PRACTICE PROBLEMS SET 1
Digital Logic and Introductory Review Problems

1. Design a circuit that computes F = 5A, using the fewest number of 4-bit adders. Input A is a 4-bit number. How many bits are required for the result to avoid overflow?

2. Design a 3-bit ALU to perform the operations specified. Draw the internal components and connections within each AL-extender, however you can use a block diagram to depict the adder.

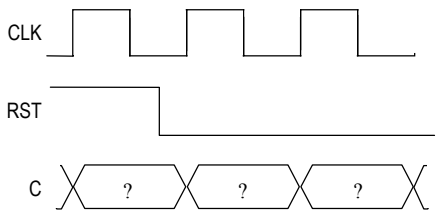
Inputs		Operation
a	b	
0	0	Set output to 2
0	1	A – B
1	0	B + 1
1	1	A + B

3. Create the internal design of a full subtractor. Be sure to include a truth table, logic equations, and a gate-level schematic.

4. Using only 2-input, 1-output MUXes, implement the following components
   a) 8-input, 1 output MUX
   b) 2-input AND gate
   c) half adder

5. Trace the behavior of the Verilog code provided. Fill in the value of `C` in each time step. *(Hint: run the code through the simulator to verify your result)*

```
always @ (posedge RST or posedge CLK) begin
    if( RST == 1 ) begin
        A = 2; B = 4; C = 1;
        end
    else begin
        A <= B;
        B = B + 1;
        C <= A+ B;
    end
end
```



6. Provide an example/scenario where blocking statements are useful.

7. Provide an example/scenario where non-blocking statements are useful.

8. According to the Mythical Man Month, designer productivity decreases due to team-size complexity. Assuming a hypothetical 6,000,000 transistor project (`T`), in which a single designer working alone can produce 7,500 transistors per months (`P`), and each additional designer added to project results in a productivity decrease of 150 transistors per designer (`D`).
   a) Derive an equation to compute the months until completion (`M`) based on `T`, `P`, `D`, and `N` (team size).
   b) Plot the months until completion (`M`) verses team size (`N`), with the team size ranging from 1 designer to 50 designers. *Hint: use excel or similar program to plot graph.*
   c) Plot the productivity per designer (`I`) verses team size (`N`), with the team size ranging from 1 designer to 50 designers.

d) What is the optimal team size?

e) If $D = 200$, what is the optimal team size?

9. If specifying functionality at a higher level of abstraction increases productivity, what would be the benefit of specifying an module/application at the structural level?