _________
|         |
|         O
|        /
|
|
|
_ _ T _ _ _ _ _ _ _

Already Guessed : D M T


Guess a letter. Choose from one of the following options:
A    B    C    D    E    F    G    H    I    J    K    L    M    N    O
P    Q    R    S    T    U    V    W    X    Y    Z
Input: I






 _________
|         |
|         O
|        /
|
|
|




_ I T _ _ _ I _ _ _

Already Guessed : D I M T


Guess a letter. Choose from one of the following options:
A    B    C    D    E    F    G    H    I    J    K    L    M    N    O
P    Q    R    S    T    U    V    W    X    Y    Z
Input: E






 _________
|         |
|         O
|        /
|
|
|



_ I T _ _ _ I _ E _

Already Guessed : D E I M T


Guess a letter. Choose from one of the following options:
A    B    C    D    E    F    G    H    I    J    K    L    M    N    O
P    Q    R    S    T    U    V    W    X    Y    Z
Input: H






 _________
|         |
|         O
|        /
|
|
|



H I T _ H H I _ E _

Already Guessed : D E H I M T


Guess a letter. Choose from one of the following options:
A    B    C    D    E    F    G    H    I    J    K    L    M    N    O
P    Q    R    S    T    U    V    W    X    Y    Z
Input: B
```

```
 _________
|         |
|         O
|        /|
|
|
|



H I T _ H H I _ E _

Already Guessed : B D E H I M T


Guess a letter. Choose from one of the following options:
A    B    C    D    E    F    G    H    I    J    K    L    M    N    O
P    Q    R    S    T    U    V    W    X    Y    Z
Input: C





 _________
|         |
|         O
|        /|
|
|
|



H I T C H H I _ E _

Already Guessed : B C D E H I M T


Guess a letter. Choose from one of the following options:
```

```
A    B    C    D    E    F    G    H    I    J    K    L    M    N    O
P    Q    R    S    T    U    V    W    X    Y    Z
Input: R





 _________
|         |
|         O
|        /|
|
|
|



H I T C H H I _ E R

Already Guessed : B C D E H I M R T


Guess a letter. Choose from one of the following options:
A    B    C    D    E    F    G    H    I    J    K    L    M    N    O
P    Q    R    S    T    U    V    W    X    Y    Z
Input: F





 _________
|         |
|         O
|        /|\
|
|
|



H I T C H H I _ E R
```

```
Already Guessed : B C D E F H I M R T


Guess a letter. Choose from one of the following options:
A    B    C    D    E    F    G    H    I    J    K    L    M    N    O
P    Q    R    S    T    U    V    W    X    Y    Z
Input: G




 _________
|         |
|         O
|        /|\
|        /
|
|



H I T C H H I _ E R

Already Guessed : B C D E F G H I M R T


Guess a letter. Choose from one of the following options:
A    B    C    D    E    F    G    H    I    J    K    L    M    N    O
P    Q    R    S    T    U    V    W    X    Y    Z
Input: K




 _________
|         |
|         O
|        /|\
|        /
|
|



H I T C H H I K E R

Already Guessed : B C D E F G H I K M R T


WOO!!!! YOU WON!!!!!!!!
```

test_game_mouse_cat_input.in:

```
Wall
Kitchen
Wall
Kitchen
Bedroom
```

test_game_mouse_cat_input.tbag:

```
/* Authors: Julie */
#import stdlib
#import typeConversionLib

room {}

room Closet {
      name = "Closet";
}

room Bedroom {
      name = "Bedroom";
}

room Wall {
      name = "Wall";
}

room Kitchen {
      name = "Kitchen";
}

Closet <-> Bedroom;
Closet <-> Wall;
Kitchen <-> Wall;
Kitchen <-> Bedroom;

start { Closet }

npc {
      string roomName;
}

npc Cat {
      roomName = "Bedroom";
}

boolean started = false;

NOT started {
      strPrintLine("You're a mouse.");
      started = true;
}

true {
      printCurrentRoomInfo();
      getInputAdjacentRooms(currentRoom);
      ->input
}

currentRoom.name ~~ Cat.roomName {
      print("you got eaten by the cat.\n");
      endgame;
}

func void printCurrentRoomInfo() {
      print("Currently in: ");
      print(currentRoom.name);
      print("\n");
}
```

test_game_mouse_cat_input.out:

```
You're a mouse.
Currently in: Closet
Choose from one of the following options:
```

```
Wall    Bedroom
Input: Wall


Currently in: Wall
Choose from one of the following options:
Kitchen    Closet
Input: Kitchen


Currently in: Kitchen
Choose from one of the following options:
Bedroom    Wall
Input: Wall


Currently in: Wall
Choose from one of the following options:
Kitchen    Closet
Input: Kitchen


Currently in: Kitchen
Choose from one of the following options:
Bedroom    Wall
Input: Bedroom


you got eaten by the cat.
```

test_gcd_func.tbag:

```
/* Authors: Julie */
true {
      print(gcd(2,14));
      print("\n");
      print(gcd(3,15));
      print("\n");
      print(gcd(99,121));
      print("\n");
      endgame;
}
```

```
func int gcd(int a, int b) {
      while (a != b) {
            if (a > b) { a = a - b; }
            else { b = b - a; }
      }
      return a;
}
```

test_gcd_func.out:

```
2
3
11
```

test_gcd_func2.tbag:

```
/* Authors: Julie */
true {
  print(gcd(14,21));
      print("\n");
  print(gcd(8,36));
      print("\n");
      print(gcd(99,121));
      print("\n");
      endgame;
}

func int gcd(int a, int b) {
      while (a != b) {
            if (a > b) { a = a - b; }
            else { b = b - a; }
      }
      return a;
}
```

test_gcd_func2.out:

```
7
4
11
```

test_gcd_handler1.tbag:

```
/* Authors: Julie */
int a = 36;
int b = 8;

a == b {
      print(a);
      endgame;
}

a > b {
      a = a - b;
}

a < b {
      b = b - a;
}
```

test_gcd_handler1.out:

```
4
```

test_gcd_handler2.tbag:

```
/* Authors: Julie */
int a = 8;
int b = 36;

a == b {
      print(a);
      endgame;
}

a > b {
      a = a - b;
}

a < b {
      b = b - a;
}
```

test_gcd_handler2.out:

```
4
```

test_gcd_handler3.tbag:

```
/* Authors: Julie */
int a = 2;
int b = 14;

a == b {
      print(a);
      endgame;
}

a > b {
      a = a - b;
}

a < b {
      b = b - a;
}
```

test_gcd_handler3.out:

```
2
```

test_gcd_handler4.tbag:

```
/* Authors: Julie */
int a = 99;
int b = 121;

a == b {
      print(a);
      endgame;
}
```

```
a > b {
      a = a - b;
}

a < b {
      b = b - a;
}
```

test_gcd_handler4.out:

```
11
```

test_global_array_in_handler.tbag:

```
/* Authors: Julie */
int[1] a1;
int[2] a2;

true {
      a1[0] = 0;
      a2[0] = 0;
      a2[1] = 1;
      print(a1[0]);
      print(a2[0]);
      print(a2[1]);
      endgame;
}
```

test_global_array_in_handler.out:

```
001
```

test_global_var_func.tbag:

```
/* Authors: Julie */
int a = 5;

true {
      testvar();
      endgame;
}
```

```
func int testvar() {
      print(a);
      return 0;
}


test_global_var_func.out:

5
test_global_var_handler.tbag:

/* Authors: Julie */
int a = 5;

true {
      print(a);
      endgame;
}

test_global_var_handler.out:

5
test_handler1.tbag:

/* Authors: Julie */
boolean pred1 = false;
boolean pred2 = false;
int a = 0;
int b = 0;

true {
      a = 666;
      pred1 = true;
}

pred2 {
      print(a + b);
      endgame;
}

pred1 {
      b = 3;
      pred2 = true;
}
```

test_handler1.out:

```
669
```

test_handler2.tbag:

```
/* Authors: Julie */
boolean pred1 = false;
boolean pred2 = true;
int int3 = 4;
int int4 = 9;

pred1 {
      print("four");
      pred1 = false;
      endgame;
}

NOT pred2 {
      print("two");
      int4 = int4 + 5;
      pred2 = true;
}

int3 < 6 {
      print(1);
      pred2 = false;
      int3 = 7;
}

int4 >= 10 {
      print(3);
      pred1 = true;
      int4 = 9;
}
```

test_handler2.out:

```
1two3four
test_helloworld.tbag:

/* Authors: Julie */
true {
      print("hello world\n");
      endgame;
}

test_helloworld.out:

hello world

test_helloworld_func.tbag:

/* Authors: Julie */
true {
      hello();
      endgame;
}

func int hello() {
      print("hello world function");
      return 0;
}

test_helloworld_func.out:

hello world function
test_if_func.tbag:

/* Authors: Julie */
true {
      testif();
      endgame;
}


func int testif() {
      if (true) {
            print("true ");
      }
      else {}
      print("hi");
      return 0;
}


test_if_func.out:

true hi
test_if_func2.tbag:

/* Authors: Julie */
true {
      testif();
      endgame;
}

func int testif() {
      if (true) {
            print(666);
      }
      else {
            print(" lol");
      }
      print("hi");
      return 0;
}


test_if_func2.out:

666hi
test_if_func3.tbag:

/* Authors: Julie */
true {
      testif();
      endgame;
}

func int testif() {
      if (false) {
            print("true ");
```

```
	}
	else {}
	print("hi");
	return 0;
}


test_if_func3.out:

hi
test_if_func4.tbag:

/* Authors: Julie */
true {
	testif();
	endgame;
}

func int testif() {
	if (false) {
		print(666);
	}
	else {
		print(" lol");
	}
	print("hi");
	return 0;
}


test_if_func4.out:

 lolhi
test_if_handler3.tbag:

/* Authors: Julie */

true {
	if (true) {
		print(666);
	}
	else {
		print(" lol");
```

```
      }
      print("hi");
      endgame;
}

test_if_handler3.out:

666hi
test_local_var_func.tbag:

/* Authors: Julie */
true {
      testvar();
      endgame;
}

func int testvar() {
      int a = 5;
      print(a);
      return 0;
}


test_local_var_func.out:

5
test_local_var_handler.tbag:

/* Authors: Julie */
true {
      int a = 5;
      print(a);
      endgame;
}

test_local_var_handler.out:

5
test_loop_event.tbag:

/* Authors: Julie */
int i = 0;
```

```
i < 5 {
      print(i);
      i = i + 1;
}

i >= 5 {
      print(666);
      endgame;
}
```

test_loop_event.out:

```
01234666
```

test_loop_while_func.tbag:

```
/* Authors: Julie */
int i = 0;

true {
      whileTest();
      endgame;
}

func void whileTest() {
      while (i < 5) {
            print(i);
            print("\n");
            i = i + 1;
      }
      print(666);
}
```

test_loop_while_func.out:

```
0
1
2
3
4
666
```

test_loop_while_handler.tbag:

```
/* Authors: Julie */
int i = 0;

true {
      while (i < 5) {
            print(i);
            print("\n");
            i = i + 1;
      }
      print(666);
      endgame;
}
```

test_loop_while_handler.out:

```
0
1
2
3
4
666
```

test_ops.tbag:

```
/* Authors: Julie */
#import stdlib

true {
  intPrintLine(1 + 2);
  intPrintLine(1 - 2);
  intPrintLine(1 * 2);
  intPrintLine(100 / 2);
  intPrintLine(99);
  boolPrintLine(1 == 2);
  boolPrintLine(1 == 1);
  intPrintLine(99);
  boolPrintLine(1 != 2);
  boolPrintLine(1 != 1);
  intPrintLine(99);
  boolPrintLine(1 < 2);
  boolPrintLine(2 < 1);
  intPrintLine(99);
  boolPrintLine(1 <= 2);
  boolPrintLine(1 <= 1);
  boolPrintLine(2 <= 1);
  intPrintLine(99);
  boolPrintLine(1 > 2);
  boolPrintLine(2 > 1);
  intPrintLine(99);
  boolPrintLine(1 >= 2);
  boolPrintLine(1 >= 1);
  boolPrintLine(2 >= 1);
  endgame;
}
```

test_ops.out:

```
3
-1
2
50
99
false
true
99
true
false
99
true
false
99
true
true
false
99
false
true
99
false
true
true
```

test_room_data_w_blank_room_decl.tbag:

```
/* Authors: Julie */
room {}

room myRoom {
      name = "living room";
}

room myRoom1 {
      name = "kitchen";
}

myRoom <-> myRoom1;

start {myRoom}

true {
      print("hi\n");
      print(myRoom.name);
      print("\n");
      endgame;
}
```

test_room_data_w_blank_room_decl.out:

```
hi
living room
```

test_stdlib.tbag:

```
/* Authors: Julie */
#import stdlib

true {
      strPrintLine("hi");
      intPrintLine(666);
      boolPrintLine(true);
      boolPrintLine(false);
      endgame;
}
```

test_stdlib.out:

```
hi
666
true
false
```

test_string_literals.tbag:

```
/* Authors: Julie */
true {
	string a = "single quo'te";
	string newline = "\n";
	string c = "tab\ttab";
	string d = "backspac\be";
	string e = "carriage r\return";
	string f = "formfeed\fformfeed";
	string g = "escaped \"double quote\"";
	string h = "backslas\\h";

	print(a);
	print(newline);
	print(c);
	print(newline);
	print(d);
	print(newline);
	print(e);
	print(newline);
	print(f);
	print(newline);
	print(g);
	print(newline);
	print(h);
	print(newline);
	endgame;
}
```

test_string_literals.out:

```
single quo'te
```

```
tab   tab
backspace
carriage r
eturn
formfeedformfeed
escaped "double quote"
backslas\h

test_subtract.tbag:

/* Authors: Julie */
true {
	print(69-7);
	endgame;
}

test_subtract.out:

62
```

9.2 Full Git Commit History

```
2950f75	Maria van Keulen	Tue Dec 22 20:39:14 2015 -0500	Added Iris's test author annotations
2840dde	Maria van Keulen	Tue Dec 22 20:24:49 2015 -0500	Merge branch 'master' of https://github.com/jj-ian/tbag
5905e4a	Maria van Keulen	Tue Dec 22 20:24:25 2015 -0500	Added test author annotations
7725c34	gregorychen3	Tue Dec 22 20:17:50 2015 -0500	authors added to Makefile
70845ae	Maria van Keulen	Tue Dec 22 19:41:01 2015 -0500	Added authors this project never ends
e1179e8	Maria van Keulen	Tue Dec 22 17:18:50 2015 -0500	Last commit EVAR
039bfb8	jj-ian	Tue Dec 22 04:52:39 2015 -0500	Merge pull request #43 from jj-ian/jj-ian/tests
1ab3f85	Julie	Tue Dec 22 04:44:10 2015 -0500	updated preprocessing script so imports can go at top of file, updated tests to match, updated tests to account for java driver formatting changes
71aab16	Julie	Tue Dec 22 03:49:33 2015 -0500	Merge branch 'jj-ian/tests' of https://github.com/jj-ian/tbag into jj-ian/tests
c6e8abc	Julie	Tue Dec 22 03:48:26 2015 -0500	finished cat kingdom demo
28dc203	Julie	Tue Dec 22 03:36:20 2015 -0500	deleted backup
8954afb	Julie	Tue Dec 22 03:35:36 2015 -0500	finished cat kingdom demo
a942df4	Julie	Tue Dec 22 02:34:37 2015 -0500	still working on cat kingdom demo
4e77dff	Julie	Mon Dec 21 18:25:31 2015 -0500	added more cat subjects data to cat kingdom demo
4fd8af2	Julie	Mon Dec 21 18:12:37 2015 -0500	working on cat kingdom demo, updated .gitignore to ignore Julie's scripts
```

```
b5c87de Julie   Mon Dec 21 13:56:29 2015 -0500      cat kingdom output, not valid yet
7173e52 Julie   Mon Dec 21 03:07:13 2015 -0500      working on cat kingdom demo, made new
library, updated some tests
f7274bf Julie   Mon Dec 21 01:58:05 2015 -0500      started cat kingdom game
5ca5dbd Julie   Tue Dec 22 03:48:26 2015 -0500      finished cat kingdom demo
b191cc0 Julie   Tue Dec 22 03:36:20 2015 -0500      deleted backup
2ac5c04 Julie   Tue Dec 22 03:35:36 2015 -0500      finished cat kingdom demo
699fe07 Julie   Tue Dec 22 02:34:37 2015 -0500      still working on cat kingdom demo
7333d2c Maria van Keulen      Mon Dec 21 18:34:35 2015 -0500      Fixed
check_matching_decls_helper, renamed func
8364b64 Julie   Mon Dec 21 18:25:31 2015 -0500      added more cat subjects data to cat kingdom
demo
0b92623 Julie   Mon Dec 21 18:12:37 2015 -0500      working on cat kingdom demo, updated
.gitignore to ignore Julie's scripts
31a349c Julie   Mon Dec 21 13:56:29 2015 -0500      cat kingdom output, not valid yet
def58fc Julie   Mon Dec 21 03:07:13 2015 -0500      working on cat kingdom demo, made new
library, updated some tests
3eb502c Julie   Mon Dec 21 01:58:05 2015 -0500      started cat kingdom game
0ed0758 mvankeulen94   Mon Dec 21 13:32:54 2015 -0500      Merge pull request #42 from
jj-ian/scfix
aceb14f Maria van Keulen      Mon Dec 21 13:22:10 2015 -0500      Check GIFO num args, updated
usage msg in script
79bf83e Maria van Keulen      Mon Dec 21 10:24:22 2015 -0500      Final sem check fixes
2197cc3 jj-ian Mon Dec 21 00:28:54 2015 -0500      Merge pull request #41 from
jj-ian/jj-ian/tests
351b35c Julie   Mon Dec 21 00:21:34 2015 -0500      modified golden refs for some tests after i
changed java library
ef96dfb Julie   Sun Dec 20 23:55:11 2015 -0500      Merge branch 'jj-ian/tests' of
https://github.com/jj-ian/tbag into jj-ian/tests
7fde1df Julie   Sun Dec 20 23:52:33 2015 -0500      finished hangman test, modified java lib so
options print on same line, updated stdlib.tbag
513aff3 Julie   Sun Dec 20 23:52:33 2015 -0500      finished hangman test, modified java lib so
options print on same line, updated stdlib.tbag
09cce71 mvankeulen94   Sun Dec 20 23:01:00 2015 -0500      Merge pull request #40 from
jj-ian/sem_check_fin
bd600a7 Maria van Keulen      Sun Dec 20 22:54:03 2015 -0500      Added
item/npc/getinputfromadj checking
da6c970 Maria van Keulen      Sun Dec 20 22:33:12 2015 -0500      Removed unnecessary comments
cd44d17 Maria van Keulen      Sun Dec 20 22:27:24 2015 -0500      Finished type check updates
c9e3fda Maria van Keulen      Sun Dec 20 21:37:35 2015 -0500      Fixed item/npc err checking
and more type checking
01a8209 Maria van Keulen      Sun Dec 20 21:15:31 2015 -0500      More type check fixes
2c4e74f Maria van Keulen      Sun Dec 20 20:48:33 2015 -0500      Added type checking funcs
23a7590 Maria van Keulen      Sun Dec 20 20:22:15 2015 -0500      check num args for getadj
function
6222486 jj-ian Sun Dec 20 22:01:11 2015 -0500      Merge pull request #39 from
jj-ian/jj-ian/tests
fc7dce6 Julie   Sun Dec 20 22:00:14 2015 -0500      updated library import script to be
compatible w python 2 and 3
```

```
34d378c Julie   Sun Dec 20 21:29:43 2015 -0500      fixed a few things in stdlib and scripts,
still workin on hangman game
a3e6bb2 jj-ian  Sun Dec 20 20:34:35 2015 -0500      Merge pull request #38 from
jj-ian/jj-ian/tests
042eb5a Julie   Sun Dec 20 20:33:23 2015 -0500      hooked up #import to compiler and test
script, updated tests to match
ed1ca88 jj-ian  Sun Dec 20 19:54:57 2015 -0500      Merge pull request #37 from
jj-ian/jj-ian/tests
9db84bc Julie   Sun Dec 20 19:53:45 2015 -0500      Merge branch 'jj-ian/tests' of
https://github.com/jj-ian/tbag into jj-ian/tests
cb12b8f Julie   Sun Dec 20 19:35:47 2015 -0500      done w/ import library script, testing it
on various programs
a063f6b Julie   Sun Dec 20 18:42:50 2015 -0500      working on #import, new test for functions
and stdlib
984f96f Julie   Sun Dec 20 02:24:14 2015 -0500      hangman
6cfa8dd Julie   Sun Dec 20 02:09:34 2015 -0500      updated hangman test
116694f Julie   Sun Dec 20 19:38:33 2015 -0500      Merge branch 'master' of
https://github.com/jj-ian/tbag
a932126 mvankeulen94   Sun Dec 20 19:37:52 2015 -0500      Merge pull request #36 from
jj-ian/sem_check_f
7e0b200 Maria van Keulen      Sun Dec 20 19:13:47 2015 -0500      Fixed out file after rebase
0f0742a Maria van Keulen      Sun Dec 20 17:54:14 2015 -0500      Updated fail tests to reflect
alpha renaming
9afdae7 Maria van Keulen      Sun Dec 20 17:40:55 2015 -0500      Updated getInputFromOptions
tests
7f009f0 Maria van Keulen      Sun Dec 20 17:20:36 2015 -0500      Added wrapper function for
find_variable and tests
f3e4d3a Maria van Keulen      Sun Dec 20 15:42:53 2015 -0500      Fixed rdecl bug and added
more tests
c52a7a4 Maria van Keulen      Sun Dec 20 15:14:23 2015 -0500      Fixed bug in assign, added
more fail tests
93ed1e9 Maria van Keulen      Sun Dec 20 13:36:03 2015 -0500      Added fail tests, updated
script to rm temp files
9d77d01 bslakter       Sun Dec 20 18:56:23 2015 -0500      will they pass, lord i hope
b58a7ef Julie   Sun Dec 20 18:42:50 2015 -0500      working on #import, new test for functions
and stdlib
bc32398 Brian Slakter  Sun Dec 20 17:47:03 2015 -0500      Merge pull request #34 from
jj-ian/tests_passing
c669206 bslakter       Sun Dec 20 17:17:34 2015 -0500      tests passing
04a5eb3 Julie   Sun Dec 20 15:50:23 2015 -0500      Merge branch 'jj-ian/tests' of
https://github.com/jj-ian/tbag into jj-ian/tests
41bb76e Julie   Sun Dec 20 02:24:14 2015 -0500      hangman
8e03678 Julie   Sun Dec 20 02:09:34 2015 -0500      updated hangman test
7c16743 Julie   Sun Dec 20 15:42:04 2015 -0500      working on hangman test, adding to stdlib
6d76c64 Iris    Sun Dec 20 15:41:06 2015 -0500      adding getInputAdjacentRooms check
c92dfc6 bslakter       Sun Dec 20 15:17:27 2015 -0500      camel case, adjacency function
8797392 Julie   Sun Dec 20 13:41:35 2015 -0500      fixed bug in java library, updated tests to
reflect compiler updates, updated hangman test
850395c Iris Zhang     Sun Dec 20 13:01:25 2015 -0500      Merge pull request #32 from
jj-ian/sem_check_fail
```

```
0b589c8 bslakter      Sun Dec 20 12:50:26 2015 -0500      pred list reverse
f0d00f8 Maria van Keulen      Sun Dec 20 12:11:12 2015 -0500      get_input_from_options
semcheck accepts strlits
1ee3a40 Maria van Keulen      Sun Dec 20 11:09:24 2015 -0500      Rmed goto edit
a3c37f4 Iris   Sun Dec 20 11:01:41 2015 -0500      Semcheck ignores for player input and
get_input_from_options
15edd1d Maria van Keulen      Sun Dec 20 10:49:55 2015 -0500      Fixed remaining ocaml
warnings in semcheck
f4a8e4e Maria van Keulen      Sun Dec 20 10:43:25 2015 -0500      Cleaned up binop section
ccede1c Maria van Keulen      Sun Dec 20 09:01:54 2015 -0500      Added array type checking for
array ops
69d29b0 Maria van Keulen      Sun Dec 20 00:44:44 2015 -0500      Fixed boolneg op checking
45dae31 Iris   Sat Dec 19 23:21:52 2015 -0500      Add fail tests for sem_check
b0bf6cd Maria van Keulen      Sat Dec 19 23:09:42 2015 -0500      Added binary op and unary op
testing
af6821a Julie   Sun Dec 20 02:09:34 2015 -0500      updated hangman test
a6b3ed2 gregorychen3   Sun Dec 20 02:03:50 2015 -0500      global arr decl codegen fixed to be
static, also added missing semi.
e3419da jj-ian Sun Dec 20 01:56:37 2015 -0500      Merge pull request #31 from
jj-ian/jj-ian/tests
6618925 Julie   Sun Dec 20 01:51:35 2015 -0500      test for global array, this won't work
until bug is fixed
533eebe Julie   Sun Dec 20 01:46:50 2015 -0500      added another test for hangman, this one
isn't working bc global array decls have to get fixed
38c0f24 jj-ian Sun Dec 20 01:17:29 2015 -0500      Merge pull request #30 from
jj-ian/jj-ian/tests
92879be Julie   Sun Dec 20 01:15:34 2015 -0500      fixed merge conflicts
35b3dc8 Julie   Sun Dec 20 01:11:40 2015 -0500      updated java library and mouse gameplay
test
7ae8dad Julie   Sun Dec 20 00:20:42 2015 -0500      gameplay tests, updated
driver_functions.txt
02a5bf2 Julie   Sun Dec 20 00:23:44 2015 -0500      Merge branch 'jj-ian/tests' of
https://github.com/jj-ian/tbag into jj-ian/tests
98b20ee Julie   Sun Dec 20 00:20:42 2015 -0500      gameplay tests, updated
driver_functions.txt
40e337d Julie   Sun Dec 20 00:20:42 2015 -0500      gameplay tests, updated
driver_functions.txt
f1f5ffa Maria van Keulen      Sat Dec 19 22:16:22 2015 -0500      Added fail tests, fixed error
messages
d219605 Iris   Sat Dec 19 22:06:37 2015 -0500      Deleted outdated array_length test
fd4fe30 Iris   Sat Dec 19 22:04:12 2015 -0500      Fix comment in parser that was throwing
error
52ec962 Iris Zhang     Sat Dec 19 21:58:33 2015 -0500      Merge pull request #29 from
jj-ian/sem_check_up
c598025 Iris   Sat Dec 19 21:19:33 2015 -0500      Add semchecking of items working with tests
d21d8be Maria van Keulen      Sat Dec 19 21:09:24 2015 -0500      Fixed bug in array
declaration, added tests
0167165 Iris   Sat Dec 19 20:59:00 2015 -0500      Semchecking NPCs working with tests
282d13c Maria van Keulen      Sat Dec 19 20:24:48 2015 -0500      Checked not operand, checked
recursive types
```

```
31922de Maria van Keulen      Sat Dec 19 19:47:03 2015 -0500      Added get_input_from_options
func checking
b43ee2c Maria van Keulen      Sat Dec 19 18:59:04 2015 -0500      Added arr_len semantic
checking
c977814 Iris   Sat Dec 19 18:53:24 2015 -0500      Added goto in stmt for semcheck... not sure
if working with tests
45f157a Iris   Sat Dec 19 17:13:42 2015 -0500      Semcheck Room Field access working with
testgit add semantic_checker.ml
d37a547 Iris   Sat Dec 19 17:11:02 2015 -0500      working on semchecking room field access
6f48d2a Maria van Keulen      Sat Dec 19 16:00:32 2015 -0500      Fixed find_room failure bug
b8f0487 Maria van Keulen      Sat Dec 19 15:47:06 2015 -0500      Added special cases to eq/neq
ops
f461cfc Iris   Sat Dec 19 15:44:43 2015 -0500      Change return type of expr checking of
rooms to void
2c27a07 Maria van Keulen      Sat Dec 19 15:36:56 2015 -0500      Rmed unnecessary
comments/functions
97e1eba Iris   Sat Dec 19 15:35:12 2015 -0500      Redo the way we sem check for Room == Room
8954914 Maria van Keulen      Sat Dec 19 14:34:52 2015 -0500      Added sem_check back into
build procedure
7e5836c bslakter      Sat Dec 19 17:48:08 2015 -0500      authors
a74b5d7 bslakter      Sat Dec 19 17:46:12 2015 -0500      formatting
689d2ba gregorychen3   Sat Dec 19 17:00:16 2015 -0500      Merge branch 'master' of
https://github.com/jj-ian/tbag
d5a0096 gregorychen3   Sat Dec 19 16:59:55 2015 -0500      code beautification (tabbing etc)
11eb64e Julie   Sat Dec 19 16:58:33 2015 -0500      updated test script to include stdlib for
all tbag files to test, updated stdlib, added more tests, updated tests to work w stdlib
6af6efc Iris Zhang     Sat Dec 19 14:18:03 2015 -0500      Merge pull request #28 from
jj-ian/sem_check_tests
d3e40d0 Iris   Sat Dec 19 14:14:21 2015 -0500      Adding one line that somehow got deleted in
rebase
570494e Maria van Keulen      Sat Dec 19 11:08:21 2015 -0500      Added separate function
finding for exprs/decls
6048ac4 Maria van Keulen      Sat Dec 19 10:45:48 2015 -0500      Fixed bug in duplicate
function checking
7549543 Maria van Keulen      Sat Dec 19 10:24:01 2015 -0500      Added different print func
for each type
b6b6494 Maria van Keulen      Sat Dec 19 09:48:55 2015 -0500      In process of fixing find
function mechanism
474866c Maria van Keulen      Sat Dec 19 08:46:47 2015 -0500      Moved stuff from symbol_table
to translation_env
5913383 Maria van Keulen      Sat Dec 19 08:29:02 2015 -0500      check_valid_type -> check
return and var types
8147b7a Iris   Sat Dec 19 02:29:09 2015 -0500      Add comment in sem_check for TODO for
checking room names as valid expr
c04ce1c Iris   Sat Dec 19 02:22:32 2015 -0500      Add hacky fix for currentRoom in semcheck
by adding it as a global variable
a864afd Iris   Sat Dec 19 02:01:53 2015 -0500      Adj_decl sem_check working with test
378822c Iris   Sat Dec 19 01:42:24 2015 -0500      Added adjacencies to sem_checker but not
passing tests
```

```
26b02d1 Iris   Sat Dec 19 01:27:45 2015 -0500      room_decl body stmts now checking types,
but not yet tested
2c3d0ac Iris   Sat Dec 19 00:35:15 2015 -0500      ROOM_DECL SEMANTIC CHECKING HALF WORKING~~
62bc4ce Iris   Fri Dec 18 23:31:15 2015 -0500      Room_decl added to sem_check compiling
4f155e6 Maria van Keulen      Fri Dec 18 23:03:37 2015 -0500      Rearranged binop checking
4b6f52a Maria van Keulen      Fri Dec 18 21:48:02 2015 -0500      Added var existence fail
tests
c38a127 Maria van Keulen      Fri Dec 18 21:31:37 2015 -0500      Updated run_tests to run fail
tests
49a859f Maria van Keulen      Fri Dec 18 21:30:16 2015 -0500      Rmd print statements, checked
find_variable in try
553cd73 Iris   Fri Dec 18 20:47:13 2015 -0500      working on room_decls sem check
b4ccd94 bslakter      Fri Dec 18 18:15:54 2015 -0500      added file with some functions to be
used in semcheck
44acc26 Maria van Keulen      Fri Dec 18 16:10:17 2015 -0500      Updated function arg/param
comparison
8814b97 Iris   Fri Dec 18 15:52:19 2015 -0500      Added recursive function check in semcheck
4e4ef2d Iris   Fri Dec 18 15:30:10 2015 -0500      Change room_def using list.fold_left to
list.map
f4c6bd9 Iris   Fri Dec 18 15:24:20 2015 -0500      Fixed test_while_loop failure var decls
before func decl checking
fa7b789 Gregory Chen   Sat Dec 19 13:58:39 2015 -0500      Merge pull request #27 from
jj-ian/array_length
2dadfc0 gregorychen3   Sat Dec 19 13:56:54 2015 -0500      tests included. they pass
52f80ed gregorychen3   Sat Dec 19 13:56:07 2015 -0500      arr_len() implemented, new tests
pass
43d8ba7 jj-ian Fri Dec 18 18:00:54 2015 -0500      Merge pull request #26 from
jj-ian/jj-ian/tests
cd434d1 Julie  Fri Dec 18 17:58:36 2015 -0500      Merge branch 'jj-ian/tests' of
https://github.com/jj-ian/tbag into jj-ian/tests
1dbd575 Julie  Fri Dec 18 17:57:21 2015 -0500      more tests -- power set of npc, items, and
room defs/decls
a6714be Julie  Fri Dec 18 17:57:21 2015 -0500      more tests -- power set of npc, items, and
room defs/decls
c813928 gregorychen3   Fri Dec 18 17:28:47 2015 -0500      more array tests
1ffff91 gregorychen3   Fri Dec 18 17:19:43 2015 -0500      fixed codegen bug concerning array
decls. array tests added.
2a6a313 bslakter      Fri Dec 18 16:17:40 2015 -0500      precedence and such
515222f bslakter      Fri Dec 18 15:53:03 2015 -0500      tbag
80ed587 bslakter      Fri Dec 18 15:50:42 2015 -0500      updated precendence
ed0d1d4 gregorychen3   Fri Dec 18 14:38:25 2015 -0500      tbag.ml modified to (temporarily)
skip semantic check
dd7509f mvankeulen94   Fri Dec 18 14:25:00 2015 -0500      Merge pull request #25 from
jj-ian/mvankeulen94/sem_check_updated
158d443 Maria van Keulen      Fri Dec 18 10:02:52 2015 -0500      script outputs compiler errs
if no Driver.java
b6e48e0 Maria van Keulen      Fri Dec 18 10:02:03 2015 -0500      Added prelim checking for
print function
1490edc Maria van Keulen      Fri Dec 18 08:53:59 2015 -0500      java_tbag outputs compiler
error messages if fail
```

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85da3b8 Maria van Keulen      Fri Dec 18 08:53:41 2015 -0500      Added pred_stmt checking, but
it broke the tests
7b5033d Maria van Keulen      Fri Dec 18 04:01:12 2015 -0500      Fixed semantic_checker after
rebase
207c874 Maria van Keulen      Fri Dec 18 03:41:59 2015 -0500      Integrated semantic_checker
into build process
2dc43ea Maria van Keulen      Fri Dec 18 03:32:38 2015 -0500      Added more internal checking
to check_func_decl
1ba28d7 Maria van Keulen      Fri Dec 18 02:40:23 2015 -0500      Added check_var_decl function
40f4a9a Maria van Keulen      Fri Dec 18 02:02:28 2015 -0500      check_func_decl now compiles
b71cebf Maria van Keulen      Fri Dec 18 00:37:03 2015 -0500      Started function checking
2d4bbad Iris   Fri Dec 18 00:33:09 2015 -0500      Did room_def semantic_checking
c7abb98 Maria van Keulen      Thu Dec 17 23:26:58 2015 -0500      Fixed block, if, while in
check_stmt
11d6fa6 Maria van Keulen      Thu Dec 17 23:05:21 2015 -0500      Fixed operator checking in
check_expr
e8658bf Maria van Keulen      Thu Dec 17 22:57:58 2015 -0500      Added most of check_stmt
function except Goto
6e881ef Maria van Keulen      Thu Dec 17 22:23:05 2015 -0500      Updated semantic checker,
rmed argument type
e29db0a Maria van Keulen      Thu Dec 17 21:51:01 2015 -0500      Added updated version of
semantic checker
c8a78b6 jj-ian Fri Dec 18 00:46:59 2015 -0500      Merge pull request #24 from
jj-ian/jj-ian/tests
079ca11 Julie  Fri Dec 18 00:45:01 2015 -0500      Merge branch 'jj-ian/tests' of
https://github.com/jj-ian/tbag into jj-ian/tests
fdce7d2 Julie  Fri Dec 18 00:44:29 2015 -0500      updated string literal script to work w/
new compiler changes
a6b500e Julie  Thu Dec 17 18:07:38 2015 -0500      added new test, string literal
f87ddca Julie  Fri Dec 18 00:44:29 2015 -0500      updated string literal script to work w/
new compiler changes
f83a11a Julie  Fri Dec 18 00:40:59 2015 -0500      Merge branch 'jj-ian/tests' of
https://github.com/jj-ian/tbag into jj-ian/tests
0dc4b90 Julie  Thu Dec 17 18:07:38 2015 -0500      added new test, string literal
eca48a4 Julie  Fri Dec 18 00:38:44 2015 -0500      finished modifying existing tests so they
are successful with today's compiler changes
84dab3e gregorychen3   Thu Dec 17 23:38:07 2015 -0500      more tests fixed
65d83e0 Julie  Thu Dec 17 23:36:33 2015 -0500      renamed room test
5665d6a gregorychen3   Thu Dec 17 23:25:07 2015 -0500      more tests fixed
76e1efa gregorychen3   Thu Dec 17 23:11:39 2015 -0500      fixed four more tests
c5f4e0d gregorychen3   Thu Dec 17 22:59:13 2015 -0500      Merge branch 'master' of
https://github.com/jj-ian/tbag
71b9c10 gregorychen3   Thu Dec 17 22:58:40 2015 -0500      some tests fixed
7d7f397 Julie  Thu Dec 17 22:28:09 2015 -0500      added new test for a minimal program using
rooms
9227311 Julie  Thu Dec 17 21:36:37 2015 -0500      Merge branch 'jj-ian/tests' of
https://github.com/jj-ian/tbag into jj-ian/tests
2584da8 Julie  Thu Dec 17 18:07:38 2015 -0500      added new test, string literal
c467b19 bslakter       Thu Dec 17 20:01:27 2015 -0500      stdlib from julie
fa7fd53 gregorychen3   Thu Dec 17 19:54:31 2015 -0500      pretty_printer.ml deleted
```

```
f04c16b gregorychen3   Thu Dec 17 19:53:02 2015 -0500      codegen corrected include name field
in Room.java
57b60a6 gregorychen3   Thu Dec 17 19:49:34 2015 -0500      Merge branch 'master' of
https://github.com/jj-ian/tbag
2f48efe bslakter       Thu Dec 17 19:49:43 2015 -0500      std lib started
ccc7812 gregorychen3   Thu Dec 17 19:48:47 2015 -0500      rooms, npcs, and items all
independently optional
680bda4 bslakter       Thu Dec 17 19:26:08 2015 -0500      code_gen, case sensitivity
ef6480f gregorychen3   Thu Dec 17 19:14:27 2015 -0500      npcs and items are optional now
2d99685 Julie  Thu Dec 17 18:07:38 2015 -0500      added new test, string literal
149b469 bslakter       Thu Dec 17 17:14:05 2015 -0500      all together now
4b1ee84 bslakter       Thu Dec 17 17:10:52 2015 -0500      Merge branch 'master' of
https://github.com/jj-ian/tbag
36caca4 bslakter       Thu Dec 17 17:10:49 2015 -0500      negative numbers
34de0b5 gregorychen3   Thu Dec 17 17:10:11 2015 -0500      Merge branch 'master' of
https://github.com/jj-ian/tbag
072e1b0 gregorychen3   Thu Dec 17 17:07:42 2015 -0500      funcs now come at end of tbag file
c07d88b bslakter       Thu Dec 17 16:53:13 2015 -0500      endgame implemented
0f08111 bslakter       Thu Dec 17 15:58:26 2015 -0500      strequals
c92ab34 bslakter       Thu Dec 17 15:49:28 2015 -0500      npcs and items now there
b583ca6 jj-ian Thu Dec 17 00:42:40 2015 -0500      Merge pull request #23 from
jj-ian/jj-ian/tests
4e395cd Julie  Thu Dec 17 00:40:05 2015 -0500      Merge branch 'jj-ian/tests' of
https://github.com/jj-ian/tbag into jj-ian/tests
067088a Julie  Thu Dec 17 00:39:00 2015 -0500      more tests
3962d43 Julie  Thu Dec 17 00:39:00 2015 -0500      more tests
39d6a98 jj-ian Wed Dec 16 20:53:26 2015 -0500      Merge pull request #22 from
jj-ian/jj-ian/tests
7c3e953 Julie  Wed Dec 16 20:44:15 2015 -0500      fixed bug in input testing script, added
test for a small game that deals w/ inputs
3868451 Julie  Wed Dec 16 18:29:56 2015 -0500      a bunch of gcd tests
ff0d0c4 Julie  Wed Dec 16 02:33:54 2015 -0500      more tests, testing functions, handlers,
loops
ab730d1 Julie  Wed Dec 16 00:14:04 2015 -0500      committing so i can pull
ffcf8f1 Julie  Tue Dec 15 01:18:04 2015 -0500      more tests, still working on
test_fib_event.tbag, that one isn't complete
5939719 Julie  Tue Dec 15 00:20:35 2015 -0500      deleted *.DS_Store, had added .DS_Store to
.gitignore in prev commit
d853efa Julie  Tue Dec 15 00:19:31 2015 -0500      added new tests - simple arithmetic
789840c Maria van Keulen      Fri Dec 11 17:11:50 2015 -0500      Updated test runner to
account for game IO
3d22e91 Julie  Fri Dec 11 16:41:08 2015 -0500      new test w/ simple print statement,
modified .gitignore to ignore .log and .diff files
b756e3b Gregory Chen   Thu Dec 10 17:41:26 2015 -0500      Merge pull request #21 from
jj-ian/array_improvements
737dd9d gregorychen3   Thu Dec 10 17:40:09 2015 -0500      All assign and access can now be
used with expr for location.
45acc18 gregorychen3   Thu Dec 10 17:29:52 2015 -0500      array declarations now more robust.
can take int expr for size.
```

```
c6c43baGregory Chen   Thu Dec 10 15:49:04 2015 -0500      Merge pull request #20 from
jj-ian/dot_field_access
dcf484egregorychen3   Thu Dec 10 15:47:37 2015 -0500      added an extra dot-field notation
test in go_outside game
50e7182gregorychen3   Thu Dec 10 15:45:34 2015 -0500      dot field notation now supported
f513475gregorychen3   Thu Dec 10 00:45:54 2015 -0500      added name field to room in
go_outside game.
7a93411gregorychen3   Thu Dec 10 00:44:48 2015 -0500      uncommented displayAdj() library
function
21e0a80gregorychen3   Wed Dec 9 23:51:38 2015 -0500go outside game working.
222ad23bslakter       Wed Dec 9 14:24:28 2015 -0500travel rooms to rooms based on input
4dc723ebslakter       Wed Dec 9 14:00:45 2015 -0500adding in START
5f3ca82bslakter       Wed Dec 9 13:59:19 2015 -0500fixing goto
d796b09bslakter       Wed Dec 9 13:58:26 2015 -0500updated driver funcs
f0a22e5bslakter       Tue Dec 8 21:43:07 2015 -0500need to finish implementing strings, store
rooms in hashmap to be able to reference room names
6ca9291Gregory Chen   Tue Dec 8 20:28:44 2015 -0500Merge pull request #19 from
jj-ian/dispAdj_built_in_func
40e73dfgregorychen3   Tue Dec 8 20:26:53 2015 -0500implemented dispAdj built in func.
helloworld program tests.
7b358b7bslakter       Tue Dec 8 19:47:51 2015 -0500java lib
8f22b20bslakter       Tue Dec 8 19:42:53 2015 -0500merging with gregs
69d5e3abslakter       Tue Dec 8 19:41:56 2015 -0500bringing in java_lib
f0988eagregorychen3   Tue Dec 8 19:29:39 2015 -0500code gen now generating global variable
currentRoom
1345ffcgregorychen3   Tue Dec 8 19:18:28 2015 -0500compile.ml no longer necessary; deleted
b46a805gregorychen3   Tue Dec 8 19:13:03 2015 -0500code for goto being generated
dd58042bslakter       Tue Dec 8 18:40:36 2015 -0500ASSOCIATIVITY
0355964Julie  Tue Dec 8 17:59:34 2015 -0500made shell script to run java target
d5f1722jj-ian Mon Dec 7 21:03:17 2015 -0500Merge pull request #18 from
jj-ian/jj-ian/java_target
cc39e1fJulie  Mon Dec 7 20:51:35 2015 -0500compiled java files in java target
afac28cJulie  Mon Dec 7 20:40:36 2015 -0500changed name of java target package from default
to EventDrivenJavaTargetPackage
2df5586Julie  Mon Dec 7 20:33:14 2015 -0500finished java target sample, refactored stuff to
what generated code should look like, debugged sample, added mockup for cheat code support
5279729Julie  Sun Dec 6 23:53:27 2015 -0500java target, working out some more control flow
issues
cb977b2Julie  Sun Dec 6 23:21:50 2015 -0500java target, working on unlocking behavior, added
support for cheat code like things, refining how someone should write a tbag program
e326c0bJulie  Fri Dec 4 14:22:12 2015 -0500java target sample, adding more handlers, dealing
w/ room keys/locks
d4588a6Julie  Fri Dec 4 14:12:11 2015 -0500java target, still working on sample game with
locks
9a2e354Julie  Fri Dec 4 13:55:23 2015 -0500working on java target
95a1c77gregorychen3   Mon Dec 7 15:31:06 2015 -0500trivial changes for newline and indenting
in code gen.
f3bfc70Gregory Chen   Mon Dec 7 15:27:17 2015 -0500Merge pull request #17 from
jj-ian/boilerplate_scanner
```

```
bc0486d gregorychen3   Mon Dec 7 15:25:02 2015 -0500Boilerplate code for java scanner now 
implemented.
9ea5773 jj-ian Fri Dec 4 03:24:27 2015 -0500Merge pull request #16 from 
jj-ian/jj-ian/java_target
a658a56 Julie  Fri Dec 4 03:20:48 2015 -0500more java target stuff, adding sub-.gitignore in 
Java Target folder so git will track .java and .class files in that folder but not elsewhere 
in the repo
70c8c27 Maria van Keulen      Thu Dec 3 22:03:52 2015 -0500Test script now compiles Driver.java
cbf6ada Julie  Thu Dec 3 21:29:17 2015 -0500new event driven java target, moved old java 
target to separate folder
c0b043f bslakter       Wed Dec 2 15:37:08 2015 -0500boolean expressions wooooo
aa86c62 bslakter       Wed Dec 2 15:11:35 2015 -0500lets see if i show up
a3fd52b Iris Zhang     Wed Dec 2 14:36:36 2015 -0500Merge pull request #15 from 
jj-ian/izhang/sast
4a2d89a Iris   Wed Dec 2 14:34:34 2015 -0500Merge branch 'izhang/sast' of 
https://github.com/jj-ian/tbag into izhang/sast
609349e Iris   Wed Dec 2 13:56:53 2015 -0500Fix printed error for checking While stmt
0ba9e79 Maria van Keulen      Tue Dec 1 23:45:33 2015 -0500Started work on statement checking
19b9d58 Maria van Keulen      Tue Dec 1 21:42:34 2015 -0500Compiles without errors!
6dc2cf6 Maria van Keulen      Mon Nov 30 00:13:15 2015 -0500      Comntd out checked_body, 
added stmt check skeleton
16819f5 Maria van Keulen      Sun Nov 29 22:50:28 2015 -0500      Fixed some sast refs, moved 
process_var_decl up
71ddf6e Iris   Sun Nov 29 21:16:20 2015 -0500      Working on more semantic analyzer, got it 
to compile until line 83.
c0c21f3 Iris   Wed Nov 25 19:14:45 2015 -0500      Working on semantic analyzer lots of syntax 
errors
ef895f7 Iris   Sun Nov 22 20:04:56 2015 -0500      Still hacking away at semantic checker
82af66c Iris   Sat Nov 21 16:50:26 2015 -0500      Work on semantic_checker begin, vars and 
funcs
9fb8d3d bslakter       Wed Dec 2 14:17:24 2015 -0500HELLO WORLD, in our NEW world
bc5dff8 Iris   Wed Dec 2 13:56:53 2015 -0500Fix printed error for checking While stmt
8df57ba bslakter       Wed Dec 2 13:30:00 2015 -0500adding in variable declarations, moving 
stuff around
b037d00 Gregory Chen   Wed Dec 2 12:58:51 2015 -0500Merge pull request #14 from 
jj-ian/bool_literals
11daa91 gregorychen3   Wed Dec 2 12:57:30 2015 -0500trivial
2ae2208 gregorychen3   Wed Dec 2 12:54:45 2015 -0500Boolean literals implemented
81cd493 gregorychen3   Wed Dec 2 12:30:54 2015 -0500hello world has a while loop test now
32e3694 Gregory Chen   Wed Dec 2 00:10:56 2015 -0500Merge pull request #13 from 
jj-ian/predicate_syntax
b25814c gregorychen3   Wed Dec 2 00:07:38 2015 -0500parser successfully taking in new predicate 
syntax
adb3025 gregorychen3   Tue Dec 1 23:58:03 2015 -0500fixed a bug where func's locals were in the 
reverse order.
d6f2f43 gregorychen3   Tue Dec 1 23:54:53 2015 -0500fixed a bug where code for a func's locals 
was not being generated
1b25044 Maria van Keulen      Tue Dec 1 23:45:33 2015 -0500Started work on statement checking
00e36fc gregorychen3   Tue Dec 1 23:31:27 2015 -0500preliminary predicate syntax implemented. 
trivially.
```

```
ad4d84c gregorychen3   Tue Dec 1 22:21:33 2015 -0500hello_world.tbag modified with testing for
booleans. all works.
1c054f3 Maria van Keulen      Tue Dec 1 21:42:34 2015 -0500Compiles without errors!
24c069e Gregory Chen   Tue Dec 1 21:41:37 2015 -0500Merge pull request #12 from
jj-ian/implement_booleans
0e51f90 gregorychen3   Tue Dec 1 21:40:23 2015 -0500boolean data type implemented
f7e2c94 Gregory Chen   Tue Dec 1 14:10:29 2015 -0500Merge pull request #11 from jj-ian/gregs
b817bb8 gregorychen3   Tue Dec 1 14:06:51 2015 -0500now generating Npc.java and Item.java
618249a gregorychen3   Tue Dec 1 12:05:38 2015 -0500trivial changes to revert to java target
2743f74 Maria van Keulen      Mon Nov 30 00:13:15 2015 -0500      Comntd out checked_body,
added stmt check skeleton
fb26948 Maria van Keulen      Sun Nov 29 22:50:28 2015 -0500      Fixed some sast refs, moved
process_var_decl up
2d588ac Iris   Sun Nov 29 21:16:20 2015 -0500      Working on more semantic analyzer, got it
to compile until line 83.
03ce38d gregorychen3   Sun Nov 29 17:00:08 2015 -0500      started file code_gen.ml
7caaa9a bslakter       Sun Nov 29 13:55:07 2015 -0500      new adj structure
1a6e3b1 bslakter       Sun Nov 29 13:39:49 2015 -0500      cast up
782bfbf Iris   Wed Nov 25 19:14:45 2015 -0500      Working on semantic analyzer lots of syntax
errors
c03a227 gregorychen3   Wed Nov 25 12:47:37 2015 -0500      whoops left a few renamed files
behind
1c150b3 gregorychen3   Wed Nov 25 12:47:10 2015 -0500      renamed files, all compile and hello
world works
cde8442 gregorychen3   Wed Nov 25 12:33:36 2015 -0500      renamed jast to c_ast
f74d041 bslakter       Mon Nov 23 15:50:36 2015 -0500      can define room properties
2a6181f bslakter       Mon Nov 23 12:57:36 2015 -0500      now can set adjacencies wooord
b38bfd2 bslakter       Mon Nov 23 12:16:01 2015 -0500      using funcs already built, added
constructor, can now instantiate rooms in driver
6edcbf4 Gregory Chen   Sun Nov 22 21:32:38 2015 -0500      Merge pull request #10 from
jj-ian/gregorychen3/print_room_fields
26e5761 gregorychen3   Sun Nov 22 21:27:58 2015 -0500      pretty printer now generates room
class with fields
f1c3cc2 gregorychen3   Sun Nov 22 21:13:47 2015 -0500      hello world program contains room
def w/ string fields
93685af gregorychen3   Sun Nov 22 21:07:49 2015 -0500      pretty printer taking vdecls. type
of vdecl not yet implemented
fb7066a Iris   Sun Nov 22 20:04:56 2015 -0500      Still hacking away at semantic checker
151cc41 Gregory Chen   Sun Nov 22 19:26:46 2015 -0500      Merge pull request #9 from
jj-ian/gregorychen3/pretty_print_rooms
df320ee gregorychen3   Sun Nov 22 19:19:14 2015 -0500      trivial formatting and gitignore
changes
6adb6cd gregorychen3   Sun Nov 22 18:55:53 2015 -0500      Room.java is being trivially
generated by pretty_printer.ml
d3102e3 Brian Slakter  Sat Nov 21 22:44:00 2015 -0500      Merge pull request #8 from
jj-ian/bslakter/pattern_matching_pretty_print
68130c0 bslakter       Sat Nov 21 22:42:32 2015 -0500      pattern matching taken care of -
should be good
bad6dc4 Julie  Sat Nov 21 20:39:31 2015 -0500      compiled java target files
```

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753a25e jj-ian  Sat Nov 21 20:31:15 2015 -0500      Merge pull request #7 from
jj-ian/jj-ian/javatarget
09ecc6b Julie   Sat Nov 21 20:18:35 2015 -0500      some more cleanup and refactoring
31030bd Julie   Sat Nov 21 20:13:55 2015 -0500      cleaning up and refactoring java code
8b1e88a Julie   Sat Nov 21 20:10:48 2015 -0500      support for items, picking up items from
rooms, items i/o
c0ce03d Julie   Sat Nov 21 18:26:56 2015 -0500      setting up fake function pointer for
equipping items
96165cf Julie   Sat Nov 21 17:50:38 2015 -0500      items and stats
8d12671 Julie   Sat Nov 21 16:26:46 2015 -0500      test commit
de1060d Iris    Sat Nov 21 16:50:26 2015 -0500      Work on semantic_checker begin, vars and
funcs
d6db1c4 Brian Slakter  Sat Nov 21 17:39:22 2015 -0500      Merge pull request #6 from
jj-ian/bslakter/driver-pretty-start
72ac8c3 bslakter       Sat Nov 21 17:38:54 2015 -0500      pretty printing basics
525de38 bslakter       Sat Nov 21 17:11:08 2015 -0500      hello world printing, rooms being
declared in main method
07d81ce Gregory Chen   Sat Nov 21 16:37:24 2015 -0500      Merge pull request #5 from
jj-ian/gregs
c887da5 gregorychen3   Sat Nov 21 16:20:24 2015 -0500      test_hello_world.sh now works
trivially with pretty_printer
62e5aaf gregorychen3   Sat Nov 21 15:59:09 2015 -0500      new hello world program is being
received by pretty_printer
60988ec gregorychen3   Sat Nov 21 15:50:24 2015 -0500      altered helloword.java to pass new
parser start symbol. passes jast also
04a90a5 bslakter       Sat Nov 21 16:11:42 2015 -0500      commiting up javatarget stuff
4b0d834 gregorychen3   Sat Nov 21 14:09:00 2015 -0500      Added trivial pretty_printer.ml,
modified tbag.ml and Makefile accordingly.
00914c6 gregorychen3   Sat Nov 21 13:37:39 2015 -0500      fixed tabbing in jast.mli
e3cfc0f gregorychen3   Sat Nov 21 13:34:16 2015 -0500      fixed tabbing java_builder.ml
802318a Brian Slakter  Sat Nov 21 12:28:20 2015 -0500      Merge pull request #4 from
jj-ian/bslakter/sast_to_jast
f12e622 bslakter       Sat Nov 21 12:02:30 2015 -0500      simplify sast
66c3e35 bslakter       Sat Nov 21 11:49:55 2015 -0500      SAST TO JAST woot
4f15cca bslakter       Sat Nov 21 11:27:02 2015 -0500      debugging, should be good tho
dc4fcc7 bslakter       Sat Nov 21 10:03:09 2015 -0500      added jast, about to write sast to
jast converter
d243bd2 Brian Slakter  Fri Nov 20 23:06:29 2015 -0500      Merge pull request #3 from
jj-ian/bslakter/master
8e1b74d bslakter       Fri Nov 20 23:06:01 2015 -0500      sast updated
4e55103 bslakter       Fri Nov 20 23:03:08 2015 -0500      added all parts of program to
grammar
6f77af6 bslakter       Fri Nov 20 22:36:57 2015 -0500      tryin to figure out why rules never
reduced
6c0cd91 bslakter       Fri Nov 20 21:41:11 2015 -0500      full language in progress
ae6f253 bslakter       Fri Nov 20 21:28:03 2015 -0500      trying to clean
dd751cd bslakter       Thu Nov 19 18:52:04 2015 -0500      fixed - sast interface should be set
30c058a Maria van Keulen      Thu Nov 19 17:58:46 2015 -0500      Merge branch
'testchangebranch' into fixed_master
e6bfd57 Maria van Keulen      Thu Nov 19 17:48:57 2015 -0500      Added sample test output file
```

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2ce9f7fMaria van Keulen      Thu Nov 19 17:47:29 2015 -0500      Merge branch 'fixed_master'
of https://github.com/jj-ian/tbag into fixed_master
c6391abMaria van Keulen      Thu Nov 19 17:47:21 2015 -0500      Added output file
b53b18ebslakter      Thu Nov 19 16:50:03 2015 -0500      in progress need to fix vdecl
d72d881bslakter      Thu Nov 19 16:31:51 2015 -0500      sast created, ast and parser updated
for variable decls
058809fMaria van Keulen      Thu Nov 19 16:26:15 2015 -0500      Test suite now tests output
instead of source
b10aa61bslakter      Thu Nov 19 14:30:41 2015 -0500      updated git ignore
3281c0cbslakter      Thu Nov 19 14:05:03 2015 -0500      adding in java target stuff
156a89eMaria van Keulen      Mon Nov 16 22:53:11 2015 -0500      Updated test cases, removed
comments and echos
753e757Maria van Keulen      Mon Nov 16 22:46:48 2015 -0500      Merge branch 'bintestbranch'
78654degregorychen3   Sun Nov 15 19:05:36 2015 -0500      added a msg string field to room
class in compile.ml. goodnight world
0fb86ffgregorychen3   Sun Nov 15 18:40:57 2015 -0500      added *.java to gitignore. more
formatting improvements to compile.ml
1c80210gregorychen3   Sun Nov 15 17:39:10 2015 -0500      Did a bunch of code formatting
(tabbing mostly)
311b3a7gregorychen3   Sun Nov 15 17:27:50 2015 -0500      Empty room decls now compile.
Formatting looks good in .java file.
80d00cfgregorychen3   Fri Nov 13 15:55:27 2015 -0500      removed now-unnecessary make.sh
91fa96agregorychen3   Fri Nov 13 15:53:15 2015 -0500      Removed testing from Makefile. to
test, run a the script separate from the Makefile
f7305f6Maria van Keulen      Thu Nov 12 18:06:24 2015 -0500      run_tests more generic, added
more test files
ec16c26bslakter      Thu Nov 12 17:47:41 2015 -0500      parens working too
10e1266bslakter      Thu Nov 12 17:32:12 2015 -0500      more binops
f3945fdbslakter      Thu Nov 12 17:26:37 2015 -0500      binops in progress w000t
6bf8bd0bslakter      Thu Nov 12 17:20:25 2015 -0500      Merge branch 'master' of
https://github.com/jj-ian/tbag
f431342bslakter      Thu Nov 12 17:20:21 2015 -0500      functions working well - can utilize
ids
3b8510dMaria van Keulen      Thu Nov 12 17:03:10 2015 -0500      Added run_tests.sh script
6ec48d7Maria van Keulen      Thu Nov 12 17:02:31 2015 -0500      Added test files
e863c8cbslakter      Thu Nov 12 17:00:23 2015 -0500      about to add expr recognizing id
2c6120abslakter      Thu Nov 12 16:32:50 2015 -0500      can do other functions too - about
to refactor
fc2ef4bbslakter      Thu Nov 12 16:29:43 2015 -0500      Merge branch 'master' of
https://github.com/jj-ian/tbag
b2e18dabslakter      Thu Nov 12 16:29:38 2015 -0500      can write other functions
59a5243gregorychen3   Thu Nov 12 16:23:28 2015 -0500      run.sh is now test_hello_world.sh
63adc2dgregorychen3   Thu Nov 12 16:01:39 2015 -0500      Added clean functionality to
Makefile. Deleted clean.sh
c407eb0bslakter      Thu Nov 12 15:54:28 2015 -0500      Merge branch 'master' of
https://github.com/jj-ian/tbag
9262567bslakter      Thu Nov 12 15:54:17 2015 -0500      makeile fixed
b0ccd25gregorychen3   Thu Nov 12 15:47:15 2015 -0500      updated .gitignore to ignore *.class
files
5e23220bslakter      Thu Nov 12 15:33:34 2015 -0500      separate makes
```

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4733d67 bslakter      Thu Nov 12 15:27:30 2015 -0500      hello world added
4484156 bslakter      Thu Nov 12 15:26:44 2015 -0500      runner added
93c1e77 bslakter      Thu Nov 12 15:26:00 2015 -0500      Make (it rain)
a3dd5c0 bslakter      Thu Nov 12 13:32:03 2015 -0500      just type make and we good
3f397b7 bslakter      Thu Nov 12 13:25:44 2015 -0500      HELLO WORLD SUCKASSSSS
66b942e bslakter      Thu Nov 12 13:00:20 2015 -0500      almost hello worlding w0000t
beetches
17cc8c7 bslakter      Thu Nov 12 12:51:10 2015 -0500      proper makefile now up - just type
make
df4a2c2 bslakter      Thu Nov 12 12:43:33 2015 -0500      programs connected properly via make
script, commented out compilation issues - about to make proper makefile
0fc7ddd bslakter      Wed Nov 11 20:09:10 2015 -0500      missing somehting in ast but almost
there
3ccf7b4 bslakter      Wed Nov 11 19:42:18 2015 -0500      pushing so greg can work on it too
f454664 bslakter      Wed Nov 11 19:29:46 2015 -0500      are we good to go omg
4bcf3a0 Iris   Wed Nov 11 19:26:08 2015 -0500      Merge branch 'master' of
https://github.com/jj-ian/tbag
cb301cf Iris   Wed Nov 11 19:26:04 2015 -0500      Adding Call function to parser and ast
38fffcd bslakter      Wed Nov 11 19:25:29 2015 -0500      should be able to print
6557e98 bslakter      Wed Nov 11 18:02:30 2015 -0500      basic program added, tbag
e2711bd gregorychen3   Wed Nov 11 17:45:17 2015 -0500      Changed tbag.ml to get java code.
added JavaCode.ml
553c7d7 Iris   Wed Nov 11 17:38:58 2015 -0500      Take out all dollar_sign stuff and fix
make.sh
f146784 gregorychen3   Wed Nov 11 17:25:24 2015 -0500      Added code for tbag.ml. modified
make.sh to compile tbag.ml
b875878 gregorychen3   Wed Nov 11 17:12:18 2015 -0500      Created compile.ml and tbag.ml.
ee05d7e Iris   Sun Nov 8 16:26:22 2015 -0500Accepting Brian's changes to arrayaccess
61d5f07 Maria van Keulen      Sun Nov 8 15:41:04 2015 -0500Merge branch 'master' of
https://github.com/jj-ian/tbag
8a52aeb Maria van Keulen      Sun Nov 8 15:41:00 2015 -0500Merge branch 'item_npc'
212e629 bslakter      Sun Nov 8 15:19:04 2015 -0500array access done too
f1e12ec bslakter      Sun Nov 8 14:57:38 2015 -0500array decls and assignment wooot
1dc5ae2 Maria van Keulen      Sun Nov 8 13:47:25 2015 -0500Finished temp optional npc/item
implementation
9061e3f bslakter      Sun Nov 8 13:46:44 2015 -0500adjacency declarations are good to go
5e8134d Maria van Keulen      Sun Nov 8 11:21:18 2015 -0500Added temporarily mandatory npc/item
decls
7e28181 Iris   Sun Nov 8 04:18:50 2015 -0500Adding array access to front end, WIP
6eea19b Julie   Sat Nov 7 17:09:49 2015 -0500variable declarations done
6799da8 Julie   Sat Nov 7 16:26:34 2015 -0500more data type work, formal arguments, argument
declarations
a9b213d Julie   Sat Nov 7 14:52:19 2015 -0500working on function decl in parserl, added some
stuff to scanner, scanner now reports syntax error
2a31b66 Julie   Sat Nov 7 14:12:14 2015 -0500removed scanner executable from git tracking
2aa0989 Julie   Sat Nov 7 14:09:54 2015 -0500Merge branch 'julies_branch'
559fb83 Julie   Sat Nov 7 14:07:33 2015 -0500updated gitignore to ignore scanner executable
9ae2056 Julie   Sat Nov 7 14:06:00 2015 -0500added support for string and int literals
837cf54 Gregory Chen   Sat Nov 7 11:53:53 2015 -0500ast and parser now compile with changes to
rdelc
```

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7dc79d4 Julie   Sat Nov 7 01:47:31 2015 -0500added types, but beware rdecls_list isn't
compiling. committing to check out an earlier commit
ea84ac4 Julie   Sat Nov 7 01:10:16 2015 -0500Merge branch 'master' of
https://github.com/jj-ian/tbag
5885774 Julie   Sat Nov 7 01:10:09 2015 -0500deleted Other Stuff folder since it was copied to
Other
f8a6bf8 Gregory Chen   Fri Nov 6 16:54:08 2015 -0500Merge branch 'gregs_branch'
55bdecf Gregory Chen   Fri Nov 6 16:45:42 2015 -0500syntax requires at least 2 rooms
19fd036 Gregory Chen   Fri Nov 6 16:40:45 2015 -0500multiple room_decls implemented
5ad2363 Gregory Chen   Fri Nov 6 15:44:26 2015 -0500run_menhir starts menhir now.
380fe6a Gregory Chen   Fri Nov 6 15:33:17 2015 -0500fixed run_menhir.sh
7bd33f0 Gregory Chen   Fri Nov 6 14:57:58 2015 -0500Merge branch 'master' of
https://github.com/jj-ian/tbag
7a06a32 Iris   Fri Nov 6 00:35:32 2015 -0500Add operators to parser
9cf90b0 mvankeulen94   Thu Nov 5 16:34:58 2015 -0500Merge pull request #2 from
jj-ian/while_return
f130c5a Maria van Keulen      Thu Nov 5 16:31:45 2015 -0500Added return construct
bc51a68 Maria van Keulen      Thu Nov 5 15:48:09 2015 -0500Added while construct
f4c8311 mvankeulen94   Thu Nov 5 10:54:23 2015 -0500Merge pull request #1 from
jj-ian/ifelse_branch
e03fc6a Maria van Keulen      Wed Nov 4 21:50:46 2015 -0500Fixed formatting of exprs and stmts
81e6e35 Maria van Keulen      Wed Nov 4 20:20:59 2015 -0500Removed unnecessary semi declaration
c067093 Gregory Chen   Wed Nov 4 16:31:48 2015 -0500Merge branch 'master' of
https://github.com/jj-ian/tbag
f3f83fb Iris   Wed Nov 4 14:51:01 2015 -0500Add trivial print stmt to scanner
a3e11ae Iris   Wed Nov 4 14:38:11 2015 -0500Renamed Other stuff Other
2ac4e90 Maria van Keulen      Wed Nov 4 14:00:18 2015 -0500Added initial code for if/elses
6d60bf5 Julie   Tue Nov 3 20:12:52 2015 -0500made scanner.mll print out tokens, rest of pattern
match needs to be filled out. check the bottom of the scanner.mll file
6156971 Julie   Tue Nov 3 18:10:42 2015 -0500fixed compile issue, updated make script to
compile everything, updated clean script to clean everything, fixed bugs in ast and parser
b0a74f4 Julie   Tue Nov 3 16:58:59 2015 -0500updated ast.mli and scripts, fixed the 'unbound
type constructor Ast.program error'
b03eaaf Gregory Chen   Tue Nov 3 12:30:09 2015 -0500Merge branch 'master' of
https://github.com/jj-ian/tbag
6b2481d Julie   Tue Nov 3 01:11:50 2015 -0500added more options to clean script. still working
on fixing 'Error: Unbound type constructor Ast.program' error
7b0e3e5 Julie   Tue Nov 3 00:36:26 2015 -0500debugging and adding more flags to scripts. added
compile_scanner.sh to compile just the scanner
631355e Gregory Chen   Fri Oct 30 22:29:33 2015 -0400      more indentations to parser
2cbfbb8 Gregory Chen   Fri Oct 30 22:20:31 2015 -0400      indentation changes to parser
7c167be Gregory Chen   Fri Oct 30 22:16:44 2015 -0400      minor changes to scanner.mll
3f50244 Gregory Chen   Fri Oct 30 22:11:27 2015 -0400      :Merge branch 'master' of
https://github.com/jj-ian/tbag
d5fbcd3 Iris   Fri Oct 30 22:03:21 2015 -0400      Add operators to parser and ast
db1734c Gregory Chen   Fri Oct 30 21:50:32 2015 -0400      fixed indenting in scanner.mll
fd8b1c0 Iris   Fri Oct 30 21:46:23 2015 -0400      Merge branch 'master' of
https://github.com/jj-ian/tbag
7c36fd6 Iris   Fri Oct 30 21:46:19 2015 -0400      Add operators to scanner
1fa0789 Gregory Chen   Fri Oct 30 21:33:41 2015 -0400      changed test.sh to run_menhir.sh
```

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cebf2d3 Gregory Chen   Fri Oct 30 21:13:21 2015 -0400      Modified clean.sh and make.sh to
display commands being executed. Started test.sh
85cef0f Julie   Thu Oct 29 19:55:19 2015 -0400      Merge branch 'master' of
https://github.com/jj-ian/tbag
7ccd675 Julie   Thu Oct 29 19:55:14 2015 -0400      brian's regex sample code
2c89fa9 Iris    Thu Oct 29 19:33:31 2015 -0400      Add trivial stuff to scanner from microC
9031715 Iris    Thu Oct 29 18:45:25 2015 -0400      Adding assign to scanner
48f2670 Gregory Chen   Sun Oct 25 22:40:16 2015 -0400      Merge branch 'master' of
https://github.com/jj-ian/tbag
aeb8590 Julie   Sun Oct 25 22:37:56 2015 -0400      added gitignore, deleted some files
e897fa7 Gregory Chen   Sun Oct 25 22:35:16 2015 -0400      Merge branch 'master' of
https://github.com/jj-ian/tbag
9f836fa Julie   Sun Oct 25 22:30:16 2015 -0400      ast and parser
d978e29 Gregory Chen   Sun Oct 25 22:24:25 2015 -0400      Merge branch 'master' of
https://github.com/jj-ian/tbag
378b912 Julie   Sun Oct 25 22:20:50 2015 -0400      parser
b23af47 Gregory Chen   Sun Oct 25 22:14:29 2015 -0400      deletes extraneous files from
commiit
1adc303 Julie   Sun Oct 25 22:13:52 2015 -0400      fixed some things in ast, parser, scanner
a769524 Gregory Chen   Sun Oct 25 22:13:44 2015 -0400      Merge branch 'master' of
https://github.com/jj-ian/tbag
647fbd2 Gregory Chen   Sun Oct 25 22:11:51 2015 -0400      deleted attempt at making an
interpreter
d446a69 Julie   Sun Oct 25 21:55:43 2015 -0400      ast
0530b35 Julie   Sun Oct 25 21:47:56 2015 -0400      Merge branch 'master' of
https://github.com/jj-ian/tbag
72257b2 Gregory Chen   Sun Oct 25 21:13:58 2015 -0400      Deleted unneccessary prog type from
ast.ml
4683188 Gregory Chen   Sun Oct 25 20:46:33 2015 -0400      added sample code for calc and
microc
e6f51af Julie   Sun Oct 25 20:41:44 2015 -0400      Merge branch 'master' of
https://github.com/jj-ian/tbag
08fab0d Julie   Sun Oct 25 20:41:42 2015 -0400      commented out something
ab79762 Maria van Keulen      Sun Oct 25 20:41:09 2015 -0400      Merge branch 'master' of
https://github.com/jj-ian/tbag
18dd4f6 Maria van Keulen      Sun Oct 25 20:40:03 2015 -0400      Fixed compilation errors
47a6ef4 Gregory Chen   Sun Oct 25 20:39:12 2015 -0400      Further organized microc_original
ad6062b Gregory Chen   Sun Oct 25 20:37:08 2015 -0400      organized microc compiler sample
code
40cc40a Maria van Keulen      Sun Oct 25 20:35:19 2015 -0400      Added room skeleton
e976c2a Gregory Chen   Sun Oct 25 20:32:07 2015 -0400      fixed a bug in ast.ml
6392448 Julie   Sun Oct 25 20:30:21 2015 -0400      ast
6878013 Gregory Chen   Sun Oct 25 20:26:16 2015 -0400      added tbagInterpreter.ml; adjusted
make.sh and clean.sh accordingly
e34c822 Gregory Chen   Sun Oct 25 20:14:26 2015 -0400      added some more things to clean.sh
9606b44 Gregory Chen   Sun Oct 25 20:10:28 2015 -0400      Deleted some intermediate files
f8661ae Gregory Chen   Sun Oct 25 20:08:42 2015 -0400      added parser.mli to clean.sh
89bc8b1 Julie   Sun Oct 25 20:08:13 2015 -0400      Merge branch 'master' of
https://github.com/jj-ian/tbag
f61b8ac Julie   Sun Oct 25 20:06:35 2015 -0400      ast
```

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ae1c1a8Gregory Chen   Sun Oct 25 20:06:12 2015 -0400      corrected a bug in make.sh
9535458Gregory Chen   Sun Oct 25 20:04:50 2015 -0400      added a command to clean.sh
d04e6c5Gregory Chen   Sun Oct 25 20:03:57 2015 -0400      Merge branch 'master' of
https://github.com/jj-ian/tbag
4dfc8cdGregory Chen   Sun Oct 25 20:03:35 2015 -0400      Added make.sh and clean.sh
e27f2cbJulie   Sun Oct 25 19:59:36 2015 -0400      Merge branch 'master' of
https://github.com/jj-ian/tbag
0cacc47Julie   Sun Oct 25 19:59:34 2015 -0400      parser
403b972Gregory Chen   Sun Oct 25 19:58:20 2015 -0400      Things added to scanner.
0e1dc41Gregory Chen   Sun Oct 25 19:50:51 2015 -0400      Merge branch 'master' of
https://github.com/jj-ian/tbag
f18ee1dGregory Chen   Sun Oct 25 19:49:16 2015 -0400      progress on ast and scanner
af71338Julie   Sun Oct 25 19:47:51 2015 -0400      parser
0b6a83cJulie   Sun Oct 25 19:37:31 2015 -0400      Merge branch 'master' of
https://github.com/jj-ian/tbag
6f99025Julie   Sun Oct 25 19:37:23 2015 -0400      ast and parser
51b158bGregory Chen   Sun Oct 25 19:36:03 2015 -0400      changed tbag compiler to
tbag_compiler
96e0ae6Julie   Sun Oct 25 19:11:30 2015 -0400      working on parser and ast
6d28c0cGregory Chen   Sun Oct 25 18:37:36 2015 -0400      added scanner.mll
ee416acJulie   Sun Oct 25 18:36:13 2015 -0400      ast
ee1320aJulie   Sun Oct 25 18:14:46 2015 -0400      microc compiler
f07d06djj-ian  Sun Oct 25 18:13:11 2015 -0400      Initial commit
```