CS 31 Homework 2: C Stack Diagrams and Circuits
Due Monday, Feb. 10th, 2025 by 11:59pm

Your names (include **all members of your group**):

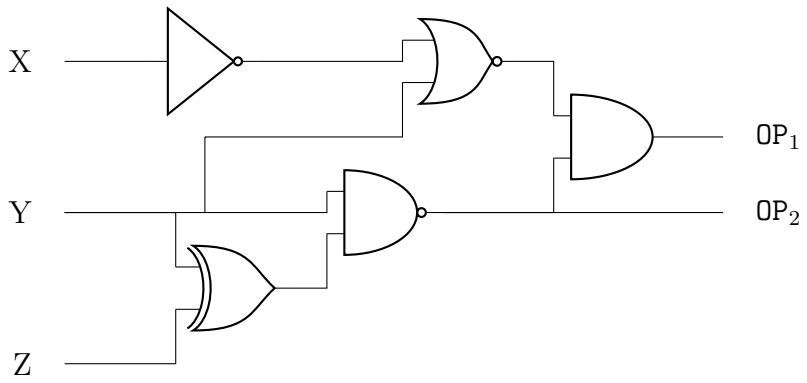
Post your answers to Gradescope in the assignment marked "HW2".

1. Trace through the following C code, and draw the stack at the execution point indicated in `alphabet`, and show the output produced by a complete run of the program. (Assume `stdio.h` has been included.)

```
  #include <stdio.h>
                                                    //YOUR STACK DRAWING
  int alphabet(char a[], int s){
    int i, val;

    val = 0;
    for(i = 0; i < s; i++) {
          a[i] = a[i] - 32;
          val += i;
    }

    // DRAW THE STACK WHEN EXECUTION GETS HERE
    return val;
  }
/************************************/
int main() {
  int i, num;
  char myarray[10];
  num = 97;

  for(i=0; i < 9; i++) {
     myarray[i] = i+num;
  }
  myarray[9] = '\0';

  printf("myarray is: %s\n", myarray);
  printf("Before: num = %d\n", num);
  num = alphabet(myarray, 8);
  printf("After: num = %d\n", num);
  printf("myarray is: %s\n", myarray);
}

// PROGRAM OUTPUT
```

2. Fill in the truth table for the following circuit. Note that this circuit is using NOT, XOR, NOR, NAND, and AND gates.

x	y	z	$\texttt{OP}_1$(x, y, z)	$\texttt{OP}_2$(x, y, z)
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		



3. Construct a circuit that implements the following truth table. You may use any of the following one- or two-input gates: `NOT`, `AND`, `OR`, `XOR`, `NAND`, `NOR`, `XNOR`.

   Write out the boolean expression for $\texttt{OP}_1$ and $\texttt{OP}_2$ before attempting to draw the circuit.

   HINT: For $\texttt{OP}_1$, can you describe each case when the output is 1? How would you combine all the cases into a single circuit? Repeat this for $\texttt{OP}_2$.

x	y	z	$\texttt{OP}_1$(x, y, z)	$\texttt{OP}_2$(x, y, z)
0	0	0	0	0
0	0	1	1	1
0	1	0	1	0
0	1	1	1	0
1	0	0	0	0
1	0	1	0	1
1	1	0	0	0
1	1	1	1	1

Scratch space in case you want it