C/C++ Programming Review

CPSC 441 – TUTORIAL 1

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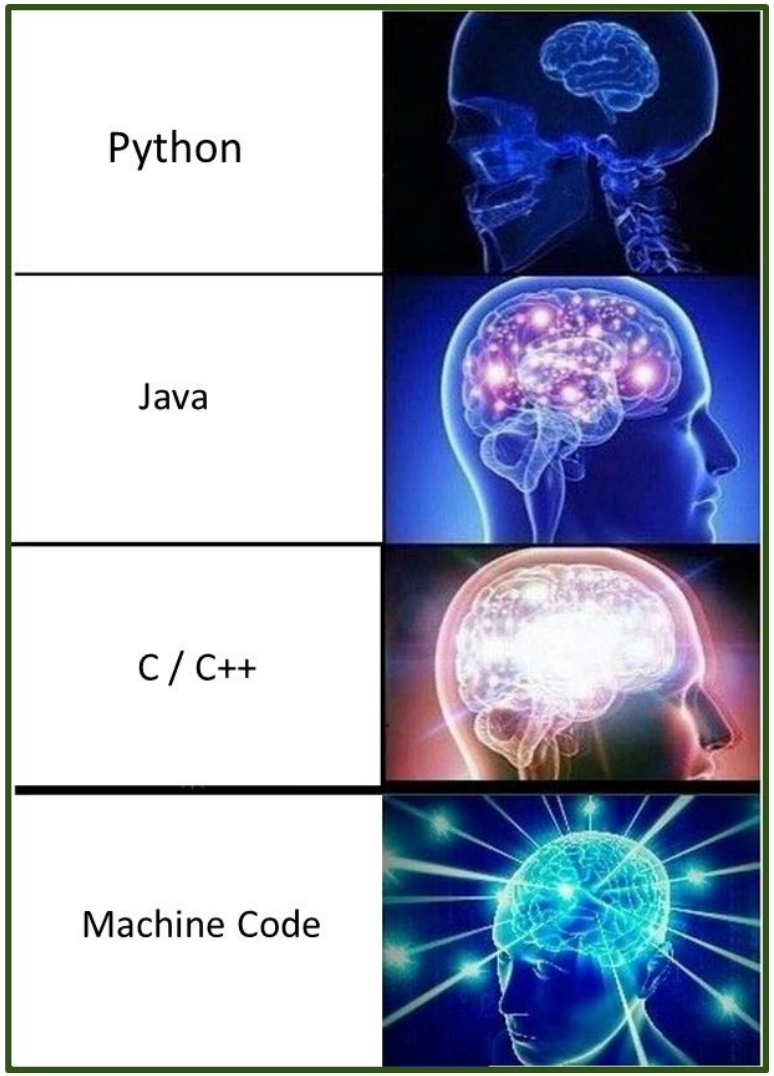
*Modified from slides by Reza Gholizadeh



Why C?

LEVEL OF CONTROL!

Hello World!

C

```
1.  #include <stdio.h>
2.  int main(int argc, char *argv[]){
3.      printf("Hello World!\n");
4.      return 0;
5.  }
```

C++

```
1.  #include <iostream>
2.  using namespace std;
3.  int main(int argc, char *argv[]){
4.      cout <<"Hello World!\n";
5.      return 0;
6.  }
```

Compiling

C

```
$ gcc Hello.c
$ a.out
Hello World!
```

```
$ gcc Hello.c -o Hello
$ ./Hello
Hello World!
```

C++

```
$ g++ Hello.cpp -o Hello
$ ./Hello
Hello World!
```

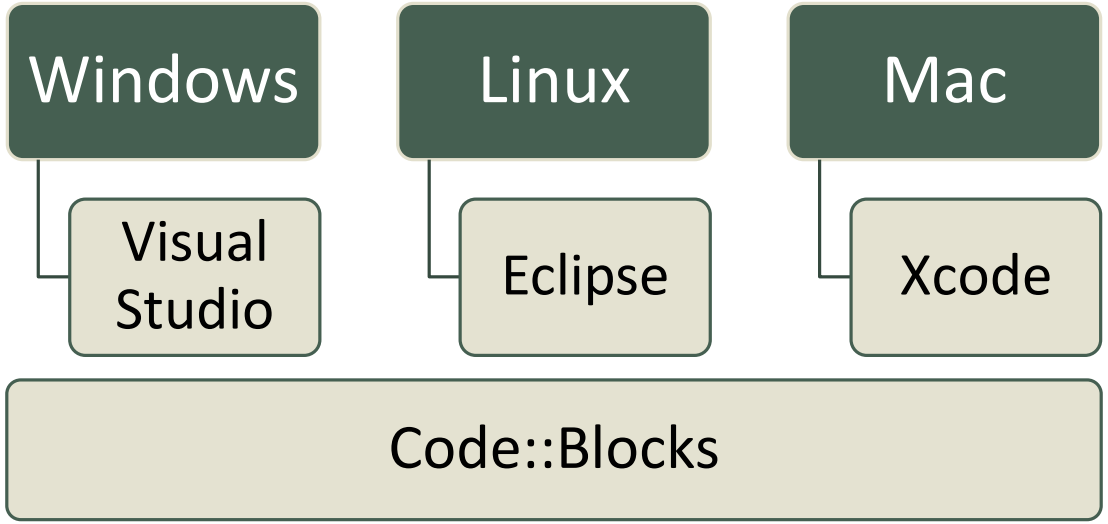
Compiler options

Some useful command line options:

- [-o file]: specifies the output file for object or executable
- [-Wall]: show all warnings (highly recommended)
- [-l libnam]: Links the library libname
  e.g., -lsocket

If you get errors saying the library cannot be found, make sure the path is correctly set, and you do have the libraries you need.

IDE Recommendation



C - Basics

- Data Types
- Main Function
- Arrays
- Structures
- Pointers
- Strings

Basic Data Types

Name	Description	Size (Bytes)	Range
char	Character or small integer.	Typically 1	signed: -128 to 127 unsigned: 0 to 255
short int (short)	Short Integer.	>=2	signed: -32768 to 32767 unsigned: 0 to 65535
int	Integer. Most efficient.	>=2; Typically 4	signed: -2147483648 to 2147483647 unsigned: 0 to 4294967295
long int (long)	Long integer.	>=4	signed: -2147483648 to 2147483647 unsigned: 0 to 4294967295
long long int	long long integer.	>=8	signed: -9.2e18 to 9.2e18 unsigned: -1.8e19 to 1.8e19
float	Floating point number.	4	+/- 3.4e +/- 38 (~7 digits)
double	Double precision floating point number.	8	+/- 1.8e +/- 308 (~15 digits)
long double	Long double precision floating point number.	>=8; Typically 16	+/- 1.2e +/- 4932 (~34 digits)

Main Function

`main``(int argc, char *argv[])`

- The main function of the program
- The program starts at the beginning of the **`main()`** and ends at the end of it.

```
int main(int argc, char *argv[]){
/* your code */
return 0;
}
```

`argc` - number of arguments passed to the program

`argv` – array of strings showing command line arguments

- Name of executable is stored in **`argv[0]`**

The return value is **int**

- **0** for **success**
- **!=0** for **some error**

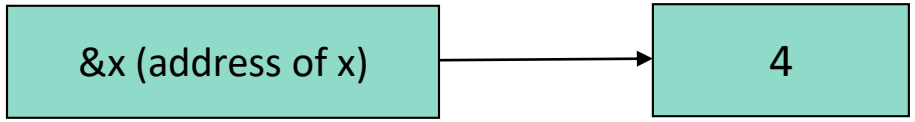
Pointers

A **pointer** is just an address to some memory location

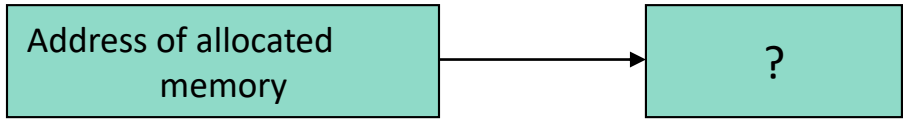
- Another variable
- Some dynamically allocated memory
- Some function
- NULL

```
int *p = &x;
```

```
int x = 4;
```




```
int *p = malloc (sizeof int);
```



allocated memory

Arrays

`type` `name[size];`

- **`type`**: type of data in the array
- **`name`**: a pointer to the first element (and the name!)
- **`size`**: size of the array

```
1.  int numbers[];
2.  char characters[6];
3.  numbers[-1] = 5;
4.  characters[6] = 'a';
```

`numbers` – an array of integers without defining its length

`characters` – an array of chars with length of 6

Watch out: C does not care about array bounds!

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Structures

```
struct
structure_tag{
        member_def;
        …
        member_def;
 }
```

- User defined data type logically grouping different data types
- Similar to C++/Java classes without methods and encapsulation

```
struct Books{}
    char title[50];
    char author[50];
    char subject[50];
    int book_id;
}
```

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Strings

`char name[length];`

- A string is an array of chars terminated with "\0" – "**hello**" is actually **hello\0**

```
1.  char str1[10];
2.  char str2[10] = {"hello"};
3.  char *strp1;
4.  char *strp2 = malloc(sizeof(char)*10);
```

str1 – a string of 10 characters

str2 – an initialized string

strp1 – a char pointer

strp2 – a char pointer initialized to point to a chunk of memory

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String library

`string.h` library contains some useful functions:

- **`char`** `*strcpy(`**`char`** `*dest,` **`char`** `*source):`

  copies chars from *`source`* to *`dest`*
- **`int`** `strlen(`**`const char`** `*source):`

  returns number of chars, excluding NULL
- **`char`** `*strchr(`**`const char`** `*source,` **`const char`** `ch):`

  returns pointer to first occurrence of *`ch`* in source; NULL if none
- **`char`** `*strstr(`**`const char`** `*source,` **`const char`** `*search):`

  return pointer to first occurrence of search in *`source`*

Formatting strings

`int` **`sscanf`**`(`**`char`** `*`*`str`*`,` **`char`** `*`*`format`*`,` *`var1`*`,` *`var2`*`, …)`

- Parses *`str`* based on the *`format`*. if desired, you can store the parsed strings into *`var1`*,… *`varn`* based on the *`format`*
- Returns the number of successful conversions

`int` **`sprintf`**`(`**`char`** `*`*`buffer`*`,` **`char`** `*`*`format`*`,` *`var1`*`,` *`var2`*`, …)`

- Produces a string formatted according to *`format`* directives and place this string into the *`buffer`*
- Returns the number of successful conversions

Standard library

```
# include <stdio.h>
```

Formatted I/O:

- `int scanf(const char *format, ...)`
  - read from standard input and store according to *format*
- `int printf(const char *format, ...)`
  - write to standard output according to *format*

File I/O

- `FILE *fopen(const char *path, const char *mode)`
  - open a file and return the file descriptor
- `int fclose(FILE *stream)`
  - close the file; return 0 if successful, EOF if not

Formatting codes for scanf

Code	Meaning	Variable
%c	Matches a single character	char
%d	Matches an integer in decimal	int
%f	Matches a real number	float
%s	Matches a string up to a white space	char *
%[^c]	Matches a string up to next c char	char *

For many more formatting options, refer to:
http://www.cplusplus.com/reference/cstdio/scanf/

Formatting codes for printf

Values normally right-justified; use negative field width to get left-justified

Code	Meaning	Variable
%nc	Char in field of n spaces	char
%nd	Integer in field of n spaces	int
%n.mf	Real number in width n.m decimals	float, double
%n.ms	First m chars from string in width n	char *
%%	Writes a single % to the stream	

For many more formatting options, refer to:
http://www.cplusplus.com/reference/cstdio/printf/

Standard library

```
# include <stdio.h>
```

Other I/O operations:

- `int getchar()`
  - read the next character from stdin; returns EOF if none
- `char *fgets(char *buffer, int size, FILE *in)`
  - read the next line from a file into *buffer*
- `int fputs(const char *str, FILE *out)`
  - output the string to a file, stopping at '\0'
  - returns number of characters written or EOF

References

C tutorial:

- *https://www.tutorialspoint.com/cprogramming/*

C++ tutorial:

- *https://www.tutorialspoint.com/cplusplus/*

C for Java programmers:

- http://faculty.ksu.edu.sa/jebari_chaker/papers/C_for_Java_Programmers.pdf
- http://www.cs.columbia.edu/~hgs/teaching/ap/slides/CforJavaProgrammers.ppt

Many other useful resources on the internet