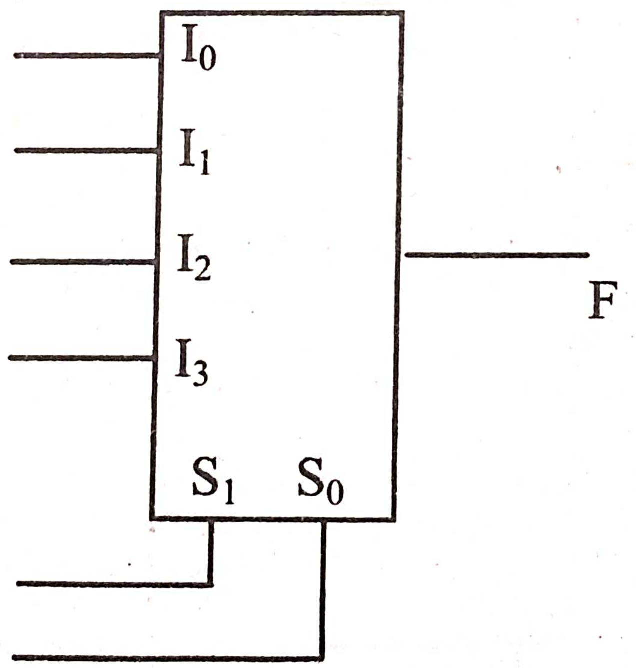
22. The Boolean equation $F(X, Y, Z) = \pi\,(2, 4, 7)$ is to be implemented using 4×1 multiplexer shown in figure. Which one of the following choices of inputs to multiplexer will realize the Boolean function?



(a) $(I_0, I_1, I_2, I_3, S_1, S_0) = (\overline{X}, 1, X, \overline{X}, Y, Z)$

(b) $(I_0, I_1, I_2, I_4, S_1, S_0) = (0, 1, \overline{X}, X, Y, Z)$

(c) $(I_0, I_1, I_2, I_4, S_1, S_0) = (1, 0, \overline{X}, X, \overline{Y}, Z)$

(d) $(I_0, I_1, I_2, I_3, S_1, S_0) = (1, 0, X, \overline{X}, Y, \overline{Z})$

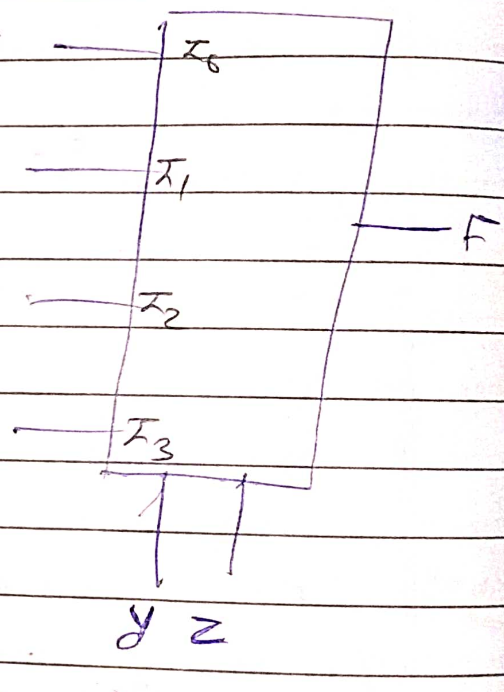
(a) 22 $F = \pi M(2, 4, 7) = \Sigma m(0, 1, 3, 5, 6)$

$F = I_0 \bar{S}_1 \bar{S}_0 + I_1 \bar{S}_1 S_0 + I_2 S \bar{S}_1 + I_3 S_1 S_0$

$0 \Rightarrow$ $2 \to 010$ $4 \to 100$ $7 \to 111$

$1 \Rightarrow$ $0 \to 000$ $1 \to 001,$ $3 \to 011,$ $5 \to 101,$ $6 \to 110$

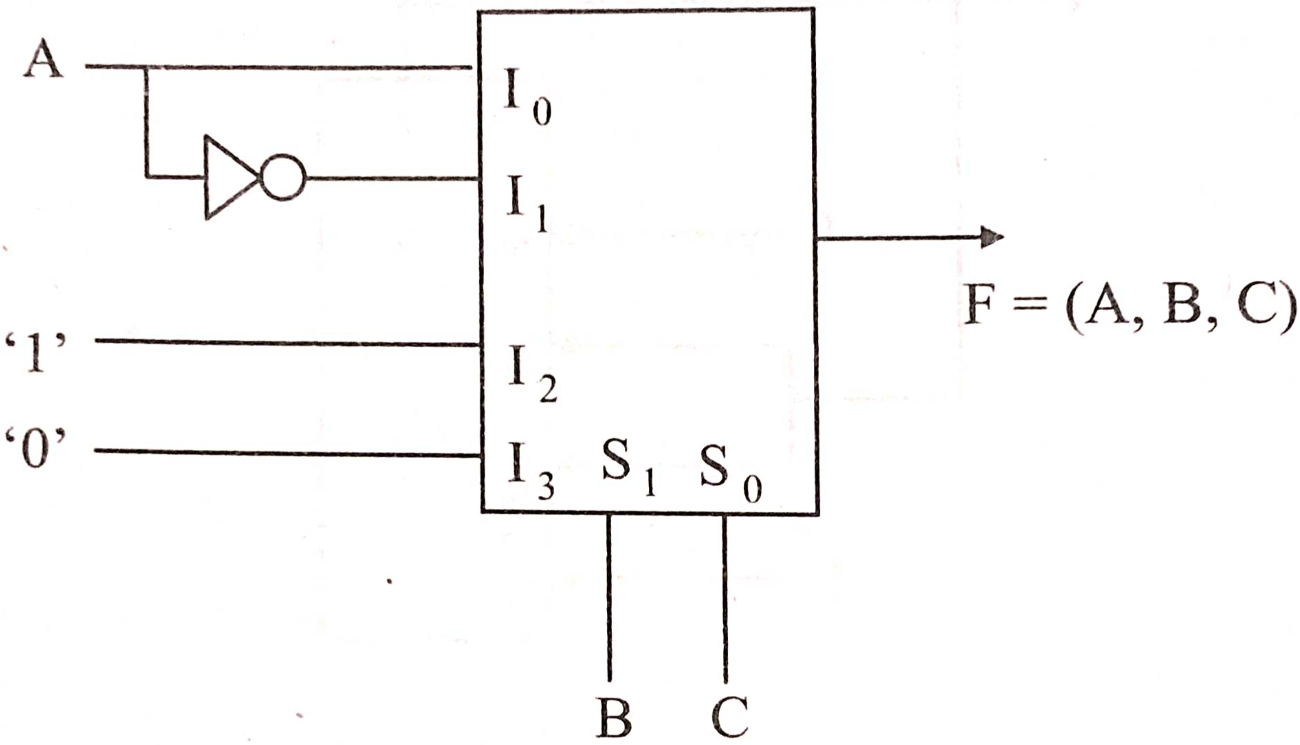
		x y z	O/P	
$I_0 \bar{S}_1 \bar{S}_0$	=	000 100	1 0	$\bar{x}$
$I_1 \bar{S}_1 S_0$	=	001 101	1 1	1
$I_2 S_1 \bar{S}_0$	=	010 110	0 1	x
$I_3 S_1 S_0$	=	011 111	1 0	$\bar{x}$



(a) $(I_0, I_1, I_2, I_3, S_1, S_0) = (\bar{x}, 1, x, \bar{x}, y, z)$

23. A 4 × 1 MUX is used to implement a 3- input Boolean function as shown in figure.

The Boolean function F(A,B,C) implemented is



(a) F (A, B, C) = $\Sigma m(1, 2, 4, 6)$

(b) F (A, B, C) = $\Sigma m(1, 2, 6)$

(c) F (A, B, C) = $\Sigma m(2, 4, 5, 6)$

(d) F (A, B, C) = $\Sigma m(1, 5, 6)$

Q 23 ⇒ $F = A\bar{B}\bar{C} + \bar{A}\bar{B}C + A \cdot 1 \cdot B\bar{C} + 0 \cdot BC$

$\cancel{\bar{B}(A \oplus C) + B\bar{C}}$

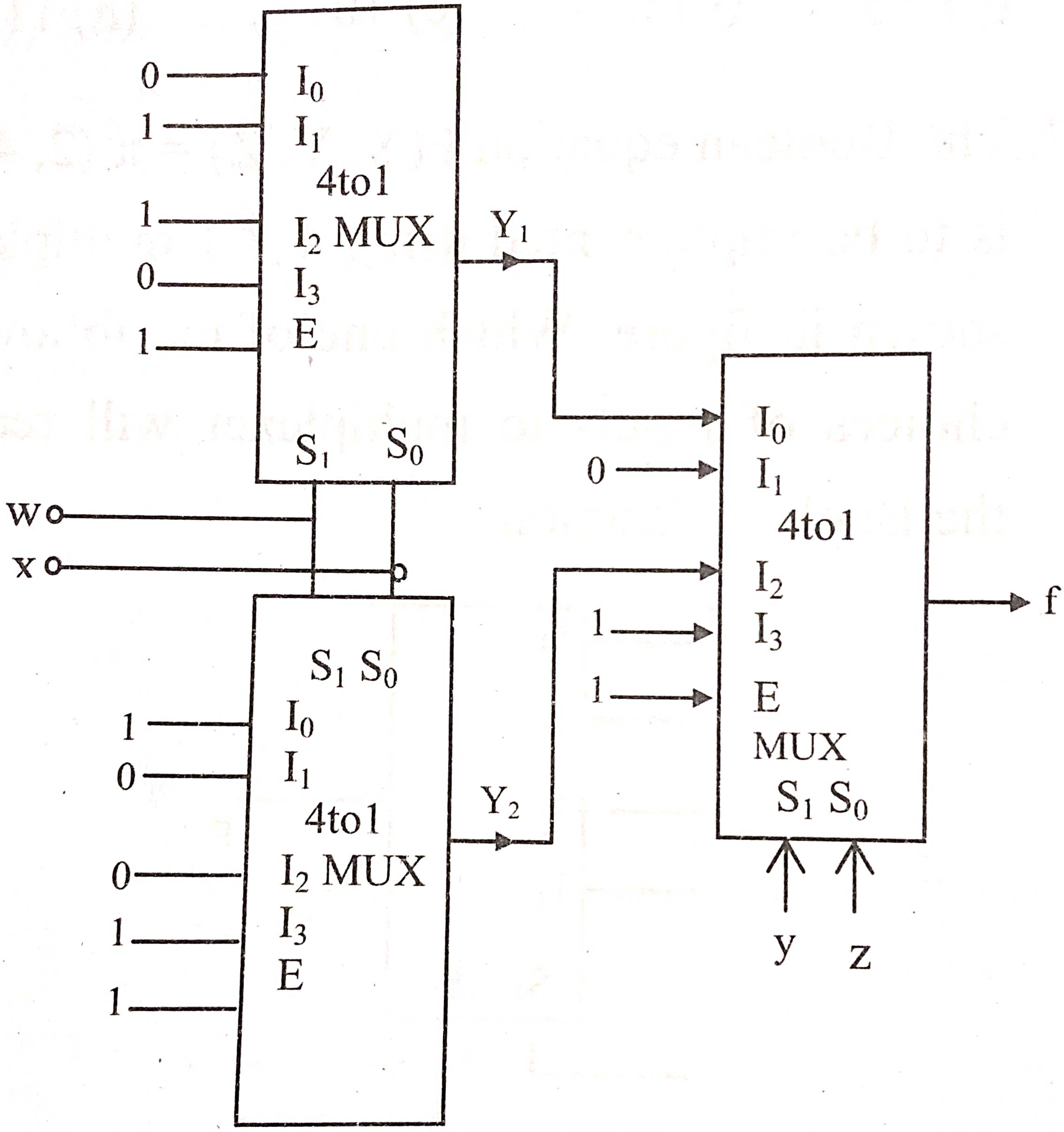
$F = A\bar{B}\bar{C} + \bar{A}\bar{B}C + AB\bar{C} + \bar{A}B\bar{C}$

$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$

$4 \quad 1 \quad 6 \quad 2$

a) $\boxed{F = \Sigma m(1, 2, 4, 6)}$

24. The function realized by the given multiplexer circuit is



(a) $f(w, x, y, z) = \Sigma m(2, 3, 4, 7, 8, 11, 14, 15)$

$+d(1, 10, 12)$

(b) $f(w, x, y, z) = \Sigma m(2, 3, 4, 7, 8, 11, 14, 15)$

(c) $f(w, x, y, z) = \pi M(2, 3, 4, 7, 8, 11, 14, 15)$

$.d(1, 10, 12)$

(d) $f(w, x, y, z) = \pi M(2, 3, 4, 7, 8, 11, 14, 15)$

(b) 24 ⇒

$Y_1 = E(0\cdot\bar{w}\bar{x} + 1\cdot\bar{w}x + 1\cdot w\bar{x} + 0\cdot wx)$

$Y_1 = 1\cdot(w \oplus x)$ —— (i)

$Y_2 = 1\cdot(1\cdot\bar{w}\bar{x} + 0\cdot\bar{w}x + 0\cdot w\bar{x} + 1\cdot wx)$

$Y_2 = \overline{(w \oplus x)}$ —— (ii)

$F = 1\cdot(Y_1\cdot\bar{y}\bar{z} + 0\cdot\bar{y}z + Y_2\cdot y\bar{z} + 1\cdot yz)$

$F = ((\bar{w}x + w\bar{x})\bar{y}\bar{z} + (\bar{w}\bar{x} + wx)y\bar{z} + (\bar{w}+w)(x+\bar{x})yz)$

$F = \bar{w}x\bar{y}\bar{z} + w\bar{x}\bar{y}\bar{z} + \bar{w}\bar{x}y\bar{z} + wxy\bar{z} + \bar{w}xyz + \bar{w}\bar{x}yz + wxyz + w\bar{x}yz$

4 8 2 14 7 3 11 15

(b) $\boxed{F = \Sigma m(2, 3, 4, 7, 8, 11, 14, 15)}$

25. Minimum size of ROM required to implement following set of Boolean equations is

$F_1(w,x,y,z) = \Sigma m(0,1,2,5,7,12,13,15)$

$F_2(w,x,y,z) = \Sigma m(0,5,6,9,13,15)$

$F_3(w,x,y,z) = \Sigma m(6,7,9,12,14,15)$

(a) 16×4

(b) 16×3

(c) 16×8

(d) 16×12

(b) Q5-1 $F_1(w,x,y,z) = \Sigma m(0,1,2,5,7,12,13,15)$
$F_2(w,x,y,z) = \Sigma m(0,5,6,9,13,15)$
$F_3(w,x,y,z) = \Sigma m(6,7,9,12,14,15)$

Sol^n

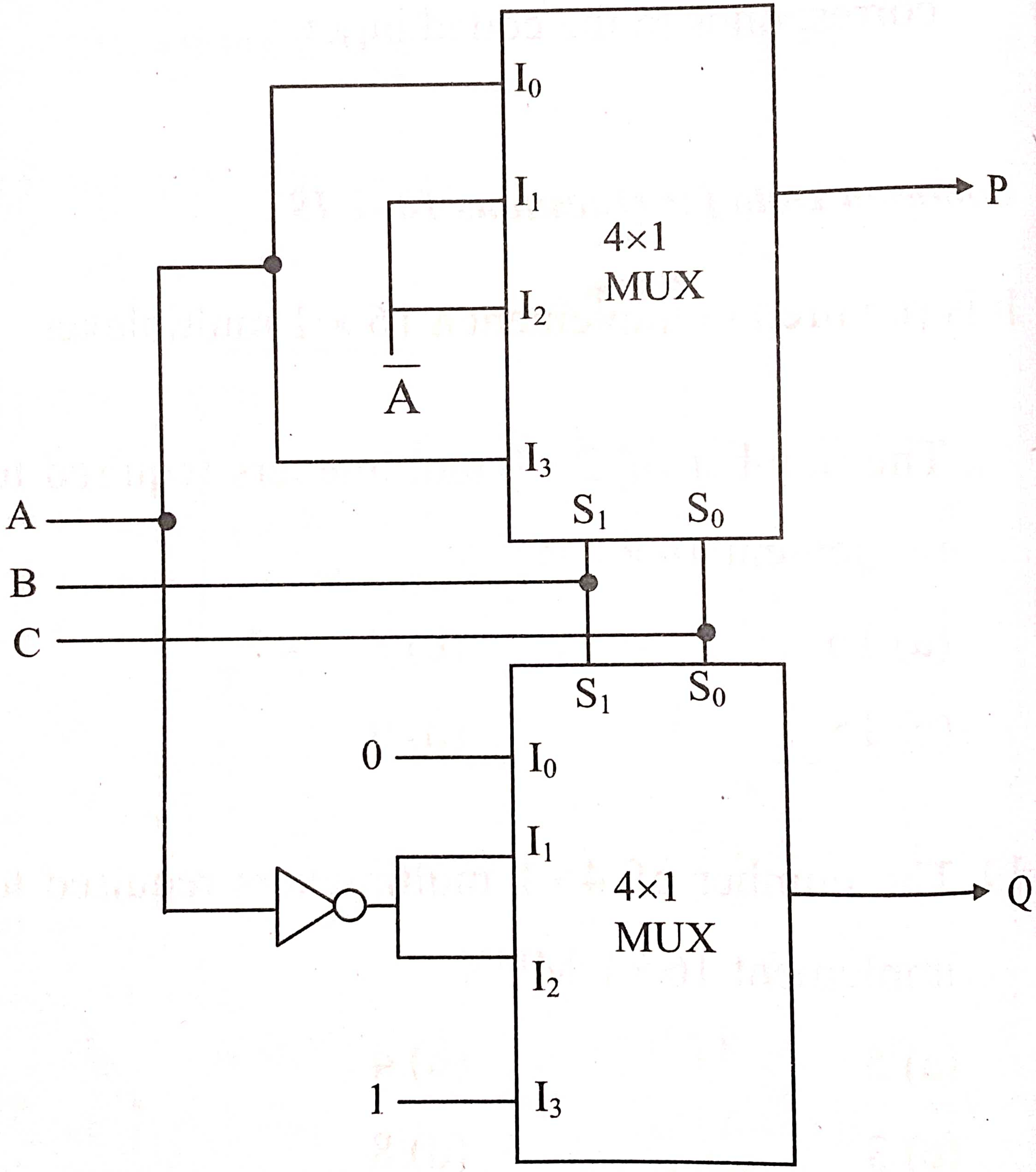
We have 4 variable f^n.
minterm = 16

Decoder size = 4×16
3 function ~~required~~ implement
3 lines needed

$\boxed{\text{ROM size} - 16 \times 3}$

(b) 16×3

26. Identify the output equations for the following circuit.



(a) $P(A,B,C) = \Sigma m\,(1, 2, 4, 7)$

$Q(A,B,C) = \Sigma m\,(2, 3, 4, 7)$

(b) $P(A,B,C) = \Sigma m\,(1, 2, 4, 7)$

$Q(A,B,C) = \Sigma m\,(1, 2, 3, 7)$

(c) $P(A,B,C) = \Sigma m\,(1, 2, 4, 7)$

$Q(A,B,C) = \Sigma m\,(3, 5, 6, 7)$

(d) $P(A,B,C) = \Sigma m\,(3, 5, 6, 7)$

$Q(A,B,C) = \Sigma m\,(1, 2, 4, 7)$

(b) 26 ⇒ $P = A\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}B\bar{C} + ABC$

$$\boxed{P = \Sigma m(1, 2, 4, 7)}$$

$Q = 0.\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}B\bar{C} + 1.BC$

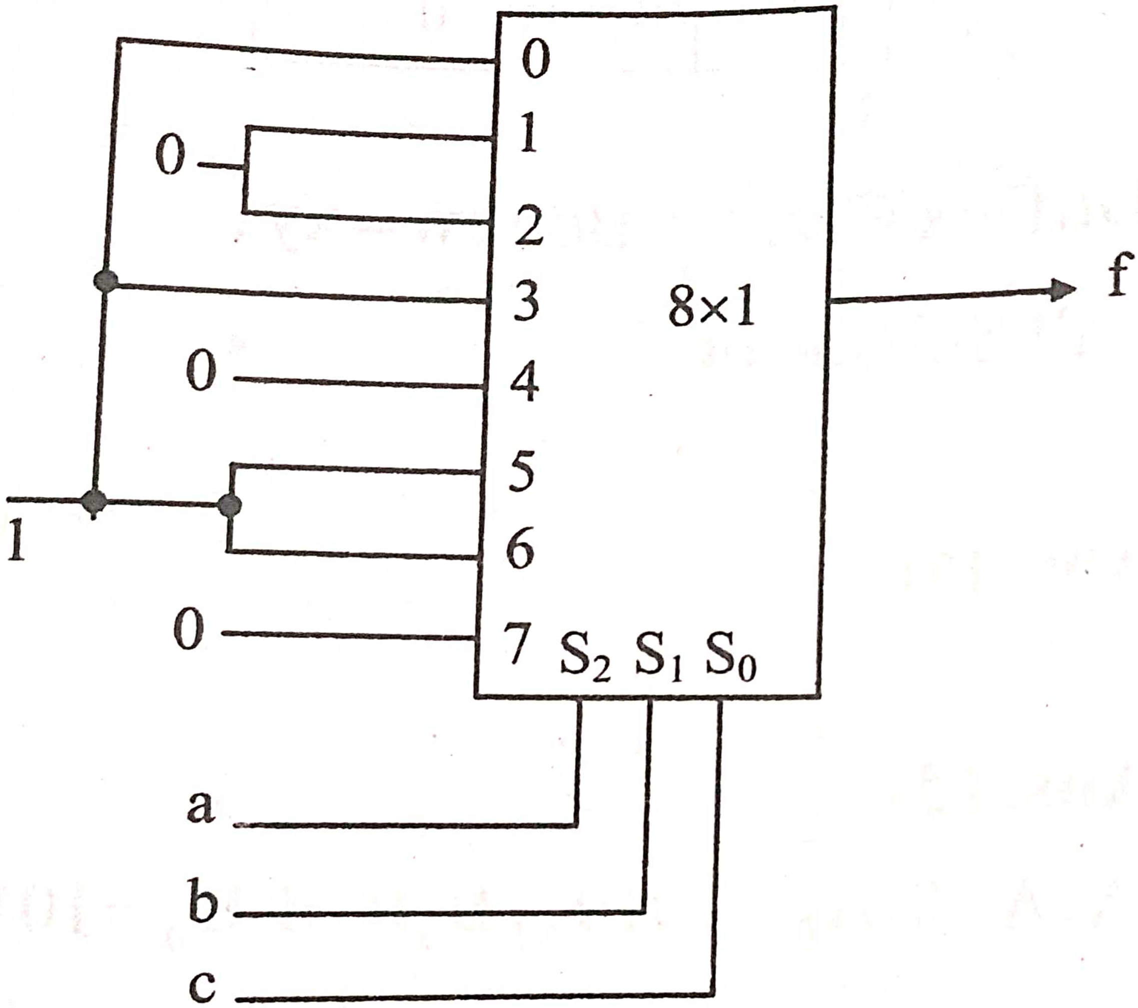
$Q = \bar{A}\bar{B}C + \bar{A}B\bar{C} + \bar{A}BC + ABC$

$C_1 \quad C_2 \quad C_3 \quad C_7$

$$\boxed{Q = \Sigma m(1, 2, 3, 7)}$$

(b)

27. The Boolean equation representing the following circuit is



(a) $f(a, b, c) = \sum m(1, 2, 4, 7)$
(b) $f(a, b, c) = \sum m(3, 5, 6, 7)$
(c) $f(a, b, c) = \sum m(0, 3, 5, 6)$
(d) $f(a, b, c) = \sum m(1, 2, 5, 7)$

e) 27

$F = 1\cdot\bar{a}\bar{b}\bar{c} + 0\cdot\bar{a}\bar{b}c + 0\cdot\bar{a}b\bar{c} + 1\cdot\bar{a}bc + 0\cdot a\bar{b}\bar{c} + 1\cdot a\bar{b}c + 1\cdot ab\bar{c} + 0\cdot abc$

$F = \underset{\uparrow m_0}{\bar{a}\bar{b}\bar{c}} + \underset{\uparrow m_3}{\bar{a}bc} + \underset{\uparrow m_5}{a\bar{b}c} + \underset{\uparrow m_6}{ab\bar{c}}$

c) $\boxed{F = \Sigma m(0, 3; 5, 6)}$

28. To design a 2-bit comparator the following are needed

(a) Two 1-bit comparators, 2 AND gates, 1 OR gate

(b) Two 1-bit comparators, 3 AND gates, 2 OR gates

(c) Three 1 bit comparators, 2 AND gates, 1 OR gate

(d) Three 1-bit comparators, 3 AND gates, 2 OR gates

(b) 28) Design 2-bit comparator —

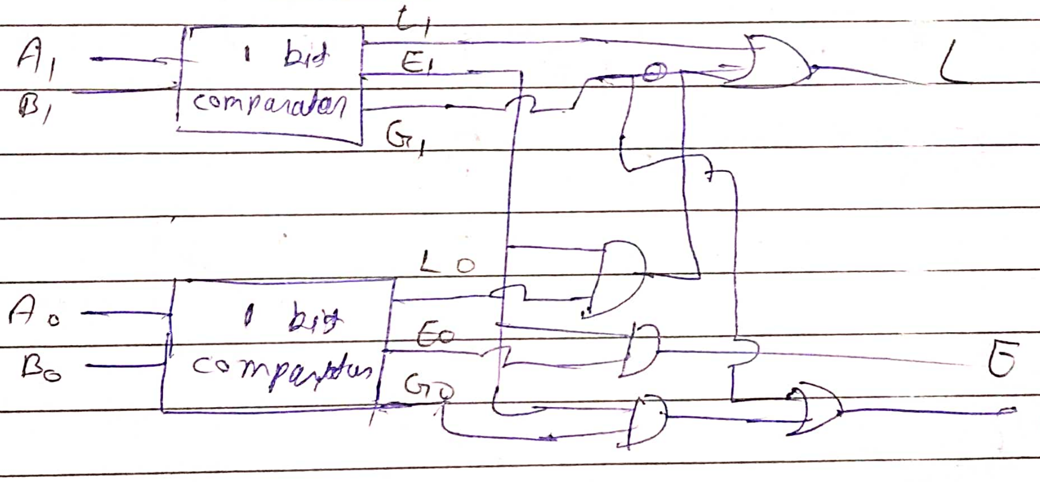
Sol^n

$G = G_1 + E_1 \cdot G_0$

$A = A_1 A_0$, $B = B_1 B_0 \Rightarrow A > B$

$E = E_1 \cdot E_0 \Rightarrow A = B$

$L = L_1 + E_1 L_0 \Rightarrow A < B$



(b) Two - 1-bit comparator 3-AND, 2-OR

29. What are basic gates required to implement a full adder?

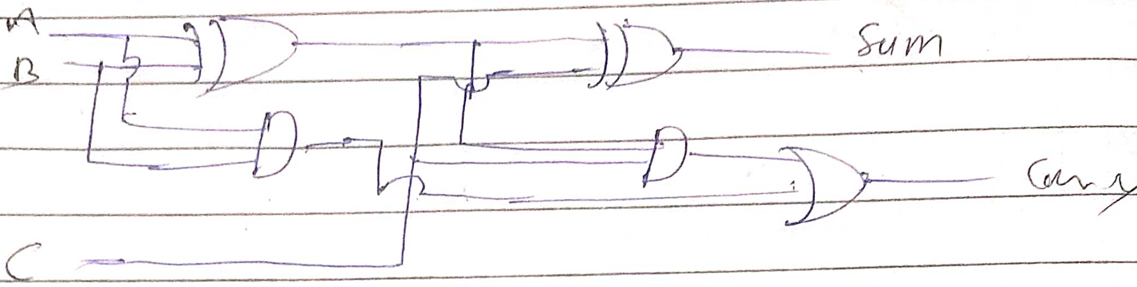
(a) 1–EX–OR gate, 1 AND gate

(b) 2–EX–OR gates, 1 OR gate

(c) 2EX–OR gates, 2 AND gates, 1 OR gate

(d) 1EX–OR gates, 2 AND gates, 2 OR gates

(c) 29 ⇒ basic gate to Full Adder.



(c) 2 - EXOR, 2-AND, 1 - OR

30. How many half adders are required to implement the following expressions.

$$D = \overline{A}BC + A\overline{B}C,\ E = A \oplus B \oplus C$$

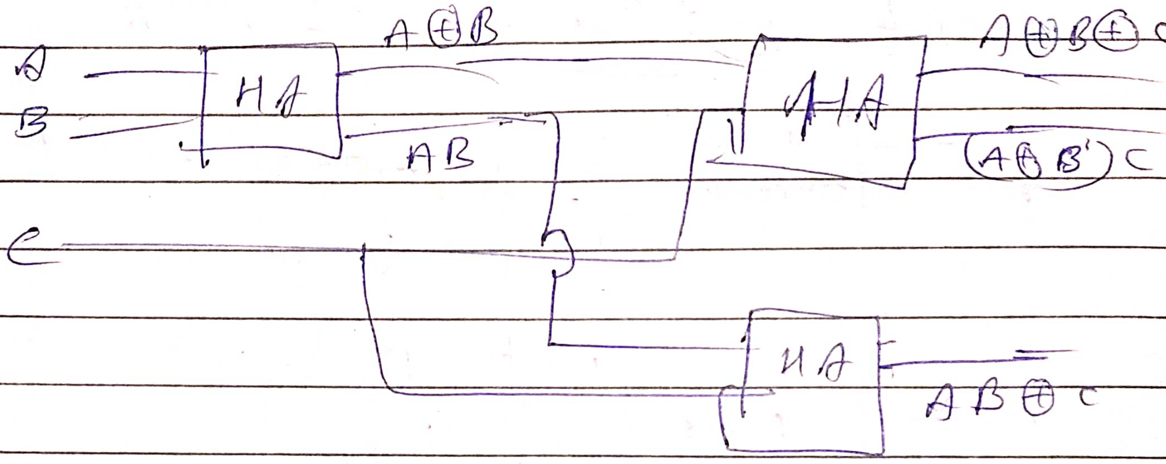
$$F = \overline{A}C + AB\overline{C} + \overline{B}C$$

(a) 2 (b) 3

(c) 4 (d) 1

(b) 30 ⇒ $D = C(A \oplus B)$ $\quad E = A \oplus B \oplus C$

$F = \overline{AB}C + AB\bar{C} = AB \oplus C$



(b) 3 - HA

31. While designing BCD(ABCD) to 9's complement BCD(PQRS), what is the expression for 'Q'?

(a) $B \oplus \overline{C}$

(b) BC

(c) $B \oplus C$

(d) $\overline{B} \oplus C$

(c) 3) →

BCD				9's of BCD				Dec	
A	B	C	D	P	Q	R	S		
0	0	0	0	1	0	0	1	0	0
0	0	0	1	1	0	0	0	1	0
0	0	1	0	0	1	1	1	2	1
0	0	1	1	0	1	1	0	3	1
0	1	0	0	0	1	0	1	4	1
0	1	0	1	0	1	0	0	5	1
0	1	1	0	0	0	1	1	6	0
0	1	1	1	0	0	1	0	7	0
1	0	0	0	0	0	0	1	8	0
1	0	0	1	0	0	0	0	9	0/1
								10	X
								11	X
								12	X
								13	X
								14	X
								15	X

Don't care

$$Q = \Sigma m(2,3,4,5) + \Sigma d(10,11,12,13,14,15)$$

AB \ CD	$\bar{C}\bar{D}$	$\bar{C}D$	CD	$C\bar{D}$
$\bar{A}\bar{B}$			1	1
$\bar{A}B$	1	1		
AB	X=1	X=1	X=0	X=0
$A\bar{B}$			X=1	X=1

→ $\bar{B}C$

→ $B\bar{C}$

(c) $\boxed{Q = B \oplus C}$

32. What are the components required to realize $10 \times 1k$ decoder?

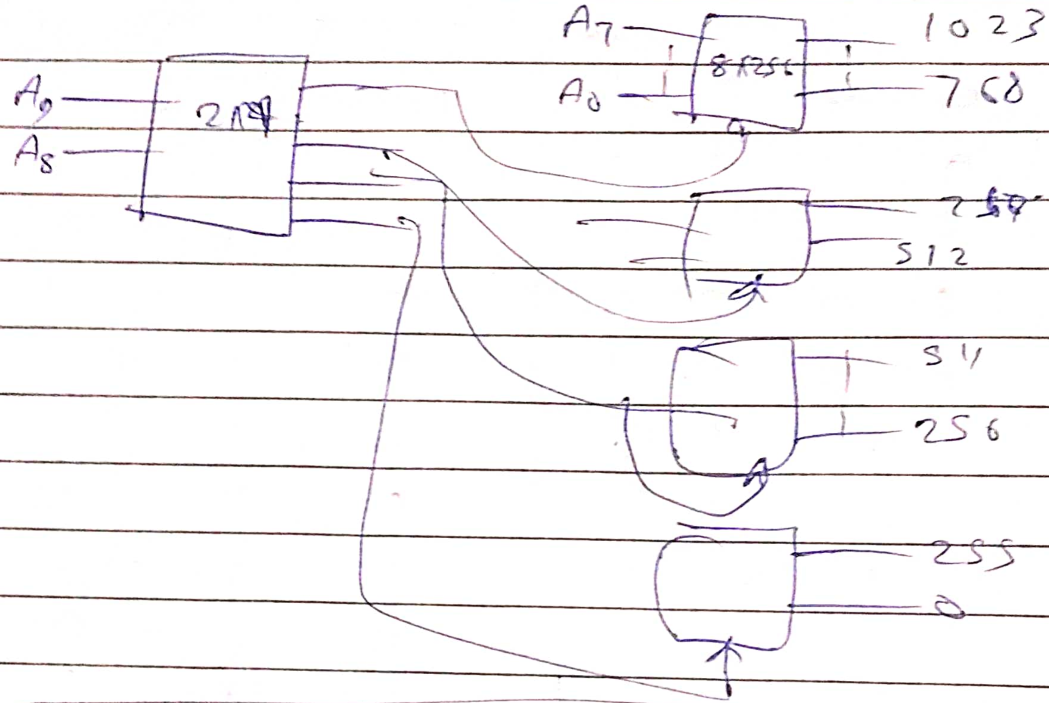
(a) '4' 8×256 decoders & '1' 2×4 decoder

(b) '8' 8×256 decoders & '2' 2×4 decoders

(c) '4' 8×256 decoders & '2' 2×4 decoders

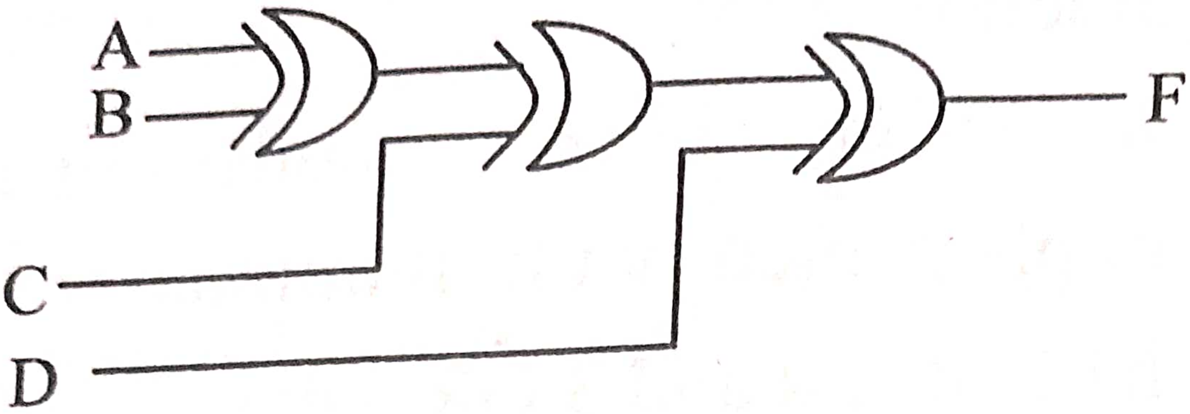
(d) '8' 8×256 decoders & '1' 2×4 decoder.

(a) 32 → component required 10 × 1024 decoder



(a) 4 ⇒ 8 × 256 → 1 → 2 × 4

33.



The above circuit is a

(a) Even parity generator

(b) Odd parity generator

(c) Even parity checker

(d) Odd parity checker

(a) 33 =)

$$F = ((A \oplus B) \oplus C) \oplus D$$

$\boxed{\text{(a) Even parity generator}}$