COMS W3101-1 Programming Language: C++ (Spring 2008)

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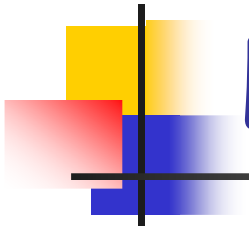
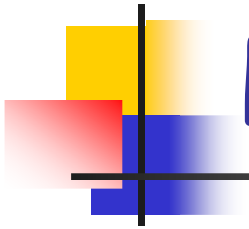


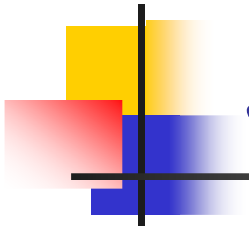
Lecture-1

- Course overview
  - See http://www.cs.columbia.edu/~ramana
- Overview of C
  - C data types
  - Input and output
  - Control statements – if, for, while, do
  - Functions
  - Pointers



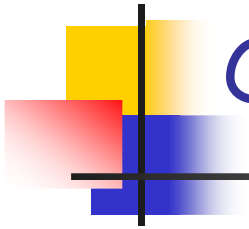
Prerequisites

- A good knowledge of C programming is recommended.
- A good background in at least one programming language is required.



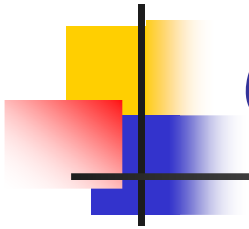
Syllabus Overview

- Overview of C
  - We will NOT cover details of C programming
- Object Oriented Programming principles wrt C++
  - Concepts of class/object, methods, inheritance, polymorphism, abstraction, data encapsulation



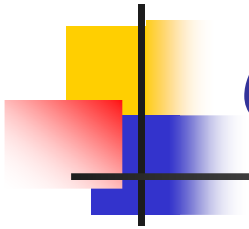
Overview of C programming language

- Basic data types
  - char, short, int, long, long long, unsigned, float, double, long double, …
- Operators:
  - Arithmetic: +, -, *, /, %, ++, --
  - Logical: ==, !=, >, <, >=, <=, &&, ||, !
  - Bitwise: &, |, ^, <<, >>, ~
- Complex data types
  - Struct



Overview of C, contd.

- Input, output
- Control statements
  - if else
  - for
  - while
  - switch, case
- Functions
- Pointers

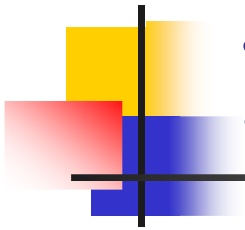


C structs

- C struct
  - used to contain > 1 basic data types
  - Can contain other structs
- E.g.,

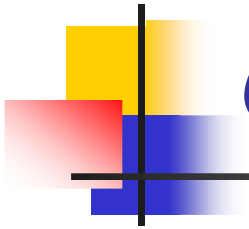
```
typedef struct
{
   int a, b, c;
   float x,y,z;
} myStruct;

myStruct m;
m.a = 1;
```



Input, Output

- Input
  - scanf – read input from std. input
    - E.g. scanf ("%d %s", &i, str);
    - Reads the values of i and str from std. Input
  - Others
    - fscanf, read, fread – we will not use in this class
- Output
  - printf – print output to std. Output
    - E.g. printf ("%d %s", i, str);
    - Print values of i and str to std. Output
  - Others
    - fprintf, write, fwrite – we will not use in this class



Control statements … if

```
if (<expr_1>)
{
   <body of if_expr_1>
}
else if(<expr_2>)
{
   < body of if_exp_2>
}
…
else /* default */
{
   …
}
```

- **Example-1**

```
if (i > j)
   printf ("i is larger\n");
```

- **Example-2**

```
if (i > j)
   printf ("i is larger\n");
else
   printf ("j is larger\n");
```

- **Example-3**

```
if (i > j)
   …
else if (i > k)
   …
else
```

Control statements - for

- For (<start_expr>;
  <termination_cond>;
  <loop_increment>)

{

  <body_of_for>

}

- Example-1 /* print 0 to 9 */

```
for (i = 0; i < 10; i++)
{
   printf ("%d: \n", i);
}
```

- Example-2

```
For ( ;  ;)  /* infinite loop */
{
   /* do something */
}
```

Control statements – while

- Similar to for statement
- while (<while_cond>)

```
{
        <while_body>
}
```

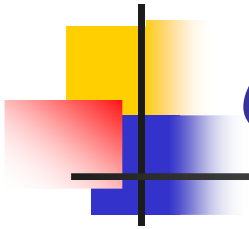
```
do
  {
        <body_of_do>
  } while (condition);
```

- Example-1 /* print 0 to 9 */

```
i = 0;
while (i < 10)
{
        printf ("%d\n", i);
        i++;
}
```

- Example-2

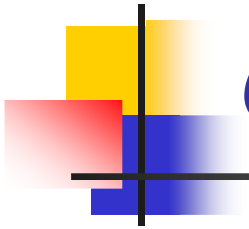
```
while (1) /* infinite loop */
{
        /* do something */
}
```



Control Statements – switch, case

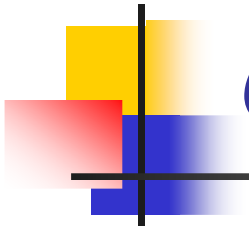
```
switch (x)
{
    case val1:
        <val1_body>;
        break;
    case val2:
        <val2_body>;
        break;
    …
    default:
        <default_body>
}
```

```
int x = 2;
switch (x)
{
    case 1:
        procedure1();
        break;
    case 2:
        procedure2(); /* executed*/
        break;
    …
    default:
        default_procedure();
}
```



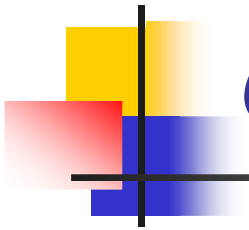
C pointers

- A pointer "points" to a memory location.
  - E.g., int x; /* x is an integer */
    int *y; /* y points to an integer */
    x = 5;
    y = 6; / NOT y = 6 ! */
- Pointers can point to any data type;
  - int *x; short *y; char *str;
  - double *z; void *p, etc.



C pointers, contd.

- Why do we need pointers?
  - Mainly to manage the memory, as opposed to the compiler managing memory.
  - User needs to assign and delete memory.
  - Allocate memory using malloc.
  - Delete memory using free.
- Examples
  - int *x = (int *) malloc (sizeof (int));
    *x = 3;
    free (x);

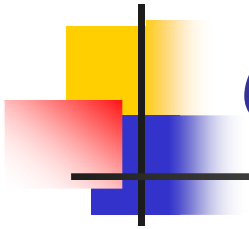


C functions

- A group of statements
  - To perform a task
  - Possibly return a value

- Syntax

```
<return_type> fn_name (arguments)
    {
        // function body
    }
```



C functions … example

- Example

```
int square (int x)  /* fn to compute square*/
{
   return (x * x);
}
void main()        /* Starting point of ANY C program*/
{
   int i = 5;
   int i_sq = square (5);
   printf ("Square of 5 is: %d\n", i_sq);
}
```