Quiz 5

1. What is the minimum number of flip flops to count from 20 to 8 ?

A. 3   B. 4   C. 5   D. 6

The answer is 4 as there are 11 states from 20 to 8. A flip-flop is a register that can store one bit value. We need 11 states so $2^4 > 11$ is the final answer

2. Given a 120 MHz clock and the following module to slow the clock down. What is the frequency of the new clock.

```
2
3    module slow_clkgen (input clk, rst, selL, output clk_out);
4
5        reg [23:0] counter;
6
7        always @(posedge clk)
8        begin
9         if (rst)
10            counter <= 23'd0;
11         else
12            counter <= counter + 1'b1;
13        end
14
15        assign clk_out = counter[22];
16    |
17    endmodule
```

This question is short answer. Be careful if the question asks period instead of frequency

$120 \text{ MHz} = 120 \cdot 10^6 \text{ Hz}$

Answer : $\dfrac{120 \cdot 10^6}{2^{23}} = 14,3 \text{ Hz} = \dfrac{1}{14,3}$ s period

3. Given a multiplexer with this following design.

 in0
in1
in2
in3

$\times$

$\swarrow 2$

sel
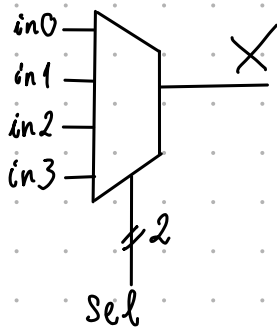
with a assigned to sel 0 and b is assigned to sel 1. what is the value of in0, in1, in2, in3 if we have this boolean expression:

$$f(a,b,c) = \sum m(2, 4, 5, 7)$$

K-map:

		ab		
	00	01	11	10
c 0	0	1	0	1
1	0	0	1	1

$ab = 00 \rightarrow 0$
$ab = 01 \rightarrow c'$
$ab = 10 \rightarrow 1$
$ab = 11 \rightarrow c$

So the answer is $0, c', 1, c$

4. what are the gates that yield output = 1 when all inputs are 0

XNOR, NOR, NAND

5. A SR-Latch built with a pair of 2-input NOR gate has active high inputs S and R ?

(True)   False

SR Latch NOR $\Rightarrow$ active high
NAND $\Rightarrow$ active low

6. Given a Verilog assignment

assign res = a && b || !a && c ? a && c : !b || !c

!b || !c

With a = 0, b = 1, c = 1. what is the output of res

$$res = \underline{a\&\&b} \; || \; \underline{!a\&\&c} \; ? \; \underline{a\&\&c} \; : \; \underline{!b || !c}$$
$$\underset{0}{} \quad || \quad \underset{1}{} \qquad \underset{0}{} \qquad \underset{1}{}$$
$$1 \qquad\qquad ? \quad (0) \quad : \quad 1$$
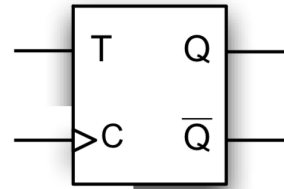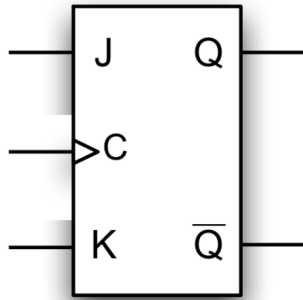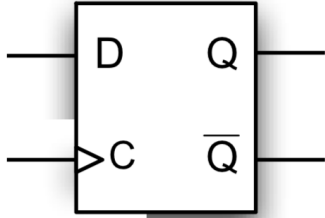
7. Non-blocking assignment should always be in a sequential always

  (True)   False

8. In what condition makes the Q to be 1

a) $D = 0$ b) $J = 1; K = 1$ (c) $J = 1; K = 0$ d) $T = 1$