Introduction to Computer Science
W 1113 – Lab (C)
Lab8

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Questions about the first half of the semester?

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Questions about HW3 or HW4

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Recap from Lab 6

- Code blocks
- Global variable scoping
- Two dimensional arrays
  - arrays of strings
- Debugging

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Recap from Lab 7

- Writing a README and comments
- Function prototypes (but I am still not sure everyone gets it)
- Preprocessors
  - #include
  - #define
- Bit Operators
- Debugging

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More on preprocessors

- #ifndef
  - Allows for code to be compiled if symbol is *not* defined.

```
#ifndef DEBUG
        printf("This is production code");
#endif
```

- #else
  - basically does the same thing

```
#ifdef DEBUG
        printf("This is test code");
#else DEBUG
        printf("This is production code");
#endif
```

- You can use these techniques to debug as well as write regular code
  - Helps in commenting
  - /* lots of code */

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More on preprocessors

- You can use these techniques to debug as well as write regular code
  - Helps in commenting

```
/***** I want to comment this testing section
        section_report();
        /* Handle the end of section stuff */
        dump_table();
***** end of commented out section */
```

  - What is wrong with this code?
- You can fix it by writing

```
#ifdef DEBUG
        section_report();
        /* Handle the end of section stuff */
        dump_table();
#endif
```

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Structs

- Used to define your own types

struct *structure-name* {
field-type field-name;
field-type field-name;
….
} *variable-name*;

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Structs II

- So an example would be

```
struct bin {
    char name [30];          // name of the part
    int quantity;            // how many in the bin
    int cost;                // the cost of the single part
} printer_cable_bin;         // where we put the cables
```

- Here printer_cable_bin is a variable of type struct bin
- You can omit the variable name

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Structs III

- The dot operator
  - In order to access one of the fields of the struct, for a particular variable, use the form *variable.field*
  - *eg: printer_cable_bin.cost = 1295;*
  - *eg: total_cost = printer_cable_bin.cost * printer_cable_bin.quantity*

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Structs IV

- I said earlier that you don't have to define variables when defining the struct
- So can I do, later in the code –
  - bin printer_cables_bin; (i.e. just like I use int or char)
  - Answer: No
- How to do it correctly
  - struct bin printer_cables_bin;
  - But this doesn't define any of the values inside of bin, therefore those remain undefined
  - So you can either assign them one at a time or you can do the following

```
struct bin printer_cable_bin = {
    "Printer Cables",
    0,
    1295
}; // However, this notation can only be used at the time of declaration
```

- Note the semicolons and the commas

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Structs V

- (Shortcut) Initializing values –

```
struct bin {
    char name [30];   // name of the part
    int quantity;             // how many in the bin
    int cost;                 // the cost of the single part
} printer_cable_bin = {
    "Printer Cables",
    0,
    1295
};
```

- Note the commas and the semicolon

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Structs VI

- Structs typically go outside all methods
- You can have them inside methods but then those are local only to the method, this is NOT RECOMMENDED

```
#include<stdio.h>

int main(void) {
  struct a {
    int b;
    double c;
  };

  struct a suhit; /* = { 6 , 7.213432 };*/

  suhit.b = 5;
  suhit.c = 3.2;

  printf("%d\n", suhit.b);
  printf("%f\n", suhit.c);

  return 0;
}
```

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Unions

- There are like structs, however they have only one memory space.

union *structure-name* {
field-type field-name;
field-type field-name;
….
} *variable-name*;

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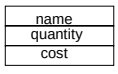
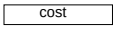
Unions II

```
struct bin {
    char name [30];     // name of the part
    int quantity;       // how many in the bin
    double cost;        // the cost of the single part
} printer_cable_bin;    // where we put the cables

VS

union bin {
    char name [30];     // name of the part
    int quantity;       // how many in the bin
    double cost;        // the cost of the single part
} printer_cable_bin;    // where we put the cables
```





- Make space for largest variable

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Unions III

- You can overwrite quantities, in union

```
printer_cables_bin.name = “Printer Cables”
printer_cables_bin.cost = 10;
printf(“The name of the bin is %s\n”,
                    printer_cables_bin.name);
```

  - What will the produce?
  - Answer: Unexpected result
  - You must keep track of which field you used
- So why use this?
  - Memory space saving

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Typedefs

- Struct allows you to create a data type/structure
- Typedefs allow the programmer to define their own variable type

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Typedefs II

- Usage
  - typedef *type-declaration*;
  - where *type-declaration* is the same as variable declaration, except that a type name is used instead of a variable name
  - eg: typedef int count; //creates a new type count that is the //same as an integer
  - Now you can say – count a; //equal to int a;

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Typedefs III

- But you can get more complex
  - typedef int group[10];
    - You can now say group classroom, which will create a variable classroom of 10 integers

```
main() {
    typedef int group[10];
    group class;
    for (i=1; i<10; i++)
            class[i] = 0;
    return 0;
}
```

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Typedefs IV

- But you can get more complex
  - typedef struct bin bin
    - This creates a variable type bin of type *struct bin*, and you can now say bin printer_cables_bin, instead of struct bin printer_cables_bin

```
struct bin {
    char name [30];
    int quantity;
    int cost;
};

typedef struct bin bin;

bin printer_cables_bin = {"Printer Cables", 10, 1290};
```

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Enums

- This is designed for variables that contain only a limited set of values
- Traditionally, if you wanted to set up the days of a week, you would -

```
typedef int week_day;
const int Sunday = 0;
const int Monday = 1;
const int Tuesday = 2;
const int Wednesday = 3;
const int Thursday = 4;
const int Friday = 5;
const int Saturday = 6;

week_day today = Tuesday;
```

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Enums II

- That was cumbersome
- You can say

```
enum week_day {Sunday, Monday, Tuesday,
        Wednesday, Thursday, Friday, Saturday};

enum week_day today = Tuesday;
```

- Usage

enum *enum-name* (tag-1, tag-2, ….} variable-name;

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Enums III

- You can omit variable-name, like in struct and union
- C implements the enum type as compatible with integer, so it is legal to say
  - today = 5; //though this may throw a warning
    // will make today Thursday

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Enums IV – more examples

```
enum week_day {Sunday, Monday, Tuesday,
      Wednesday, Thursday, Friday, Saturday};
enum day d1, d2; // makes d1 and d2 of type
                 // enum day

d1=Friday;
if (d1==d2)
   …
```

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Enums V – more examples

- You can use it to do switches

```
enum week_day {Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday};

typedef enum day day;

day find_next_day(day d) {

        day next_day;

        switch(d) {
                case Sunday:
                        next_day = Monday;
                        break;
                case Monday:
                        next_day = Tuesday;
                        break;
                …               …
                case Saturday:
                        next_day = Sunday;
                        break;
        }
        return next_day;
}
```

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Arrays of Structs

```
struct time (
    int hour;
    int minute;
    int second;
};

const int MAX_LAPS = 4;
strcut time lap[MAX_LAPS];

lap[count].hour = hour;
lap[count].minute = minute;
lap[count].second = second;
++count;
```

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Arrays of Structs II

- Another way of initializing

```
struct time start_stop[2] = {
   {10, 0, 0},
   {12, 0, 0}
};
```

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Structs with arrays

```
struct mailing {
    char name[60];
    char address1[60];
    char address2[60];
    char city[40];
    char state[2];
    long int zip;
};

struct mailing list[MAX_ENTRIES];

list[count].name[0]=S;
```

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Casting

- (type) expression
- You already know this

```
int a;
float b, total;
total = (float)a + b;
```

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Assignment

- Read Ch. 12 from the Practical C Programming book
- Start reading Ch. 13 for next class
- This class is going to get hard (pointers and memory allocation)
- **HW4**
  - Don't wait too long

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