Introduction to Computer Organization – Fall 2024

Lab 1

Due: @11:55 pm, Wed September 4th via Gradescope
(You need to indicate where your answers are located on Gradescope to receive credit)

The following assignment is intended to be completed during your assigned lab period. For **LAB 1 ONLY**, you will complete and submit the assignment individually. Later labs will be done in a group

Name	**Uniqname**
Qiulin Fan	rynnefan

Problem 1: Conversion from Binary *[12 points]*

Convert the following Binary into Decimal, Hex, and Octal.

Binary: 0101 1010 1101

Decimal: _____13+ 32 + 128 + 256 + 1024 = 1453_____

Hexadecimal: _____0x5AD _____

Octal: (for fun... not graded) _____

For the next problem, you will need to set up your IDE.

Then, download the starter code for Lab 1:
`wget https://eecs370.github.io/labs/lab1.tar.gz`
When you finish these problems, submit your C files to the Autograder. You don't need to show anything in particular for your Gradescope submission.

Problem 2: Masking Bits in a Binary Number *[9 points, Autograded]*

Write a function `int extract(int)` that *extracts* bits 7 through 4 of the given integer **a.**
Example:

```
int a = 0x2020;    // … 0010 0000 0010 0000
int result = problem3(a);
//result should = 0b0010

int extract(int a){
    //TODO: Implement this function
    int mask = 0x000000F0;
    int result = a & mask;
    result = result >> 4;
    return result;
}
```

Problem 3: Logic *[15 points]*
Answer the following questions. If you haven't taken EECS 270, you might find Wikipedia helpful.

a. Assume a is an 8-bit unsigned integer in C (usually "unsigned char") *with a=15.* What is the value of !a? What is the value of ~a?

   a = 0b00001111
   !a = 1
   ~a = 0b11110000 = 240

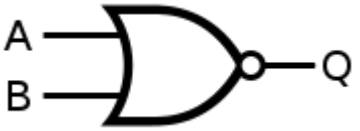
b. Match the logic gate to the truth table

__C__

A:

A	B	Q
F	F	T
F	T	F
T	F	F
T	T	F

__A__



B:

A	B	Q
F	F	F
F	T	T
T	F	T
T	T	T

__B__

C:

A	B	Q
F	F	F
F	T	F
T	F	F
T	T	T

__D__

D:

A	B	Q
F	F	F
F	T	T
T	F	T
T	T	F

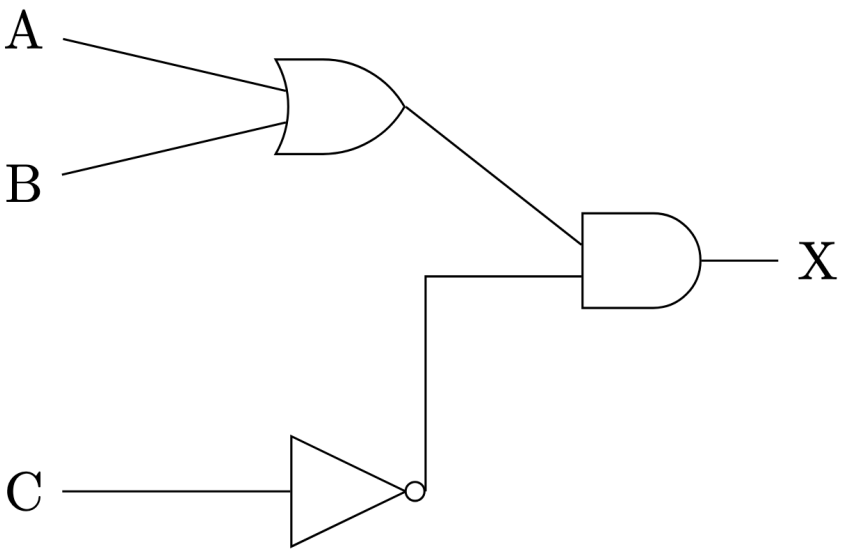
c. Write equations for the below gates. Use * for AND, + for OR, ! for NOT, and () to specify order of operations. Use no other symbols.

i. Example equation: A*B

ii. Equation: ___!(A+B)____

iii. Equation: __(A+B)*!(A*B)__

d. Draw gates which represent X=(A+B)*!C.



Problem 4: Debugging *[13 points]*

In this class, you will need to use a debugger while working on your project. In general, staff will not be able to provide adequate help in office hours if you are not able to set breakpoints in your code, step through execution line by line, and view object values during execution. Any debugging interface (an IDE like XCode or VSCode, or a terminal interface like GDB) is fine. Please read through EECS 280's Setup Tutorial and attend office hours in the first week if you need help setting up a debugger.

What debugging interface will you be using? **[5]**

_____VSCode lldb_____

Configure your programming environment to compile and run the following code:

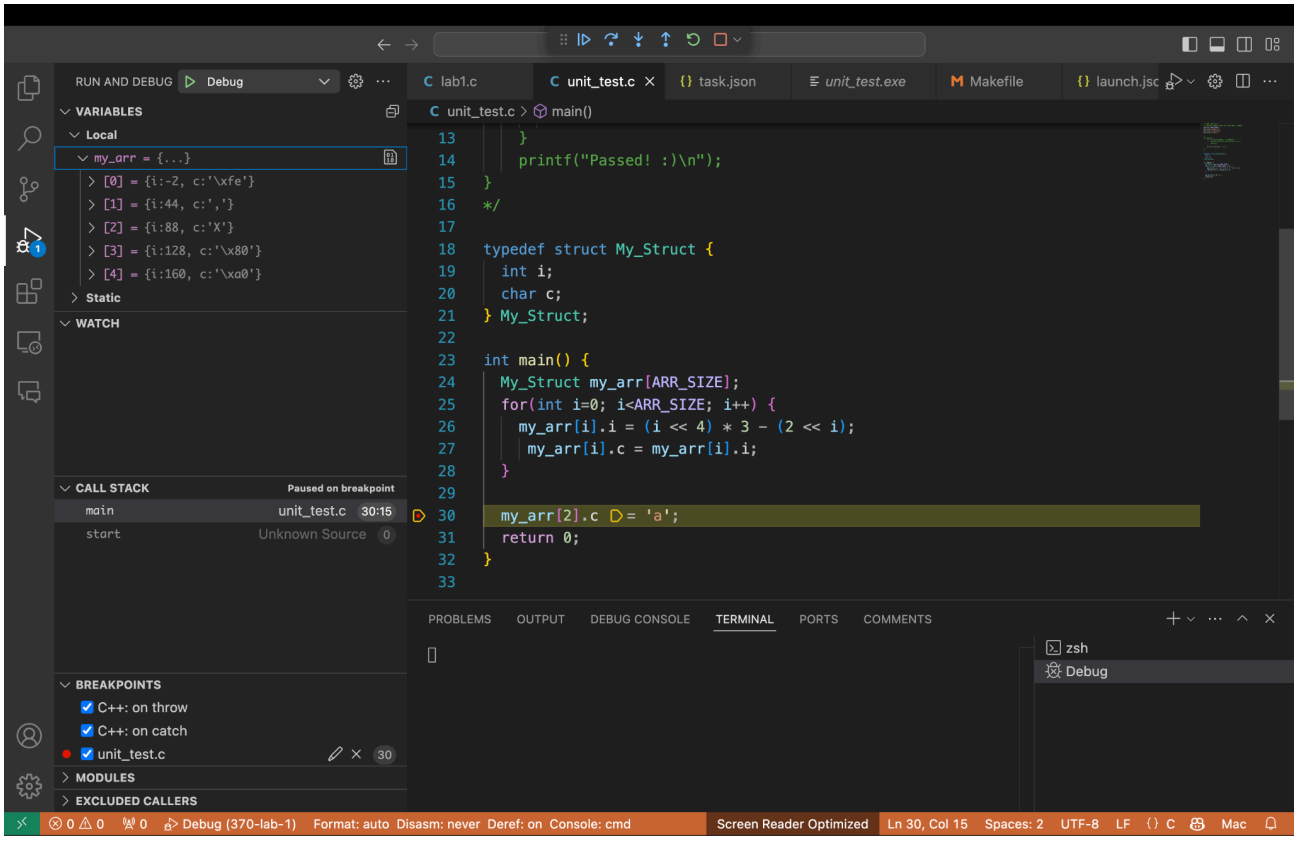
```
#define ARR_SIZE 5

typedef struct My_Struct {
  int i;
  char c;
} My_Struct;

int main() {
  My_Struct my_arr[ARR_SIZE];
  for(int i=0; i<ARR_SIZE; i++) {
    my_arr[i].i = (i << 4) * 3 - (2 << i);
     my_arr[i].c = my_arr[i].i;
  }

  my_arr[2].c = 'a';
  return 0;
}
```

Provide a screenshot below of your debugging environment where execution is paused directly **before** `my_arr[2].c = 'a'` and your debugger has printed out the previous value of `my_arr[2].c`. You should not modify the code to insert any print statements, rather the debugger should be displaying the value. **[8]**



Problem 5: Lab Survey *[1 point]*
Everyone in your group, please fill out the lab survey which will help us form groups for later assignments. It should take ~2 minutes to complete.