

Tutorial (12)

- ①. Simplify the following given expressions using K-maps and construct the logic circuit for the simplified boolean expression.

$$F_{\text{SOP}} = (A.B.c') + (A.B'.c) + (A'.B.c) + (A'.B'.c')$$

C \ AB	00	01	11	10
0	0	0	1	1
1	0	1	0	1

$\{ A.B.c' + A.B'.c \} \rightarrow A.B.(c' + c) \rightarrow A.B.1 \rightarrow A.B$
 $\{ A'.B.c + A'.B'.c' \} \rightarrow A'.B.(c + c') \rightarrow A'.B.1 \rightarrow A'.B$
 $\{ A'.B.c + A.B.c' \} \rightarrow (A' + A).B.c \rightarrow 1.B.c \rightarrow B.c$

$$F = (A.B) + (A'.B) + (B.c)$$

- ②. Simplify the following expressions using Boolean Algebra Laws.

(i) $F = A'.B'.c + (A+B+c)' + A'.B'.c'.D$ De Morgan's law

$$\begin{aligned}
 &= A'.B'.c + A'.B'.C' + A'.B'.c'.D \\
 &= \overline{AB} \cdot (c + \overline{c}) + A'.B'.C'.D \\
 &= \overline{AB} \cdot 1 + \overline{AB}C'D \\
 &= \overline{AB} + \overline{AB}C'D
 \end{aligned}$$

(ii) $F = A.B.c + A' + A.B'.c$

$$\begin{aligned}
 &= A.B.c + A.B'.c + A' \\
 &= AC(B+B') + A' \\
 &= AC \cdot 1 + A' \\
 &= AC + A' \\
 &= c(A+A') = c \cdot 1 \\
 &F = c //
 \end{aligned}$$

3. a) If the computer's opcode format were expanded to 12 bits instead of 9, and the memory address format remained the same, (25 bits), what would be the new size of each instruction in bits?

$$\text{size of the instruction} = 25 + 12 \text{ bits}$$

$$= 37 \text{ bits}$$

- b) Considering the updated opcode format (12 bits) how many different instructions can this computer have.

$$2^{12} = 4096 \text{ bits}$$

- c) If the maximum memory size remains unchanged and continues to be 2^{25} memory locations, what would be the new maximum memory size in terms of megabytes (MB)?

$$\frac{2^{25}}{2^{12}} = 2^{13} \text{ bits}$$