CE433 midterm exam (open book, open internet)

Post your answers to the website AT 5:30 pm on Thursday

1. Fundamentals

(a) Show the UQ16.16 fixed point representation of 25.25 $_{(10)}$. (5 points)

(b) Show the floating-point representation of 25.25 $_{(10)}$ (half precision). (5 points)

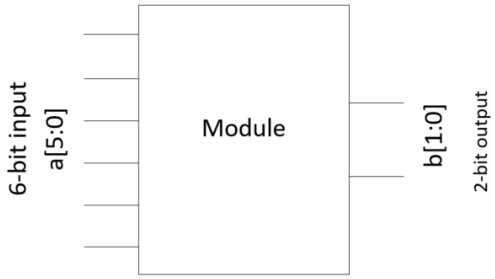
(c) Show the floating-point representation of -25.25 $_{(10)}$ (half precision). (5 points)

(d) Which 'z' has the new x and y values if the following two blocks are being executed separately and only once? (5 points)

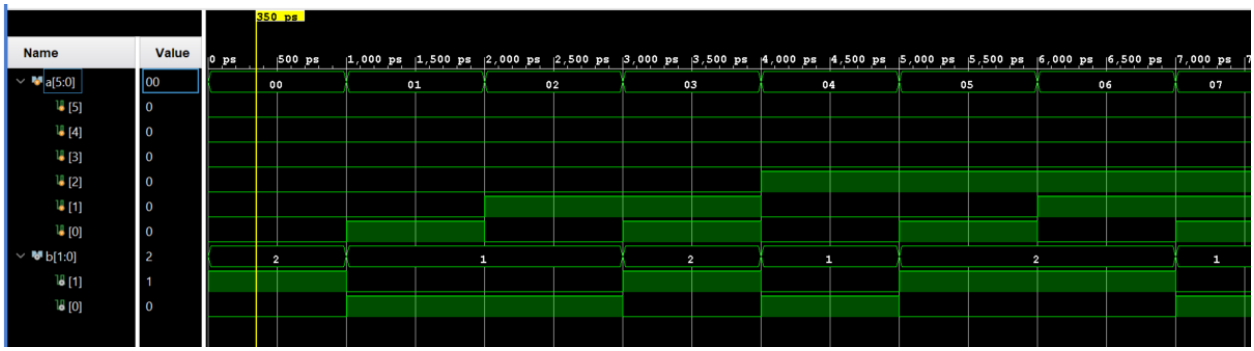
```
1  always @(posedge clk)
2  begin
3          x=a|b;
4          y=a&b;
5          z=x|y;
6  end
7
8  always @(posedge clk)
9  begin
10         x<=a|b;
11         y<=a&b;
12         z<=x|y;
13 end
14
```

2. Make a 2 ns period clock waveform. Show the code and the simulation results for credits. (10 points)

3. Design a module which has a 6-bit input bus. The module checks if there are even number of one's or odd number of one's in the input. The two output bits shows output =2'b10 when it's even, shows output = 2'b01 when it's odd. Show simulation results that displays both outputs. (10 points)



A similar simulation result as follows:



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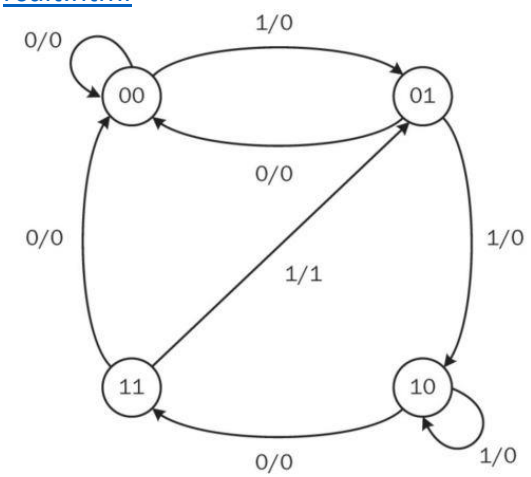
4. (a) Given that the following state diagram is a sequence detector. What the sequence of 4-bit binary code it detects? (10 points)
From Section 2 and 3 in this tutorial:
https://yilectronics.com/Courses/CE433/lectures/week5_sequentialCircuit/week5_sequentialCircuit.html



(b) Design a sequence detector to detect a serial input of 1010 by completing the following tasks: (50 points, **demonstration video required**)

- Draw the state diagram similar to what is shown in (a). (10 points)
- Find the truth table of the sequential circuit. (10 points)
- Find the logic expressions of the sequential circuit. (10 points)
- Code it up using the behavioral Verilog model. (10 points)
- Implement it on the Basys 3 board. The serial input must be taken by a switch, the values of the switch are registered by another switch (as a clock). When the sequence is correct, the monitor shows a solid green color (through VGA). When the sequence is wrong, it returns to a solid red color. Continuous inputs are allowed which means the customer is allowed to keep registering code into it and whenever 4'b1010 is detected, it turns green otherwise, it turns red. (10 points)