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CMR INSTITUTE OF TECHNOLOGY, BENGALURU.
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Internal Assessment Test 1 – Nov. 2025

Subject/Code: Digital Design and Computer Organization / BCS302				
Date: 04/11/2025	Duration: 90 mins	Max. Marks: 50	Semester: 03	Branch: AI&DS (CSDS)

Sl.	Answer any FIVE FULL Questions	Marks	CO	RBT
1	Reduce the following Boolean expressions to the minimum number of literals. i) $(x + y)(x + y')$ ii) $xy + x'z + yz$ iii) $(x + y)(x' + z)(y + z)$	5	CO1	L2
	Determine the minimum SOP form using Karnaugh Map $F = A'B'C' + B'CD + A'BCD' + AB'C'$	5	CO1	L2
2	Simplify the Boolean function $F(w, x, y, z) = \Sigma(1, 3, 7, 11, 15)$ which has the don't care conditions $d(w, x, y, z) = \Sigma(0, 2, 5)$	5	CO1	L2
	Simplify and implement the following Boolean function using NAND gates $F(x, y, z) = (1, 2, 3, 4, 5, 7)$	5	CO1	L2

3	Implement the design of combinational circuit **BCD and excess-3 code converter.**	5	CO2	L3
	Implement **full adder circuit using 3:8 decoders.**	5	CO2	L3
4	With **Truth table and K-map simplification**, implement the **full adder** with basic gates and using **two half adders and an OR gate.**	5	CO2	L3
	Realize the Boolean function using **8:1 multiplexer** $F(A, B, C, D) = \Sigma(1, 3, 4, 11, 12, 13, 14, 15)$	5	CO2	L2
5	Simplify the given Boolean function and find the prime and essential prime implicants. $f(A, B, C, D) = \Sigma m(0, 1, 4, 5, 7, 8, 13, 15) + d(2)$	5	CO1	L2
	Place the following equation into proper canonical form: $P = f(a, b, c) = ab' + bc$ $T = f(a, b, c) = (a + b)(b' + c)$	5	CO1	L2
6	Implement the following functions using 3:8 decoder: $f_1(a, b, c) = \Sigma m(1, 3, 5)$ $f_2(a, b, c) = \Sigma m(0, 1, 6)$	5	CO2	L3
	Differentiate between latches and flipflops. Draw logic diagram and truth table for SR , D, JK and D flipflops.	5	CO2	L2

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1.(a)

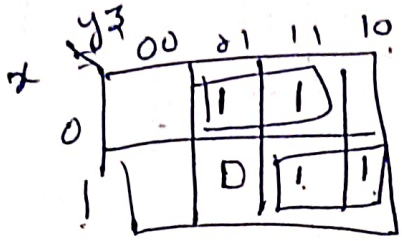
(i) $(x+y)(x+y')$

$= x + y \cdot y'$

$= x + 0$

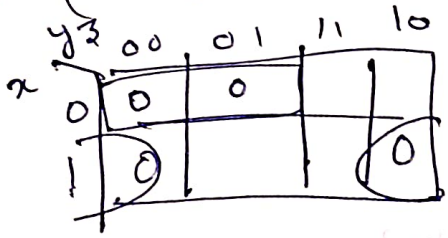
$= x$

(ii) $xy + x'z + yz$



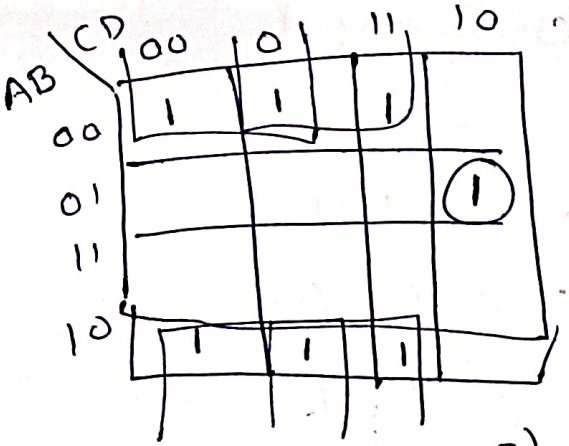
$= x'z + xy$

(iii) $(x+y)(x'+z)(y+z)$



$= (x+y)(x'+z)$

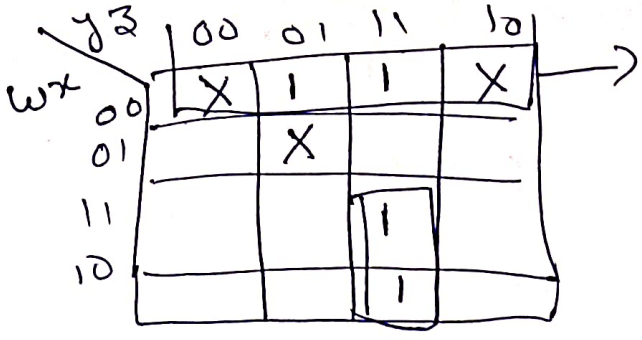
(b) $F = A'B'C' + B'CD + A'BCD' + AB'C'$



$f = B'C' + B'D + A'BC'D.$

2. $f = \Sigma(1,3,7,11,15) + d(0,2,5)$

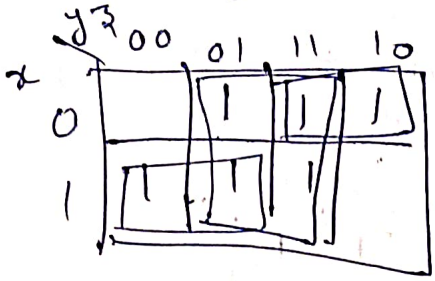
(a)



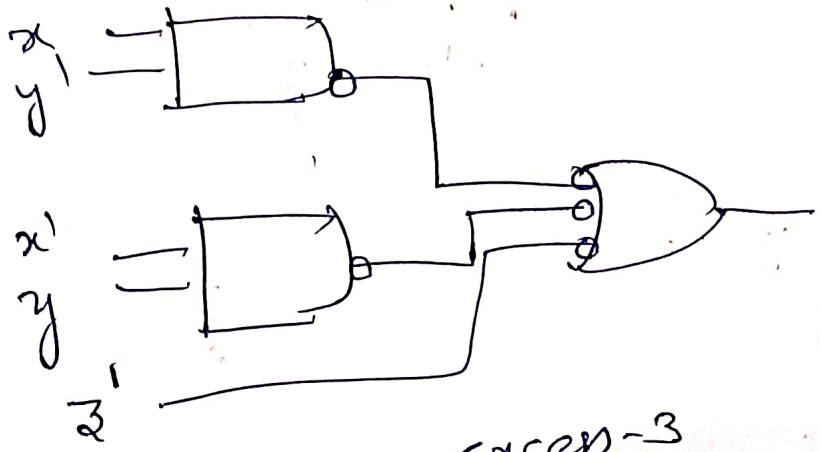
$f = w'x' + wyz.$

(2) (b)

$f(x, y, z) = \Sigma(1, 2, 3, 4, 5, 7)$

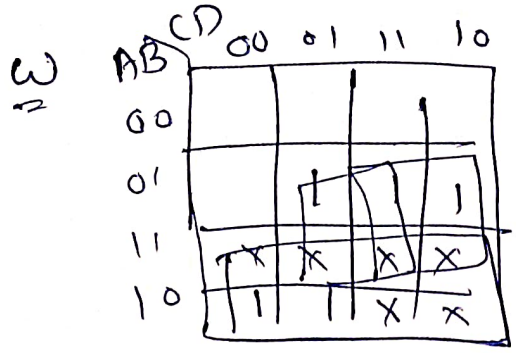


$f = z + xy' + x'y$

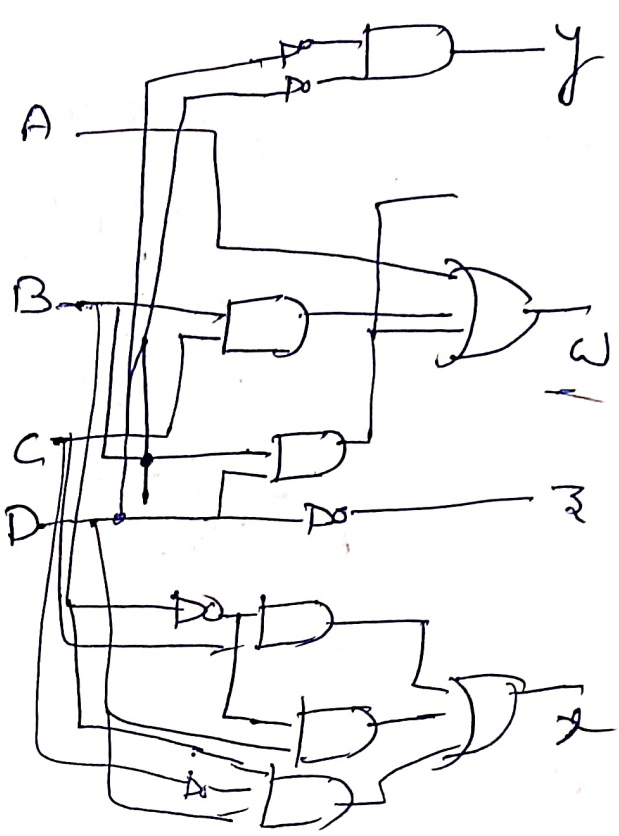


(3) BCD to Excess-3

BCD				Excess-3			
A	B	C	D	w	x	y	z
0	0	0	0	0	0	1	1
0	0	0	1	0	1	0	0
0	0	1	0	0	1	0	1
0	0	1	1	0	1	1	0
0	1	0	0	0	1	1	1
0	1	0	1	1	0	0	0
0	1	1	0	1	0	0	1
0	1	1	1	1	0	1	0
1	0	0	0	1	0	1	1
1	0	0	1	1	1	0	0



(2)



Ily $w = A + BC + BD$

$x = B'C + B'D + BC'D$

$y = CD + C'D'$

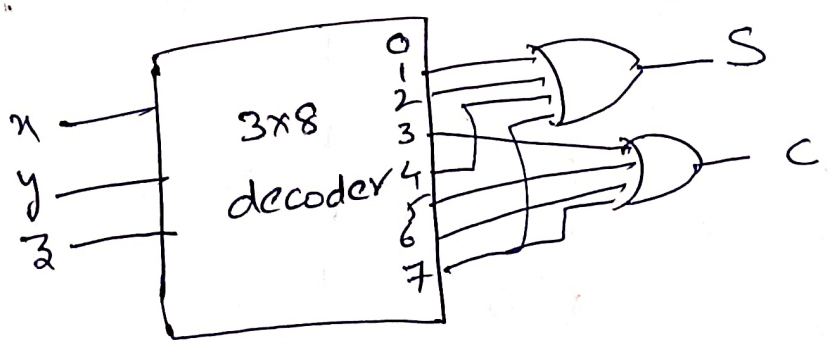
$z = D$

(3) (b) **Full adder**

x	y	z	Sum	carry
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

$S = \Sigma(1, 2, 4, 7)$

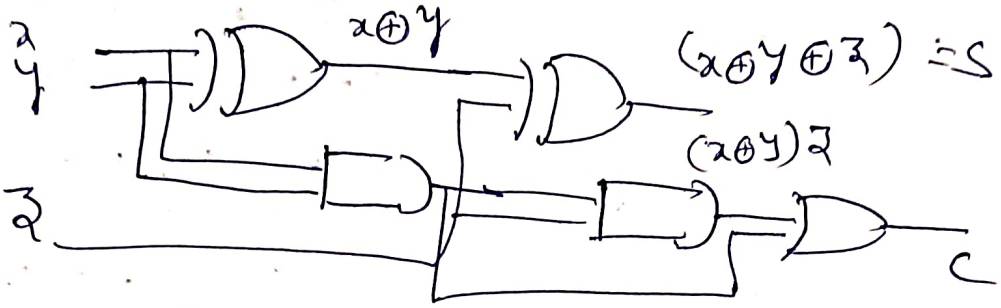
$C_2 = \Sigma(3, 5, 6, 7)$



(4) **Full adder**

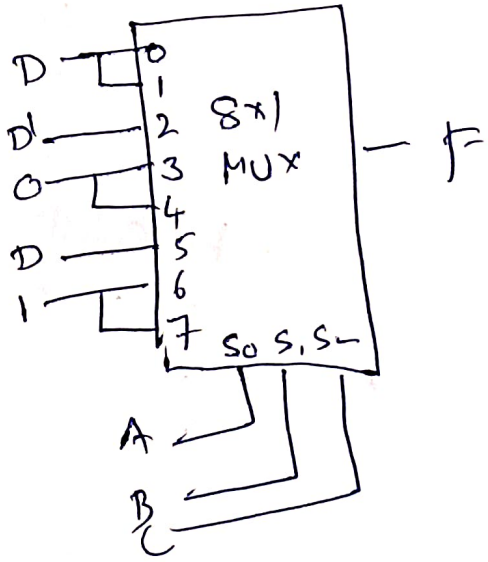
$$S = x \oplus y \oplus z$$

$$C = xy + yz + xz$$
$$= xy + xy'z + x'yz$$
$$= xy + z(xy' + x'y)$$

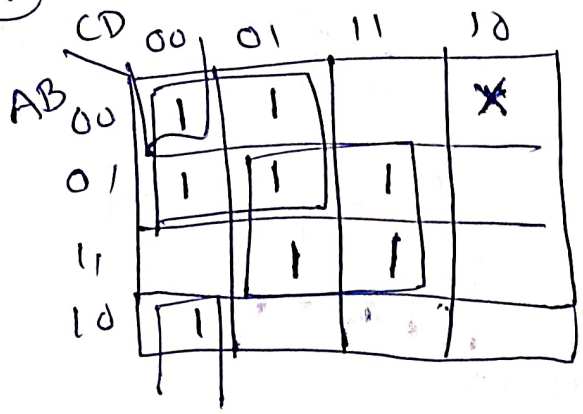


(4) (b)

A	B	C	D	f	
0	0	0	0	0	F = D
0	0	0	1	1	
0	0	1	0	0	= D
0	0	1	1	1	
0	1	0	0	1	= D'
0	1	0	1	0	
0	1	1	0	0	= 0
0	1	1	1	0	
1	0	0	0	0	= 0
1	0	0	1	0	
1	0	1	0	0	= D
1	0	1	1	1	
1	1	0	0	1	= 1
1	1	0	1	1	
1	1	1	0	1	= 1
1	1	1	1	1	



5 (a)



prime implicant

$A'C', BD, B'C'D'$

essential prime implicant

$A'C', BD, B'C'D'$

5 (b)

(i) $P = f(a, b, c) = ab' + bc$

$= ab'(c+c') + (a+a')bc$

$= ab'c + ab'c' + abc + a'bc$

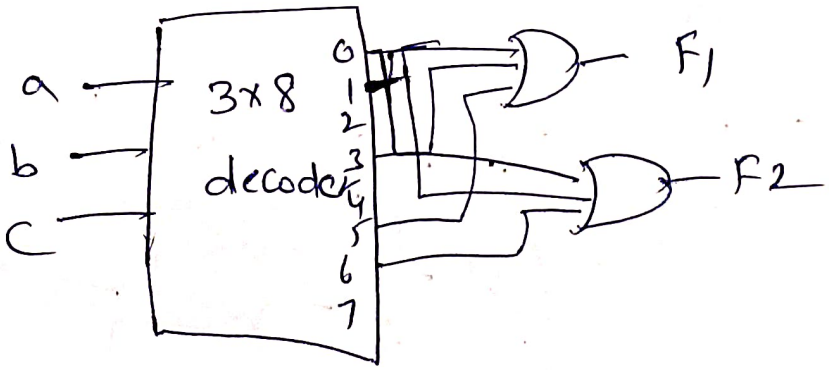
(ii) $T = f(a, b, c) = (a+b)(b'+c)$

$= (a+b+cc')(aa'+b'+c)$

$= (a+b+c)(a+b+c')(a+b'+c)$

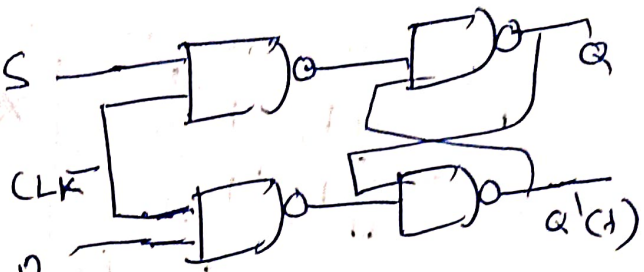
$(a'+b'+c)$

6 (a)

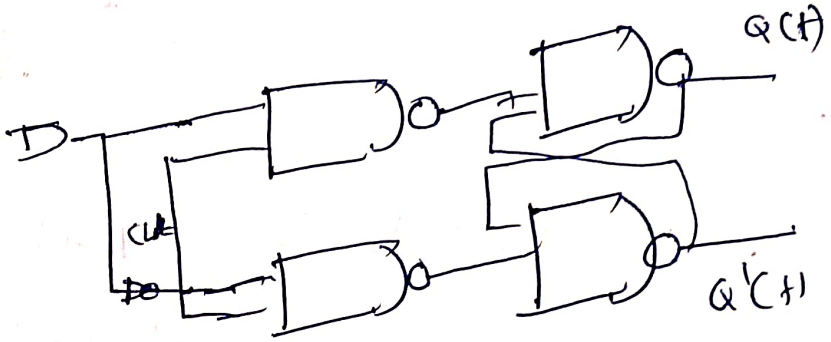


(6) b)

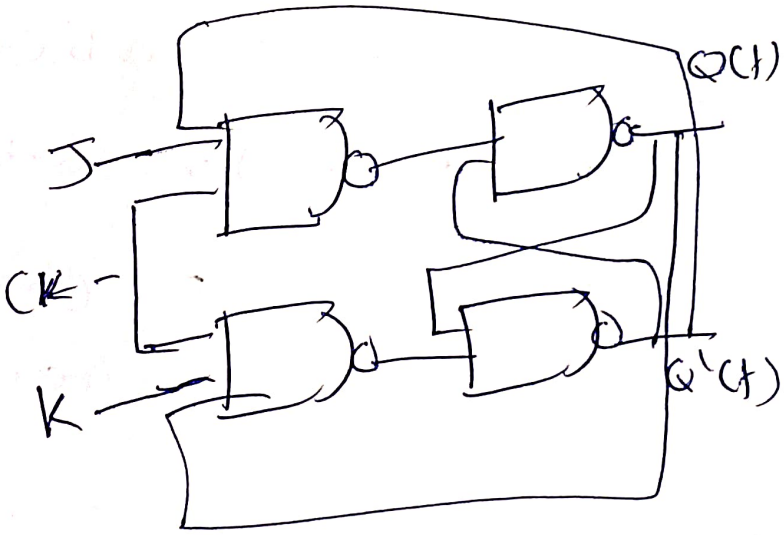
S	R	Q(t+1)
0	0	No change
0	1	0
1	0	1
1	1	Indeterminate



D	Q(t+1)
0	0
1	1



J	K	Q(t+1)
0	0	Q(t)
0	1	0
1	0	1
1	1	Q'(t)



T	Q(t+1)
0	Q(t)
1	Q'(t)