CS & IT ENGINEERING

DIGITAL LOGIC

Combinational Circuit

Lecture No. 05

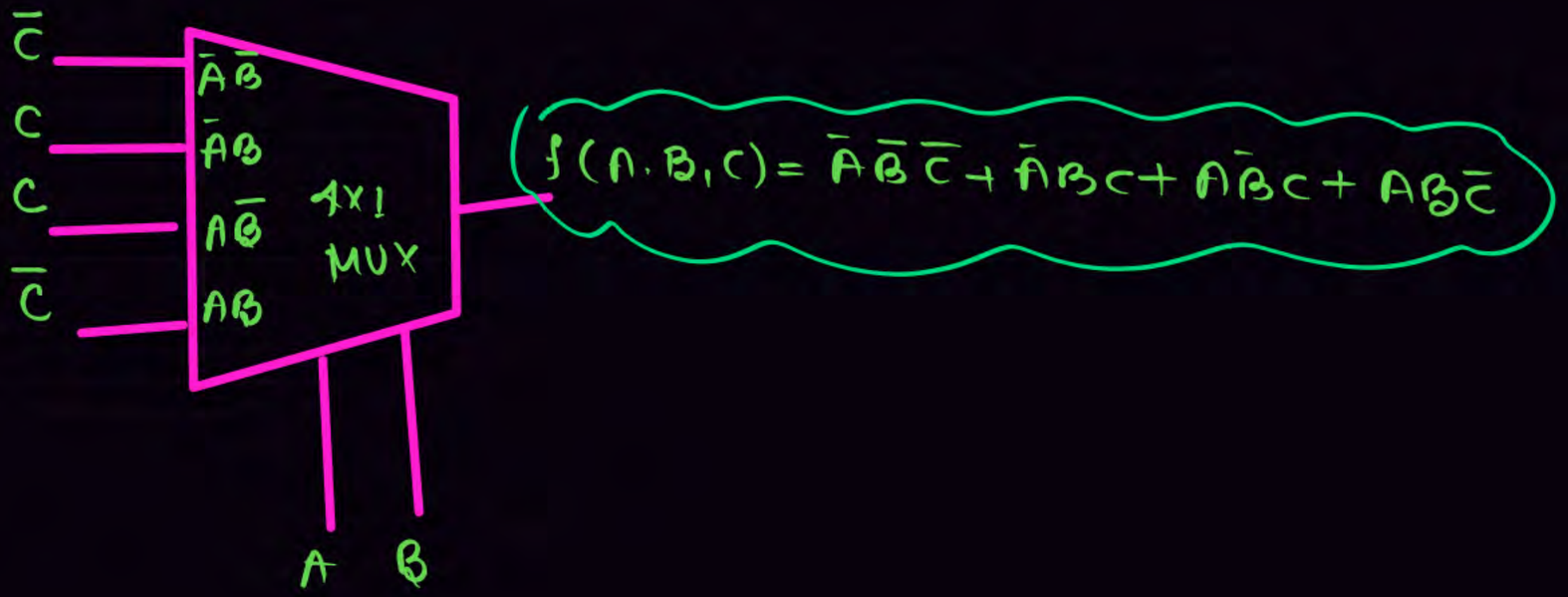
By- CHANDAN SIR

01 MULTIPLEXER

02 QUESTION PRACTICE

03 DISCUSSION

TYPE ⑤ IMPLEMENTATION OF FUNCTION :→



Ex 1 $f(A,B,C) = \Sigma m(0,1,4,7)$

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

case(1) Implement by using 8x1 MUX

$f(A,B,C) = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + A\bar{B}\bar{C} + ABC$

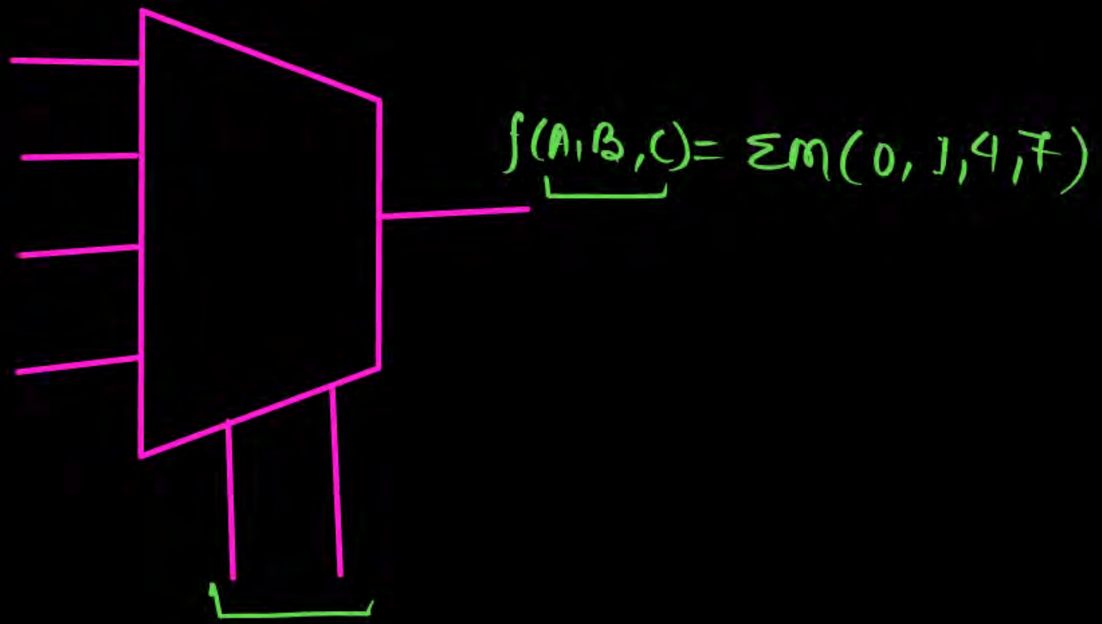
$= \Sigma m(0,1,4,7)$

case(2) :→

By using 4 × 1 MUX

$f(A, B, C) = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + A\bar{B}\bar{C} + ABC$ $= \Sigma m(0,1,4,7)$

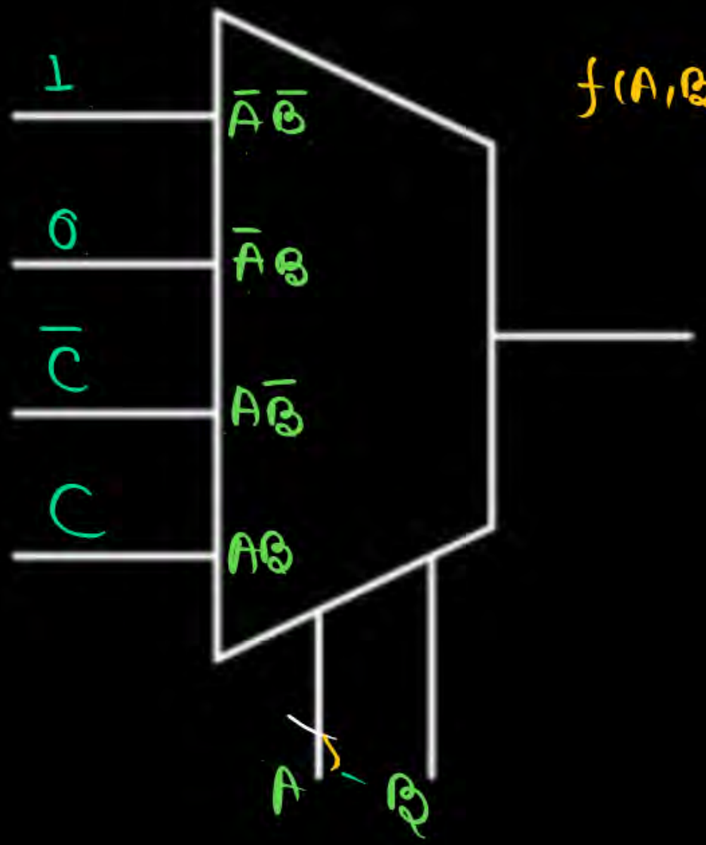
1. AB as a select line
2. BC as a select line
3. AC as a select line



1. AB is select line

$$f(A, B, C) = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + A\bar{B}\bar{C} + ABC$$

$$= \Sigma m(0,1,4,7)$$



$$f(A,B,C) = \bar{A}\bar{B}\cdot 1 + A\bar{B}\bar{C} + ABC$$

$$= \bar{A}\bar{B}(\bar{C}+C) + A\bar{B}\bar{C} + ABC$$

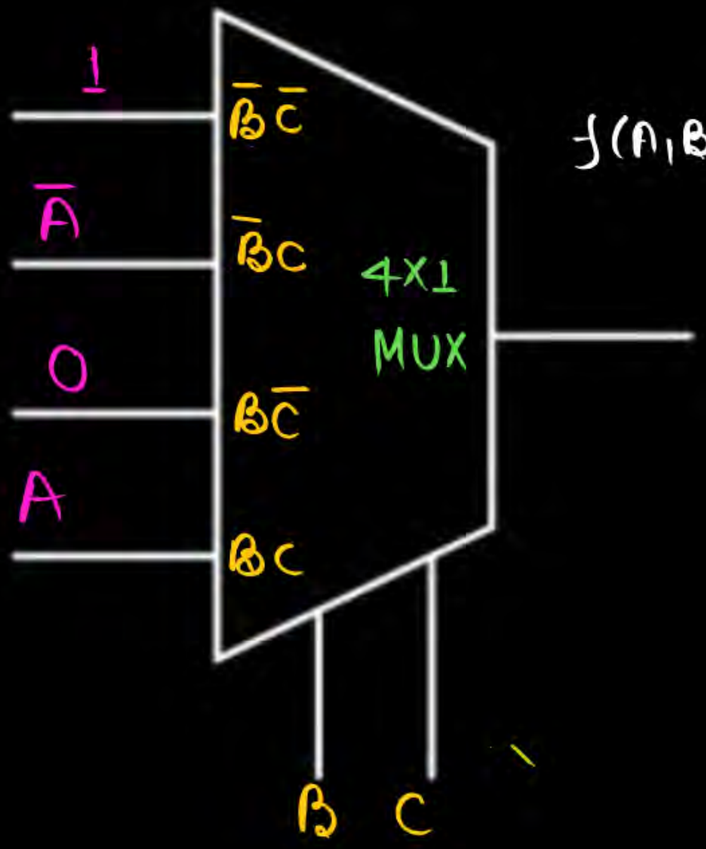
$$= \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + A\bar{B}\bar{C} + ABC$$

	$\bar{A}\bar{B}$	$\bar{A}B$	$A\bar{B}$	AB
$\bar{C}$	$\bar{A}\bar{B}\bar{C}$ 0	$\bar{A}B\bar{C}$ 2	$A\bar{B}\bar{C}$ 4	$AB\bar{C}$ 6
C	$\bar{A}\bar{B}C$ 1	$\bar{A}BC$ 3	$A\bar{B}C$ 5	ABC 7
	1	0	$\bar{C}$	C

2. BC is select line

$$f(A, B, C) = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + A\bar{B}\bar{C} + ABC$$

$$= \Sigma m(0, 1, 4, 7)$$



$$f(A,B,C) = \bar{B}\bar{C} + \bar{A}\bar{B}C + ABC$$

$$= (\bar{A}+A)\bar{B}\bar{C} + \bar{A}\bar{B}C + ABC$$

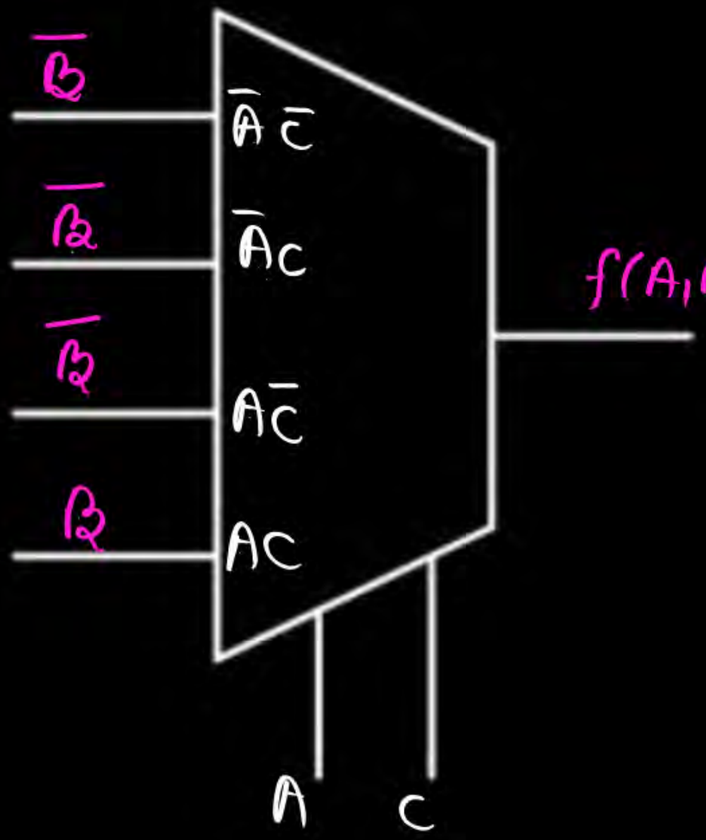
$$= \bar{A}\bar{B}\bar{C} + A\bar{B}\bar{C} + \bar{A}\bar{B}C + ABC$$

	$\bar{B}\bar{C}$	$\bar{B}C$	$B\bar{C}$	BC
$\bar{A}$	$\bar{A}\bar{B}\bar{C}$ 0	$\bar{A}\bar{B}C$ 1	$\bar{A}B\bar{C}$ 2	$\bar{A}BC$ 3
A	$A\bar{B}\bar{C}$ 4	$A\bar{B}C$ 5	$AB\bar{C}$ 6	ABC 7
	1	$\bar{A}$	0	A

3. AC is select line

$$f(A, B, C) = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + A\bar{B}\bar{C} + ABC$$

$$= \Sigma m(0, 1, 4, 7)$$



$$f(A,B,C) = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + A\bar{B}\bar{C} + ABC$$

	$\bar{A}\bar{C}$	$\bar{A}C$	$A\bar{C}$	AC
$\bar{B}$	$\bar{A}\bar{B}\bar{C}$ (0)	$\bar{A}\bar{B}C$ (1)	$A\bar{B}\bar{C}$ (4)	$A\bar{B}C$ 5
B	$\bar{A}B\bar{C}$ 2	$\bar{A}BC$ 3	$AB\bar{C}$ 6	ABC (7)
	$\bar{B}$	$\bar{B}$	B	B

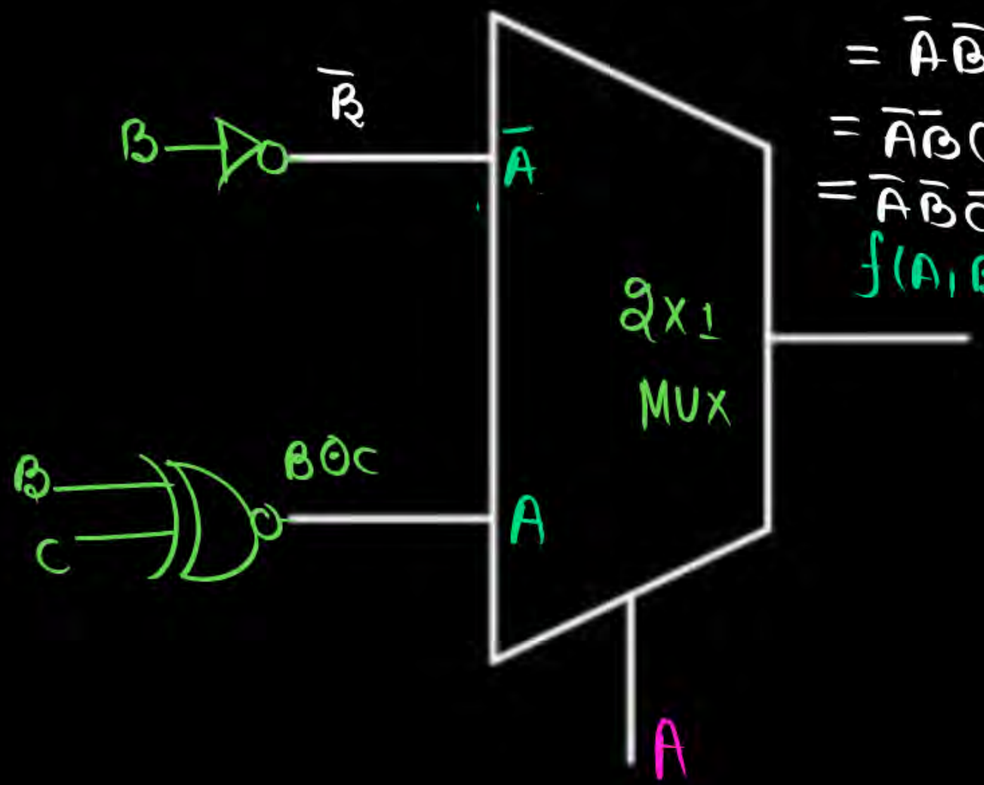
Case (3)

By using 2 × 1 MUX

$f(A,B,C) = \bar{A}\bar{B}\bar{C} + \bar{A}B\bar{C} + A\bar{B}\bar{C} + ABC$

$= \Sigma m(0,1,4,7)$

(i) "A" as a select line :-



$= \bar{A}\bar{B} + A(\bar{B}\bar{C} + BC)$

$= \bar{A}\bar{B}(\bar{C}+C) + A\bar{B}\bar{C} + ABC$

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

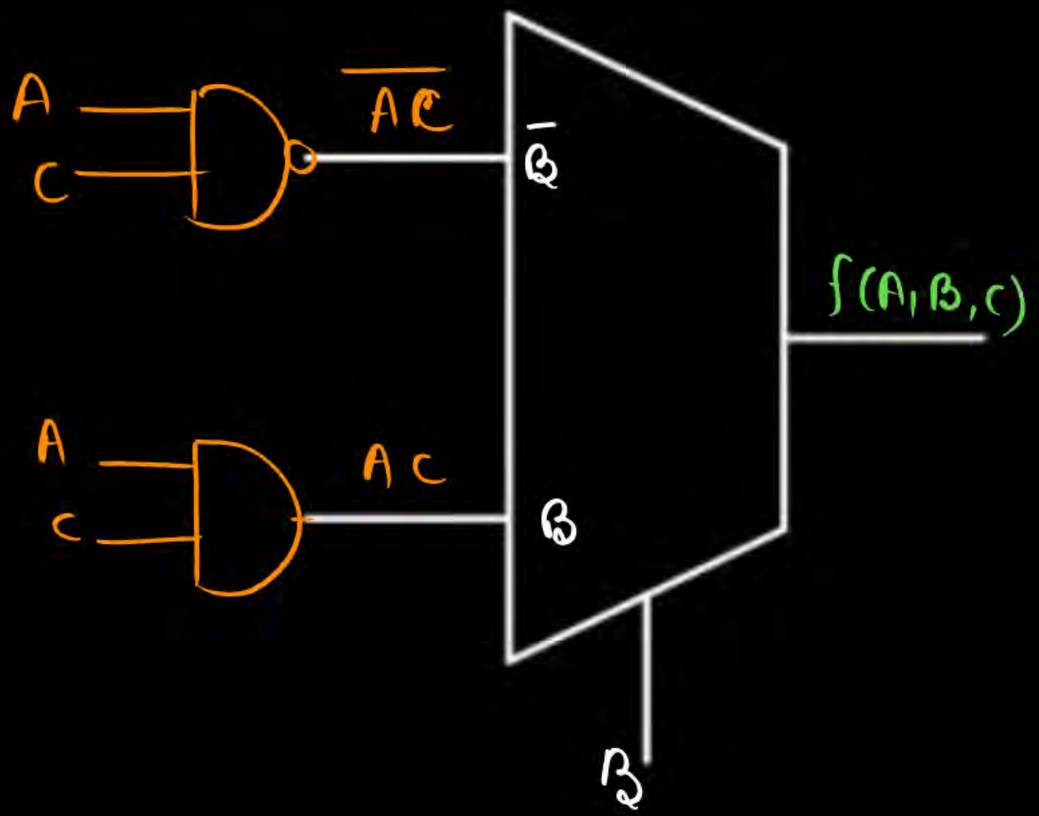
$f(A,B,C) \quad + ABC$

	$\bar{A}$	A
$\bar{B}\bar{C}$	$\bar{A}\bar{B}\bar{C}$ (0)	$A\bar{B}\bar{C}$ (4)
$\bar{B}C$	$\bar{A}\bar{B}C$ (1)	$A\bar{B}C$ 5
$B\bar{C}$	$\bar{A}B\bar{C}$ 2	$AB\bar{C}$ 6
BC	$\bar{A}BC$ 3	ABC (7)
	$\bar{B}\bar{C} + \bar{B}C$ $\bar{B}(\bar{C}+C)$ $= \bar{B}$	$\bar{B}\bar{C} + BC$ $B \odot C$

By using 2 × 1 MUX

$f(A,B,C) = \Sigma m(0,1,4,7)$

Take "B" as a select line



	$\bar{B}$	B
$\bar{A}\bar{C}$	$\bar{A}\bar{B}\bar{C}$ (0)	$\bar{A}B\bar{C}$ 2
$\bar{A}C$	$\bar{A}\bar{B}C$ (1)	$\bar{A}BC$ 3
$A\bar{C}$	$A\bar{B}\bar{C}$ (4)	$AB\bar{C}$ 6
AC	$A\bar{B}C$ 5	ABC (7)
	$\bar{A}\bar{C}+\bar{A}C+A\bar{C}$	AC

$\bar{A}(\bar{C}+C)+A\bar{C}$

$\bar{A}+A\bar{C}$

$\overline{\bar{A}+\bar{C}}$

AC

HW

$f(A,B,C) = \Sigma m(0,1,4,7)$

[iiij "C" as a select line

Q. H.W.

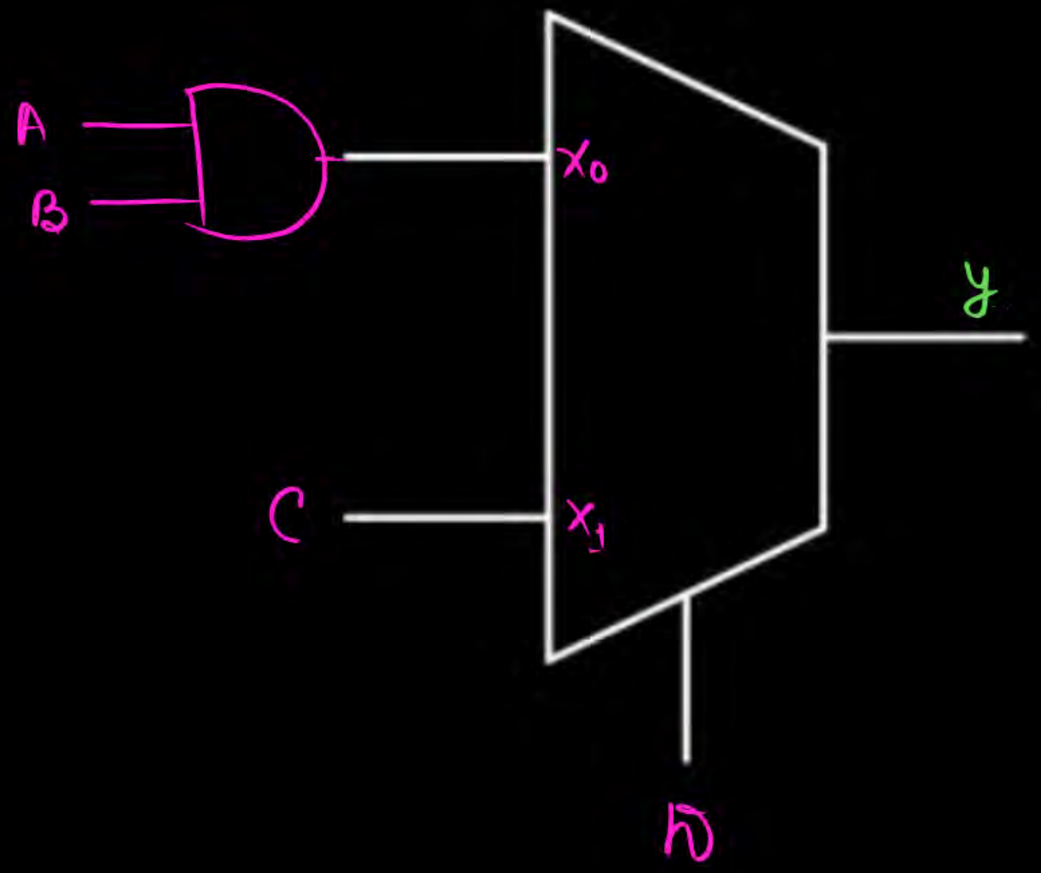
$f(A, B, C, D) = \sum m(0, 1, 3, 5, 7, 9, 12, 15)$

1. ABD as a select line
2. ACD as a select line

1) 16x1 MUX
2) 8x1 MUX
3) 4x1 MUX
4) 2x1 MUX
   - (i) A as a select line
   - (ii) AB select line
   - (iii) AC select line
   - (iii) AD select line

Type-6 Delay in MUX

$T_{AND} = 1\mu s$, $T_{MUX} = 2\mu s$



case(1) S = 0

$T = T_{AND} + T_{MUX}$

$= 1\mu s + 2\mu s$

$T = 3\mu s$

case(2) S = 1

$T = T_{MUX}$

$T = 2\mu s$

Q. HW

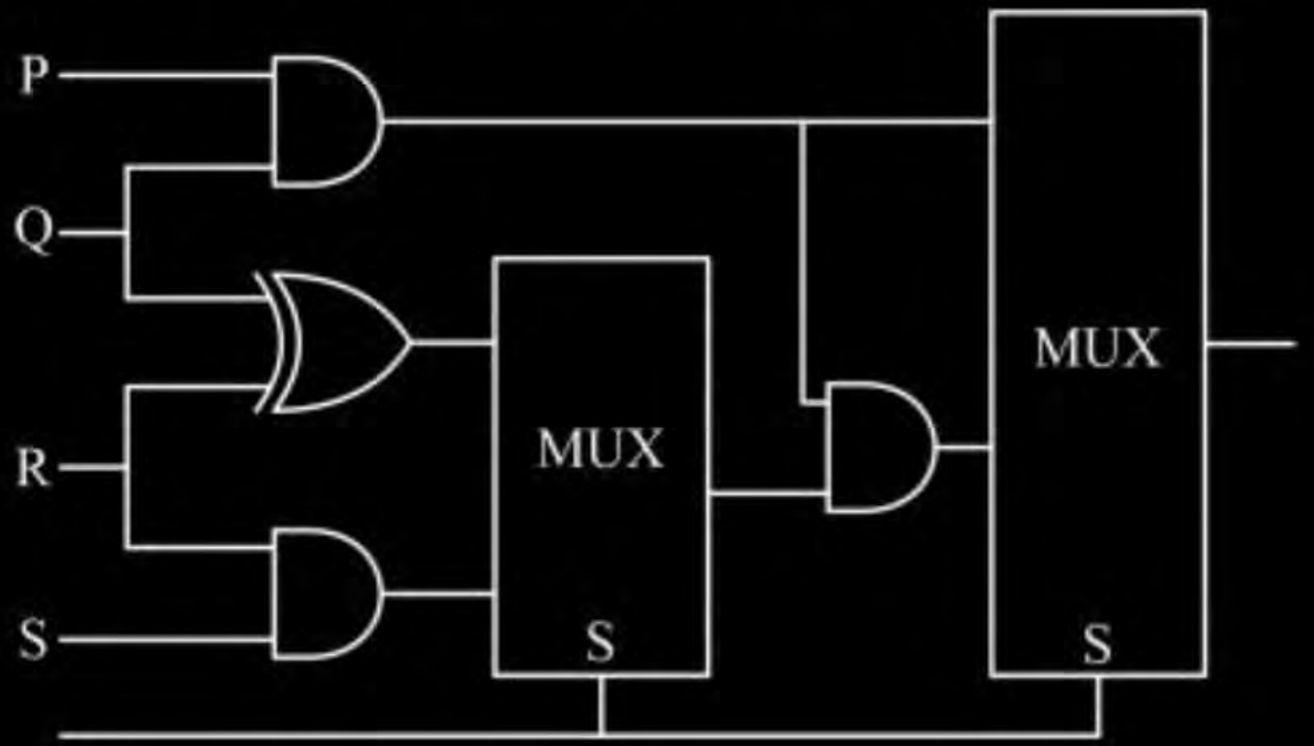
The propagation delay of the XOR gate, AND gate multiplexer (MUX) in the circuit shown in the figure are 4 ns, 2 ns and 1 ns, respectively. If all the inputs P, Q, R, S and T are applied simultaneously and held constant the maximum propagation delay of the circuit is

A 3 ns

B 6 ns

C 5 ns

D 7 ns



t·me/CJSIR

Thank you GW Soldiers !

8:00AM