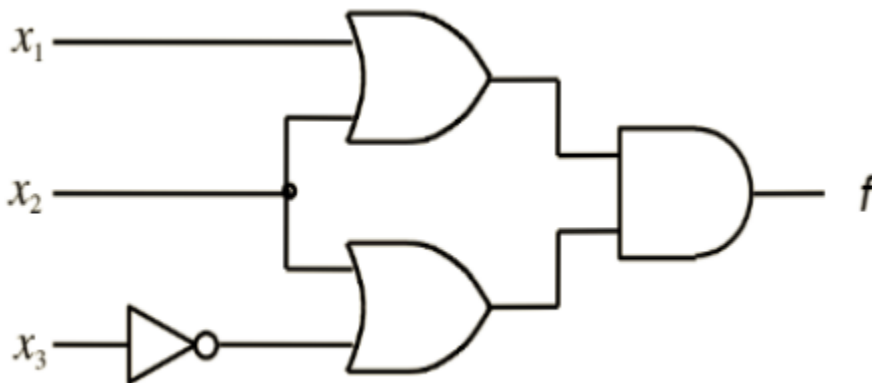


P1. (10 points) Write the corresponding Verilog symbol for the following terms:

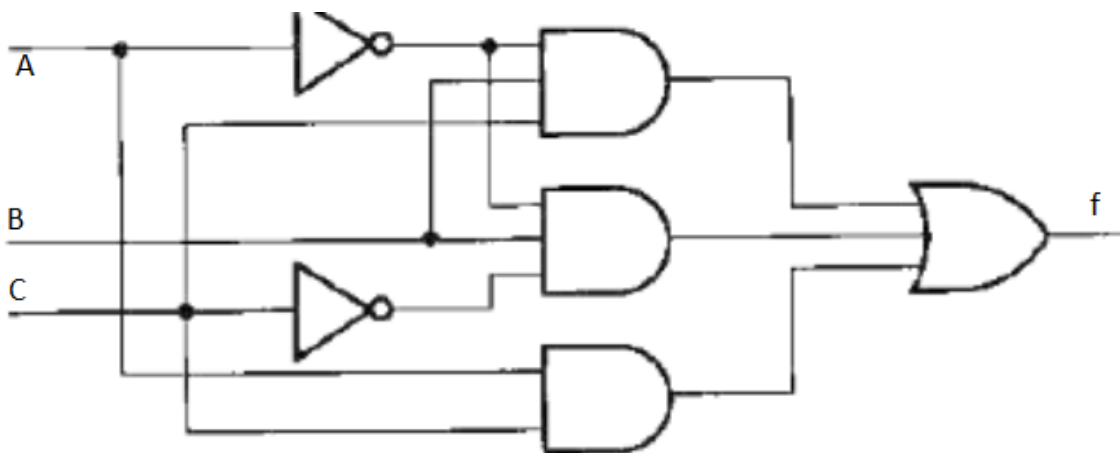
- A. AND
- B. OR
- C. XOR
- D. Complementation

P2. (10 points) Describe the difference between structural Verilog and behavioral Verilog

P3. (10 points) Write both the structural and behavioral Verilog code for the circuit shown below:



P4. (15 points) Write both the structural and behavioral Verilog code for the circuit shown below:



P5. (15 points) Find the simplest SOP form of the following functions:

- A. $f(a) = \sum m(0,1)$
- B. $f(a,b) = \sum m(1,2)$
- C. $f(a,b,c) = \sum m(0,3,5,6)$
- D. $f(a,b,c) = \sum m(1,3,4,5,6)$
- E. $f(a,b,c,d) = \sum m(0, 1, 2, 4, 5, 6, 8, 9, 10, 12, 13)$

P6. (20 points) A four-variable logic function that is equal to 1 if any three or all four of its variables are equal to 1 is called a majority function.

- a) Draw the truth table for this function.
- b) Derive the canonical SOP expression for this function.
- c) Simplify it to derive the Minimum-cost SOP expression.
- d) Draw the circuit that implements this majority function.

P7. (20 points) Derive a minimum-cost realization of the four-variable function that is equal to 1 if exactly two or three of its variables are equal to 1. Otherwise, it is equal to 0.

- a) Draw the truth table for this function.
- b) Derive the canonical SOP expression for this function.
- c) Simplify it to derive the Minimum-cost SOP expression.
- d) Draw the circuit that implements this function.