CSE 351 Section 1 – Number Bases and Working in C

Hi there and welcome to section! ☺

Numerals

A *numeral* is a symbolic representation of a number. For the purposes of this class, we will define a numeral as a sequence of digits (symbols).

Number Bases

If we have an n-digit numeral $d_{n-1}d_{n-2}\ldots d_0$ in base b, then the value of that numeral is $\sum_{i=0}^{n-1} d_i\, b^i$, which is just fancy notation to say that instead of a 10's or 100's place we have a b's or b^2's place.

The most common bases we will use in this class are 2, 10, and 16, which are called binary, decimal, and hexadecimal (or hex), respectively. In base b, each digit d_i can only be one of b fixed symbols (0-1 for binary, 0-9 for decimal, etc.).

The table on the right shows the equivalent numerals for the numbers 0 through 15 in these three major number bases. We differentiate between these bases by using the prefix '`0b`' for binary and '`0x`' for hexadecimal.

Binary	Decimal	Hex
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	10	A
1011	11	B
1100	12	C
1101	13	D
1110	14	E
1111	15	F

Exercises:

1. Complete the table below by converting the numbers into the other two common bases. You may leave the "Decimal" column unsimplified.

Binary	Decimal	Hexadecimal
0b10010011		
		0x16
	63	
0b100100		
		0xC30
	0	
		0xBAD
	437	

Setting Up Your System

You have four options for your working environment:

1) <u>CSE Labs</u>: Log in locally a *Linux* machine in CSE1: 002, 003, 006 CSE2: 110, 124, 129 (need a CSE account)
2) <u>Remote access</u>: Log in remotely to `attu.cs.washington.edu` (CSE account)
3) <u>Install the CSE VM</u>: https://www.cs.washington.edu/lab/software/linuxhomevm
4) <u>Personal computer</u>: Must be running a Linux distribution (e.g. Ubuntu, Fedora, CentOS)

You will need the following tools for the rest of the course, so make sure you know how to access/use them (already installed on `attu` and the VM) and start to get familiar with them:

- Text Editor (personal preference)
    - Try many, pick one! Some tutorials can be found on the course website.
    - <u>Command-line</u>: `nano`, `vim`, `emacs`
    - <u>Graphical</u>: `gedit`, `emacs`

- GNU Compiler Collection (`gcc`)
    - <u>Example</u>: `gcc -Wall -g -std=c18 -o execName sourceCode.c`
        - `-W` sets warnings
        - `-g` turns on debugging symbols
        - `-std` sets what version of C we are using
        - `-o` sets the name of the resulting executable

- GNU Project Debugger (`gdb`)
    - Command-line debugger that we will use heavily later in the course

Code Examples:

1) Download `HelloWorld.c` from the class webpage:
   ```
   $ wget https://courses.cs.washington.edu/courses/cse351/21au/sections/01/code/HelloWorld.c
   ```

2) Open the file in your favorite text editor and read the comments

3) Compile the file to the executable `hello`:   `$ gcc -o hello HelloWorld.c`

4) Run the program: `$ ./hello`

5) Download calculator.c from the class webpage:
   ```
   $ wget https://courses.cs.washington.edu/courses/cse351/21au/sections/01/code/calculator.c
   ```

6) Read through the code in a text editor, then compile and run the program

7) Example usage: `$ ./calculator 4 5 +`

printf

Used to print to the console. Unfortunately, you can't concatenate String variables like you can in Java.

You provide a format string as the first argument, which includes placeholders to print out variables:

- `%d` for signed int, `%u` for unsigned int, `%f` for float, `%s` for "string", `%x` for hexadecimal, `%p` for pointer
- Examples:
    - `printf("I am %d years old", 20)` prints "I am 20 years old"
    - `printf("My name is %s", "Alfian")` prints "My name is Alfian"
    - `printf("%d in hex is %x", 2827, 2827)` prints "2827 in hex is 0xb0b"