NAME: PRERNA SUNIL JADHAV
SAP ID: 60004220127
BRANCH: COMPUTER ENGINEERING

COURSE CODE: DJ19CEC305
COURSE: DIGITAL ELECTRONICS

ASSIGNMENT

Q1 Convert and present $(45)_{10}$ in Hexadecimal, Binary and Octal system.

Soln:

To convert $(45)_{10}$ to Binary divide 45 by 2 as Binary has base 2 ~~unit~~ ~~util~~ until quotient is 0.

	Quotient	Remainder
$\frac{45}{2}$	22	1
$\frac{22}{2}$	11	0
$\frac{11}{2}$	5	1
$\frac{5}{2}$	2	1
$\frac{2}{2}$	1	0
$\frac{1}{2}$	0	1

$\therefore (45)_{10} = (101101)_2$

To convert into octal,

$(45)_{10} = (101101)_2 = (55)_8$

$5 \quad 5$

To convert into Hexadecimal,

$(45)_{10} = (101101)_2 = (2D)_{16}$

$2 \quad D$

Q2

a) Perform the following operation using 2's complement

$(76)_8 - (22)_{16}$

Soln:

Converting $(76)_8$ and $(22)_{16}$ into Decimal

$(76)_8 = 7 \times 8^1 + 6 \times 8^0$

$= 56 + 6 = (62)_{10}$

$(22)_{16} = 2 \times 16^1 + 2 \times 16^0$

$= 32 + 2 = (34)_{10}$

Converting Decimal to Binary

	Quotient	Remainder
$\frac{62}{2}$	31	0
$\frac{31}{2}$	15	1
$\frac{15}{2}$	7	1
$\frac{7}{2}$	3	1
$\frac{3}{2}$	1	1
$\frac{1}{2}$	0	1

	Quotient	Remainder
$\frac{34}{2}$	17	0
$\frac{17}{2}$	8	1
$\frac{8}{2}$	4	0
$\frac{4}{2}$	2	0
$\frac{2}{2}$	1	0
$\frac{1}{2}$	0	1

$\therefore (62)_{10} = (111110)_2$

$\therefore (34)_{10} = (100010)_2$

Now,

Performing 2's complement of $(100010)_2$

1's complement → 011101

$+ \quad 1$

2's complement → 011110

Now, Performing subtraction using 2's complement

$\therefore (76)_8 \rightarrow (62)_{10} \rightarrow 111110$

$\therefore (22)_{16} \rightarrow (34)_{10} \rightarrow$ 2's comp → $(+)\,011110$

carry → 1 011100

Here, carry generated is 1, which indicates that the answer is positive and need to ignore it.

$\therefore (11100)_2 = (28)_{10}$

$\therefore (76)_8 - (22)_{16} = (28)_{10} = (11100)_2$

Q3

a) Use boolean laws to minimize and then implement using basic gates.

$Y = AB + BC + ABC + ABB$

Soln:

$Y = AB + BC + ABC + ABB$

$Y = AB + BC + ABC + AB$ ... $[\because A \cdot A = A]$

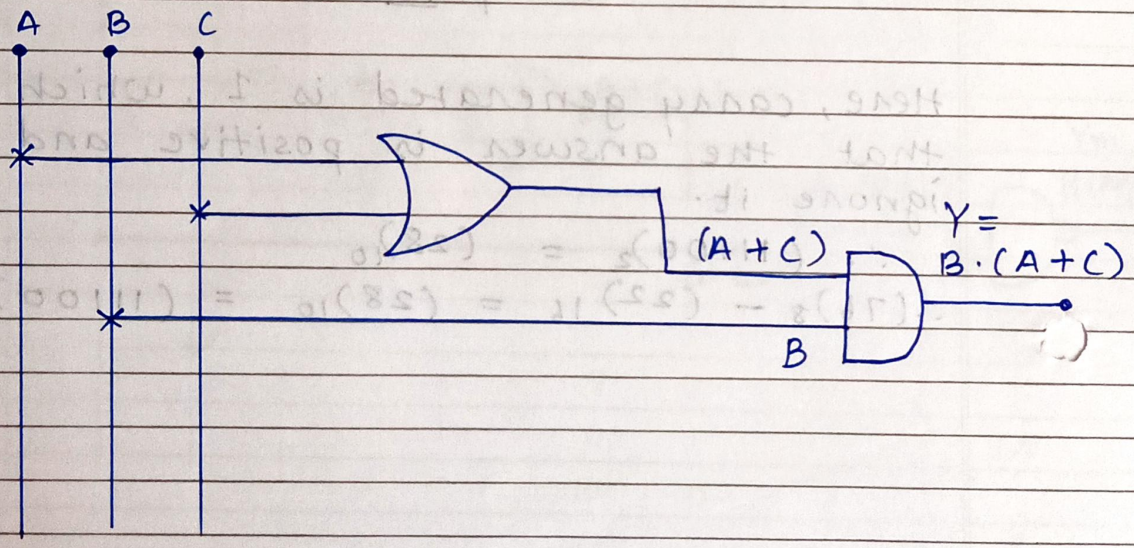
$Y = AB + BC + ABC$ ... $[\because A + A = A]$

$Y = AB + BC(1 + A)$

$Y = AB + BC$ ... $[\because 1 + A = 1]$

$Y = B(A + C)$

Implementation using basic gates.



Q4

a)

1. Minimize and implement following SOP using universal gates

$Y = AB + BC + ABC + ABB$

Soln: $Y = AB + BC + ABC + ABB$

$Y = AB + BC + ABC + AB$ ... $[\because A.A = A]$

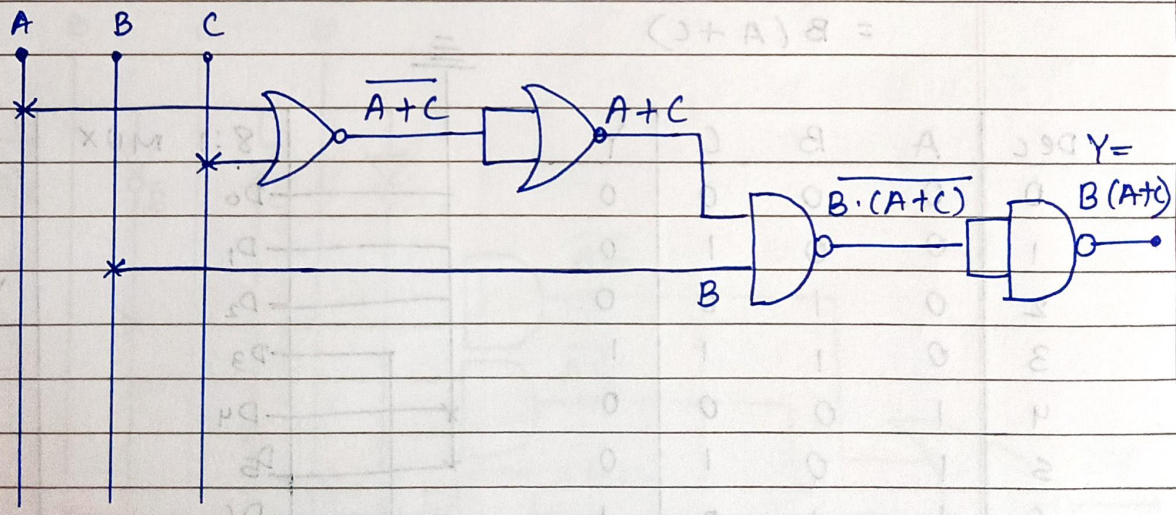
$Y = AB + BC + ABC$ ... $[\because A + A = A]$

$Y = AB + BC(1 + A)$

$Y = AB + BC$ ... $[\because 1 + A = 1]$

$Y = B(A + C)$

Implementation using universal gates.



Q4)

a)

2. Minimize and implement following SOP using Multiplexer

$Y = AB + BC + ABC + ABB$

Soln

$Y = AB + BC + ABC + ABB$

$Y = AB + BC + ABC + AB$ .... $[\because A \cdot A = A]$

$Y = AB + BC + ABC$ .... $[\because A + A = A]$

$Y = AB + BC(1 + A)$

$Y = AB + BC$ .... $[\because 1 + A = 1]$

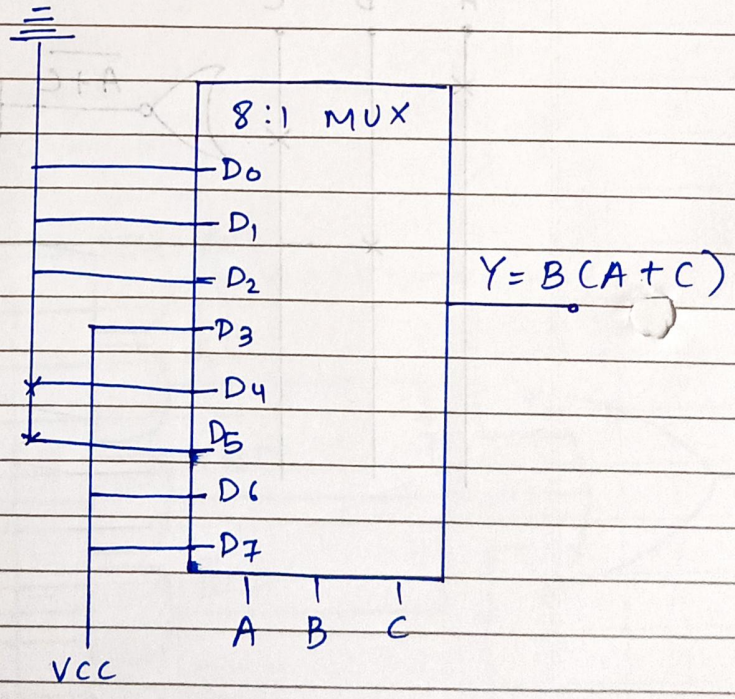
$Y = B(A + C)$

Implementation using multiplexer

$Y = AB + BC + ABC + ABB$

$= B(A + C)$

Dec	A	B	C	Y
0	0	0	0	0
1	0	0	1	0
2	0	1	0	0
3	0	1	1	1
4	1	0	0	0
5	1	0	1	0
6	1	1	0	1
7	1	1	1	1



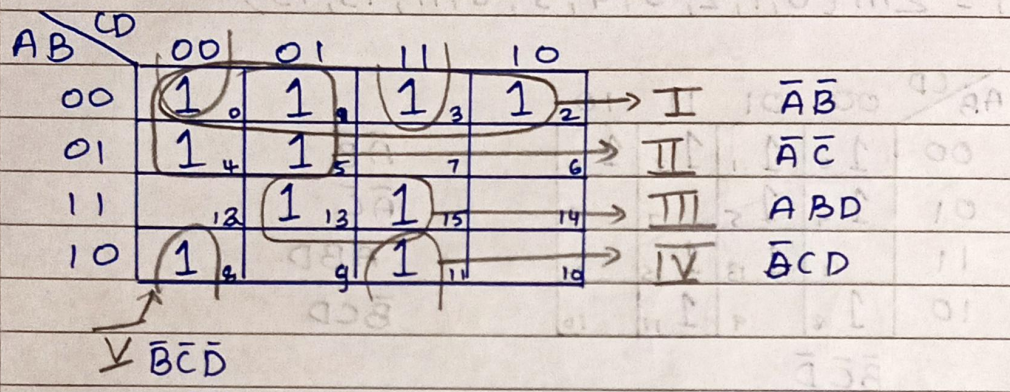
Q5

a)

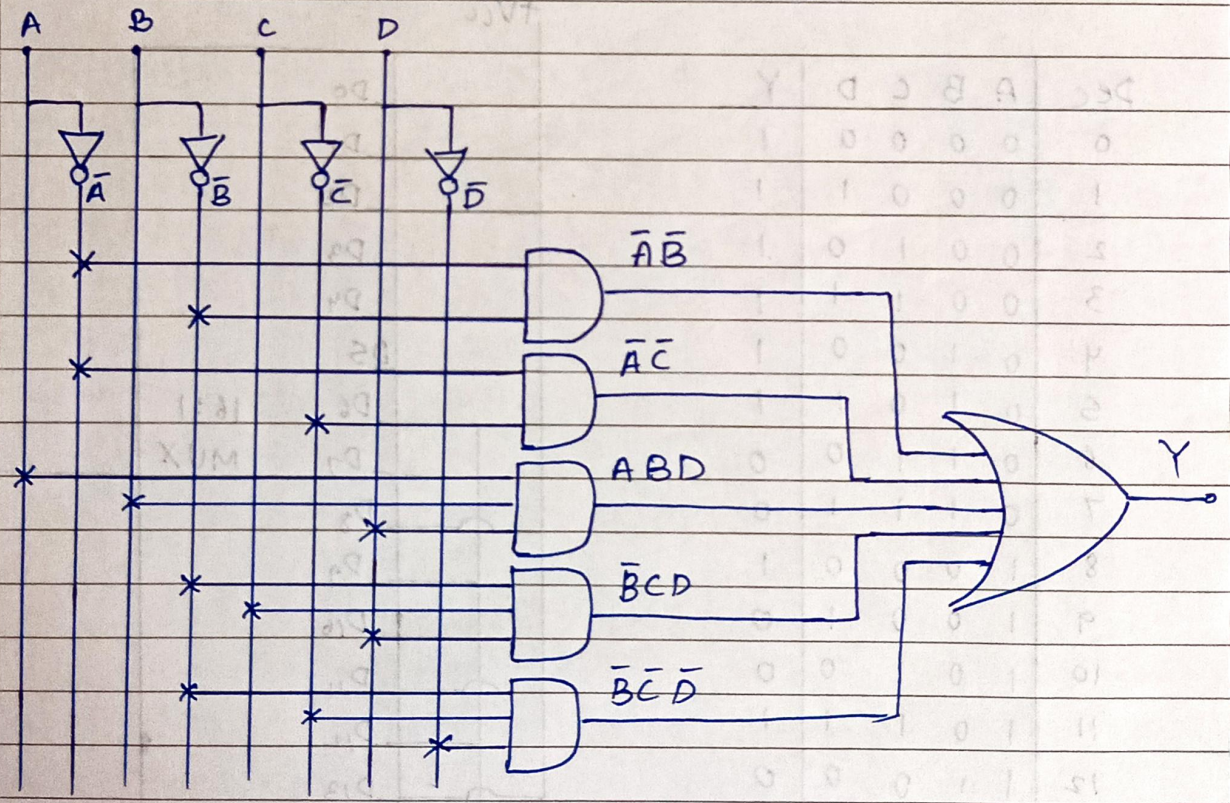
1) Simplify using K Map and Implement using basic Gates.

$Y = \Sigma m\,(0,1,2,3,4,5,8,11,13,15)$

Soln:



$\therefore Y = \bar{A}\bar{B} + \bar{A}\bar{C} + ABD + \bar{B}CD + \bar{B}\bar{C}\bar{D}$



Q5

a)

2. Simplify using K-map and implement using multiplexer (use either single 16:1 or use 2 units of 8:1)

$Y = \Sigma m(0,1,2,3,4,5,8,11,13,15)$

Soln:

AB \ CD	00	01	11	10	
00	1 (0)	1 (1)	1 (3)	1 (2)	→ I $\bar{A}\bar{B}$
01	1 (4)	1 (5)	(7)	(6)	→ II $\bar{A}\bar{C}$
11	(12)	1 (13)	1 (15)	(14)	→ III ABD
10	1 (8)	(9)	1 (11)	(10)	→ IV $\bar{B}CD$

↓ V $\bar{B}\bar{C}\bar{D}$

$\therefore Y = \bar{A}\bar{B} + \bar{A}\bar{C} + ABD + \bar{B}CD + \bar{B}\bar{C}\bar{D}$

Dec	A	B	C	D	Y
0	0	0	0	0	1
1	0	0	0	1	1
2	0	0	1	0	1
3	0	0	1	1	1
4	0	1	0	0	1
5	0	1	0	1	1
6	0	1	1	0	0
7	0	1	1	1	0
8	1	0	0	0	1
9	1	0	0	1	0
10	1	0	1	0	0
11	1	0	1	1	1
12	1	1	0	0	0
13	1	1	0	1	1
14	1	1	1	0	0
15	1	1	1	1	1