Model Answer دوائر رقمية ، منطقية

a-

$$X = \overline{(\overline{A}\,\overline{B}\,\overline{C})}\,C + \overline{\overline{A}\,\overline{B}\,\overline{C}} + D$$

Applying DeMorgan's theorem and Boolean algebra,

$$\begin{aligned} X &= (\overline{\overline{A}} + \overline{\overline{B}} + \overline{\overline{C}})C + \overline{\overline{A}} + \overline{\overline{B}} + \overline{\overline{C}} + D \\ &= AC + BC + CC + A + B + C + D \\ &= AC + BC + C + A + B + \not{C} + D \\ &= C(A + B + 1) + A + B + D \\ X &= A + B + C + D \end{aligned}$$

b- (a) Convert the binary number 11000110 to Gray code.

(b) Convert the Gray code 10101111 to binary.

(a) Binary to Gray code:

1 → + → 1 → + → 0 → + → 0 → + → 0 → + → 1 → + → 1 → + → 0

1 0 1 0 0 1 0 1

(b) Gray code to binary:

1 0 1 0 1 1 1 1

1 1 0 0 1 0 1 0

c- Sign magnitude $(-23)_{10} = (10010111)_2$

- One's complement $(-23)_{10} = (11101000)_2$

- Two's complement $(-23)_{10} = (11101001)_2$

d- Define: Boolean Variable- DeMorgan's law - Combinational digital circuits- sequential digital circuits.

Boolean Variable: is binary variable has two value either 0 or 1.

DeMorgan's law: converts the NOR gate to AND with the inputs negation also converts the NAND gate to OR with the inputs negation

for example (A+B)' =A'.B' or (A.B)' =A'+B'

Combinational digital circuits: is described with truth table and constructed from basic logic gates. the output at any time instant depends only on the inputs exists at this time instant. it has applications in adders, multiplexers, decoders.

sequential digital circuits: is described with state table and constructed from basic logic gates and memory bit element in feedback path. the output at any time instant depends on the inputs exists at this time instant and the previous value of output. it has applications in counters, registers, memories.

e- Complete $(2F.C)_{16}=(57.6)_8=(65.5151)_7=(00111000.1010)_{\text{Gray code}}$

f- i- $8F5_{11}-1FB_{11}$ ii- $111101_2 \div 101_2$

$8F5_{11}-1FB_{11}=6FA_{11}$

ii- $111101_2 \div 101_2$; Quotient = 1100_2 and Remainder = 0001_2