Lab 1: Logic Minimization and Modular Design

Problem 1. Amy, Baker, Cathy, and David, the bean buyers for the "Overhead Coffee Company", have designed a more complex voting system to decide when to buy new beans. Design and implement a *minimal* logic SystemVerilog module that they can use to indicate whether they should buy new beans. Use slide switches for vote entry (either "buy" or "not buy"), and an LED to indicate when beans should be purchased. A “buy” order is placed if:

Amy, Baker, and Cathy vote YES and David votes NO,
or Amy and Cathy vote NO and David votes YES,
or Amy votes NO and the others vote YES,
or Cathy and Baker vote NO and Amy vote YES,
or Baker and David vote YES and the rest vote NO,
or Baker votes NO and Cathy votes YES,
or Baker and David vote YES and Amy votes NO,
or Baker votes YES and the others vote NO

Simulate all possible combinations. After you have verified the circuit through simulation, download it to the Basys3 board, using four slide switches as inputs, and a single LED as output. Demonstrate your Basys3 board in a video.

For programming the Basys3 board use the following switches and LEDs

Amy: Switch 3
Baker: Switch 2 Output: Led 0
Cathy: Switch 1
David: Switch 0

Problem 2. Five judges are scoring a particular event, and they need a device to indicate particular judgments. Each judge can enter “pass” or “fail" with a single switch. Write a *minimal* logic, SystemVerilog module that can indicate two separate conditions: The motion passed (3 or more “pass” votes), or the motion failed (3 or more “fail” votes).

You do not have to simulate every possible combination, but you must simulate enough to ensure it is working accurately. After you have verified the circuit through simulation, download it to the Basys3 board, using five slide switches as inputs, and two LEDs as outputs. Demonstrate your working Basys3 board in video.

For programming the Basys3 board use the following switches and LEDs

Inputs:	Outputs:
Judge 1: Switch 4	Motion Passed: Led 15
Judge 2: Switch 3	Motion Failed: Led 0
Judge 3: Switch 2	
Judge 4: Switch 1	
Judge 5: Switch 0	

Problem 3. Create a a *minimal* logic, SystemVerilog module that can detect all prime numbered terms in a five input truth table. (FYI, 1 is not considered prime) Assume that the five inputs to your circuit (A B C D E) are used to form a five-bit binary number with a range of 0 to 31.

Your circuit should illuminate an LED whenever the input combination forms a binary prime number. After you have verified the circuit through simulation, download it to the Basys3 board, using five slide switches as inputs, and a single LED as output. Demonstrate your Basys3 board in a video.

For programming the Basys3 board use the following switches and LEDs

A: Switch 4
B: Switch 3
C: Switch 2
D: Switch 1
E: Switch 0

Output: Led 0