Université d'Ottawa · University of Ottawa

**Faculté de Génie - Faculty of Engineering ITI1100C Digital Systems I –Assignment 2**

**Due date: February 27th, 2023 11:59 PM**

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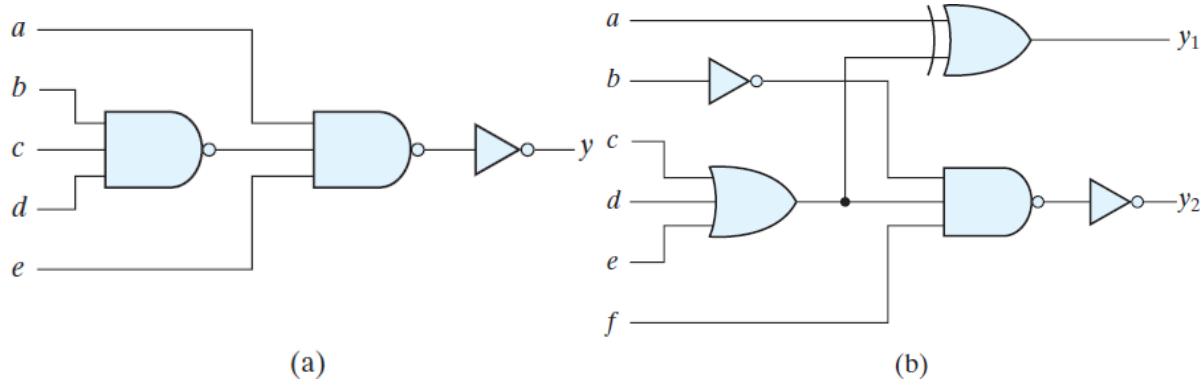
1) Obtain the truth table of the following functions, and express each function in sum of minterms and product of maxterms form:
(a) $(b + cd)(c + bd)$ (b) $(cd + b'c + bd')(b + d)$
(c) $(c' + d)(b + c')$ (d) $bd' + acd' + ab'c + a'c'$

2) Convert each of the following to the other canonical form:

(a) $F(x, y, z) = \sum(1, 3, 5)$
(b) $F(A, B, C, D) = \prod(3, 5, 8, 11)$

3) Write Boolean expressions and construct the truth tables describing the outputs of the circuits described by the logic diagrams in the following figures.




4) Simplify the following Boolean expressions to a minimum number of literals:
(a) $ABC + A'B + ABC'$ (b) $x'yz + xz$
(c) $(x + y)'(x' + y')$ (d) $xy + x(wz + wz')$
(e) $(BC' + A'D)(AB' + CD')$ (f) $(a' + c')(a + b' + c')$

5) Find the complement of the following expressions:
(a) $xy' + x'y$ (b) $(a + c)(a + b')(a' + b + c')$ (c) $z + z'(v'w + xy)$

6) Given the Boolean functions $F_1$ and $F_2$, show that:
(a) The Boolean function $E = F_1 + F_2$ contains the sum of the minterms of $F_1$ and $F_2$.
(b) The Boolean function $G = F_1F_2$ contains only the minterms that are common to $F_1$ and $F_2$.

7) Implement the Boolean function $F = xy + x'y' + y'z$
(a) With AND, OR, and inverter gates
(b) With OR and inverter gates
(c) With AND and inverter gates
(d) With NAND and inverter gates
(e) With NOR and inverter gates

8) Simplify the following Boolean functions $T_1$ and $T_2$ to a minimum number of literals:

| A | B | C | $T_1$ | $T_2$ |
|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 0 | 1 |

9) Show that a positive logic NAND gate is a negative logic NOR gate and vice versa.

10) Determine whether the following Boolean equation is true or false.

$$x'y' + x'z + x'z' = x'z' + y'z' + x'z$$