
You are required to submit a physical hand-written copy of the solutions. Use plain A4 sheets (both sides). Please show all the steps in your solution clearly. Writing the final answer directly would not fetch any marks.

1. [1 marks] Simplify the following boolean expressions to a minimum number of literals.
 - (a) $x + x'y$
 - (b) $xy + x'z + yz$
2. [1 marks] Convert decimal (+57) and (+34) to binary, using the signed-2's-complement representation and enough digits to accommodate the numbers. Then perform the binary equivalent of $(+34) + (-57)$, $(-34) + (+57)$, and $(-34) + (-57)$. Convert the answers back to decimal and verify that they are correct.
3. [0.5 marks] Find a product of maxterms expression for $F(x, y, z) = \Sigma(1, 2, 3, 5, 7)$.
4. [0.5 marks] Find a sum of minterms expression for $F(x, y, z) = \Pi(1, 3, 4, 6)$.
5. [1 marks] Simplify the Boolean function $F(w, x, y, z) = \Sigma(0, 2, 8, 10, 12, 13, 14)$ into (a) sum-of-products form and (b) product-of-sums form.
6. [1.5 marks] Implement the following Boolean function F , using the two-level forms of logic (a) NAND-AND, (b) AND-NOR, (c) OR-NAND, and (d) NOR-OR.

$$F(A, B, C, D) = \Sigma(0, 4, 8, 9, 10, 11, 12, 14)$$

7. [1.5 marks] Recall the priority encoder discussed in the class (see Sect. 4.10 in the book). Suppose we reverse the priority, i.e., we give higher priority for inputs with *lower* subscript numbers. Draw the truth-table of a four-input reverse-priority encoder, and use K-maps to obtain the simplified Boolean expressions for the two outputs. Draw the circuit diagram for this four-input reverse priority encoder.