

DLD

PAST PAPERS (2019 AND 2017)

(2019)

Short Questions

a- Convert 2455.30 from decimal to octal number system.

$$0.30 \times 8 = 2.4$$

$$0.4 \times 8 = 3.2$$

$$0.2 \times 8 = 1.6$$

8	2455
8	306 - 7
8	38 - 2
	4 - 6

$(4627.231)_8$

2. Perform $M-N$ using $r-1$'s complement where $M=1100$ and $N=1001$ are in binary number system.

$r-1$'s complement is $(1's, 5's, 7's, 9's)$ etc.

$$M = 1100 \text{ (C=12)} \quad N = 1001 \text{ (9)}$$

$M-N$

$$+ 1100$$

$$- 1001$$

$$\underline{0 \ 1100}$$

$$\underline{1 \ 1001}$$

Take the 1's complement of 1001

$$\underline{1111}$$

$$\underline{1001}$$

$$\underline{0110}$$

② ①

$$\underline{01100}$$

$$\underline{10110}$$

$$100010$$

$$+ 1$$

$$\underline{00011} \rightarrow +3$$

3. Perform the BCD addition on 259 + 378.

Write the binary form of 259 and 378

①	①	
0010	0101	1001
<u>0011</u>	<u>0111</u>	<u>1000</u>
0110	1101	10001
<u> </u>	<u>0110</u>	<u>0110</u>
0110	1)0011	1)0111
	↓ carry	↓ carry
6	3	7

$$\begin{array}{r} \textcircled{1} 259 \\ \textcircled{2} 378 \\ \hline 637 \end{array}$$

1- If sum is greater than 9 (1001) then add (6 = 0110) in the sum as added in 2nd step.

2- Generated carry is added on the next value added in 1st step.

From CH#1 (BCD addition)
Book Morris Mano

4- Draw the truth table for the following
 $F(A,B,C) = (\bar{A} + \bar{B}) (\bar{A} + \bar{B} + \bar{C}) (B + C)$

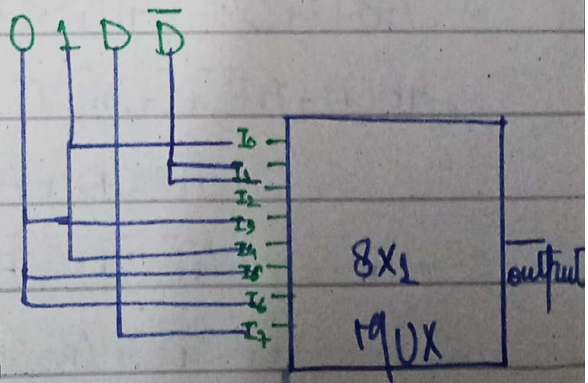
A	B	C	\bar{A}	\bar{B}	\bar{C}	$\bar{A} + \bar{B}$	$\bar{A} + \bar{B} + \bar{C}$	$B + C$	$(\bar{A} + \bar{B}) \bar{A} \bar{B} \bar{C} (B + C)$
0	0	0	1	1	1	1	1	0	0
0	0	1	1	1	0	1	1	1	1
0	1	0	1	0	1	1	1	1	1
0	1	1	1	0	0	1	1	1	1
1	0	0	0	1	1	1	1	0	0
1	0	1	0	1	0	1	1	1	1
1	1	0	0	0	1	0	1	1	0
1	1	1	0	0	0	0	0	1	0

5- To implement $F(A,B,C,D) = \Sigma(0,1,2,4,8,9,10)$ using multiplexer with three variables A, B, C as select lines. What size of MUX is required? What size of decoder is required to implement the same function?

select lines

A	B	C	D	Y
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

	I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7	
0	\bar{D}	0	2	4	6	8	10	12	14
1	D	1	3	5	7	9	11	13	15
	1	\bar{D}	\bar{D}	0	1	0	0	D	



LONG QUESTIONS

a) Simplify the following function using K-MAP in POS form.

$$F = \bar{B}D + \bar{B}C + ABCD$$

$$d = \bar{A}BD + A\bar{B}\bar{C}\bar{D}$$

$$F = \bar{B}D + \bar{B}C + ABCD$$

$$= 0 + \bar{B}D + 0 + \bar{B}C + ABCD$$

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

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

$$= A\bar{B}D + 0 + \bar{A}\bar{B}D + 0 + A\bar{B}C + 0 + \bar{A}\bar{B}C + 0 + ABCD$$

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

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

$$\bar{A}\bar{B}CD + \bar{A}\bar{B}\bar{C}\bar{D} + ABCD$$

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

$$\bar{A}\bar{B}C\bar{D} + ABCD$$

$$= 0100 + 0110 + 1100 + 1110 + 0101 + 1101 + 0000$$

$$4 \quad 6 \quad 12 \quad 14 \quad 5 \quad 13 \quad 0$$

$$\begin{aligned}
 d &= \bar{A}BD + A\bar{B}\bar{C}\bar{D} \\
 &= \bar{A}BD + 0 + A\bar{B}\bar{C}\bar{D} \\
 &= \bar{A}BD + C\cdot\bar{C} + A\bar{B}\bar{C}\bar{D} \\
 &= \bar{A}BCD + \bar{A}\bar{B}\bar{C}\bar{D} + A\bar{B}\bar{C}\bar{D} \\
 &= 1000 + 1010 + 0100 + 0111 \\
 &\quad \quad \quad 8 \quad \quad \quad 10 \quad \quad \quad 7
 \end{aligned}$$

K-MAP

$$F = \pi(4, 6, 12, 14, 5, 13, 0)$$

$$d = \pi(8, 10, 7)$$

	CD			
	00	01	11	10
AB				
00	0	1	3	2
01	4	5	7	6
11	12	13	15	14
10	8	9	11	10

Four groups are form-

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

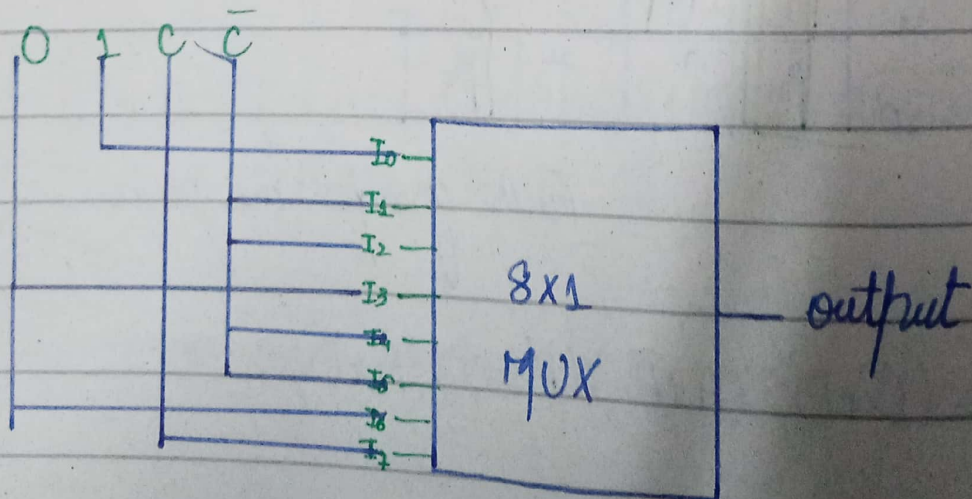
b) Implement the following function using multiplexer. Keep three variable A, B and D as select lines to the MUX.

$$F(A, B, C, D) = \Sigma(0, 1, 2, 4, 8, 9, 15)$$

Truth Table is similar to the short question (b)

But in question, ^{now} select lines are A, B and D is the required solution.

		I_0	I_1	I_2	I_3	I_4	I_5	I_6	I_7
0	\bar{C}	0	1	4	5	8	9	12	13
1	C	2	3	6	7	10	11	14	15
		1	\bar{C}	\bar{C}	0	\bar{C}	\bar{C}	0	C



(2017)

Short Questions

a) Perform $M \div N$ using $r-1$'s complement when $M = 8630$ and $N = 630$ are in decimal number system?

In decimal number system $r-1's \Rightarrow 9's$
So,

8630

630

equal the magnitude of 630 by putting 0 on MSB and then take 9's complement of 630.

8630

0630

↓
8630

9369

1) 7 9 9 9

→ + 1

8000

9999

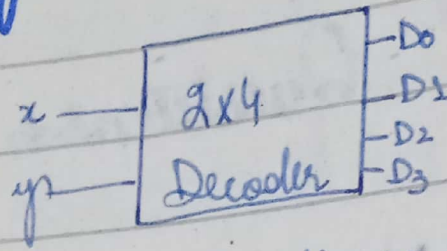
0630

9369

10 | 17
1-7

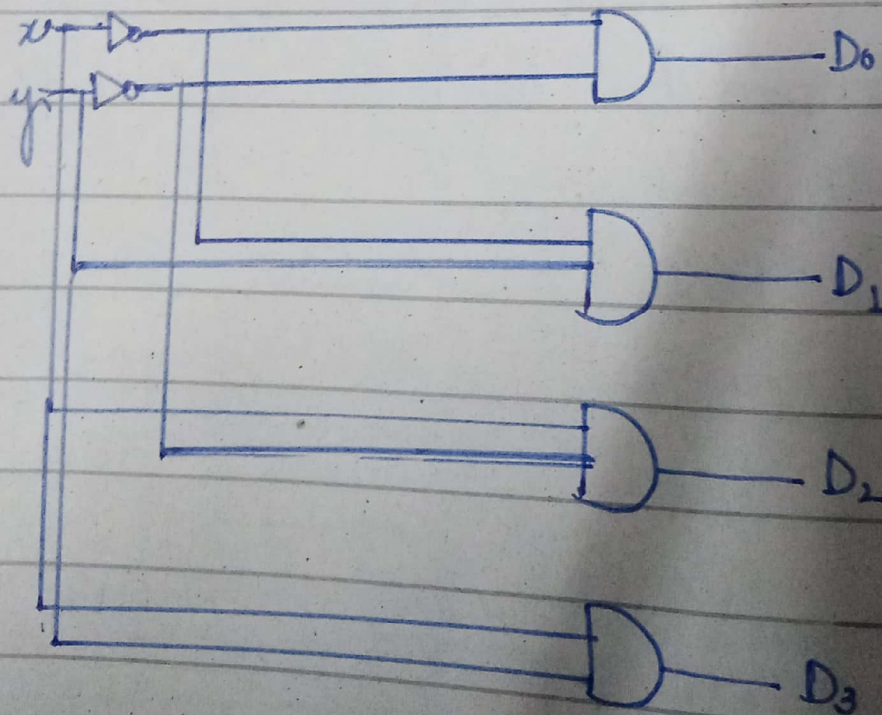
Required solution is 8000.

b) Design 2x4 Decoder -



Block diagram.

x	y	D ₀	D ₁	D ₂	D ₃
0	0	1	0	0	0
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1



c, Reduce the given function using K-MAP and write down in SOP form
 $F(A,B,C) = C\bar{A} + B\bar{C} + \bar{B}\bar{A} + AB$

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

$$= C\bar{A} \cdot 1 + B\bar{C} \cdot 1 + \bar{B}\bar{A} \cdot 1 + AB \cdot 1$$

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

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

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

$$= 011 + 001 + 110 + 010 + 000 + 111$$

$$\begin{matrix} 3 & 1 & 6 & 2 & 0 & 7 \end{matrix}$$

$$F = \Sigma (3, 1, 6, 2, 0, 7)$$

BC	00	01	11	10
A				
0	1 0	1 1	1 3	1 2
1	1 4	1 5	1 7	1 6

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

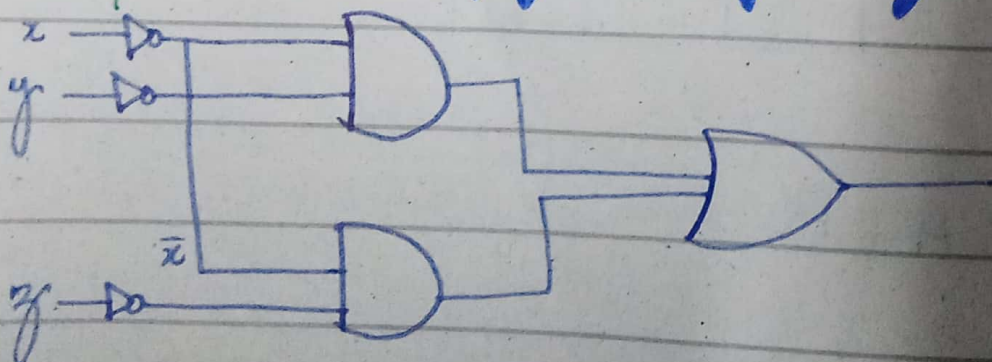
d) Draw the truth table of Full-adder circuit.

A	B	Cin	S	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

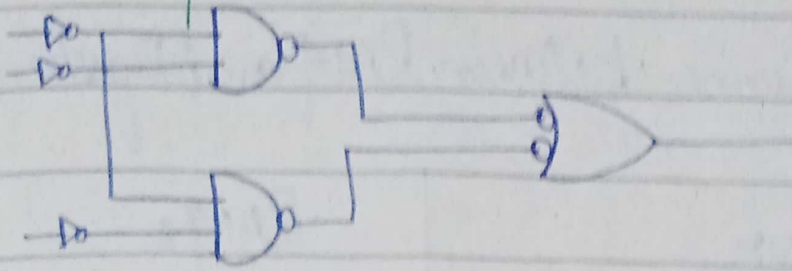
e) Draw a circuit for given function using NAND gate only.

$$F(x, y, z) = \bar{x}\bar{y} + \bar{x}\bar{z}$$

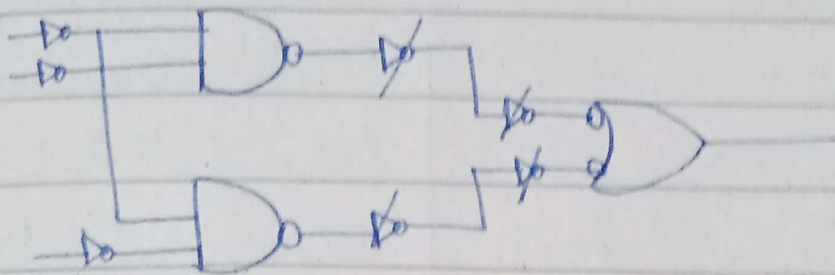
Step-I



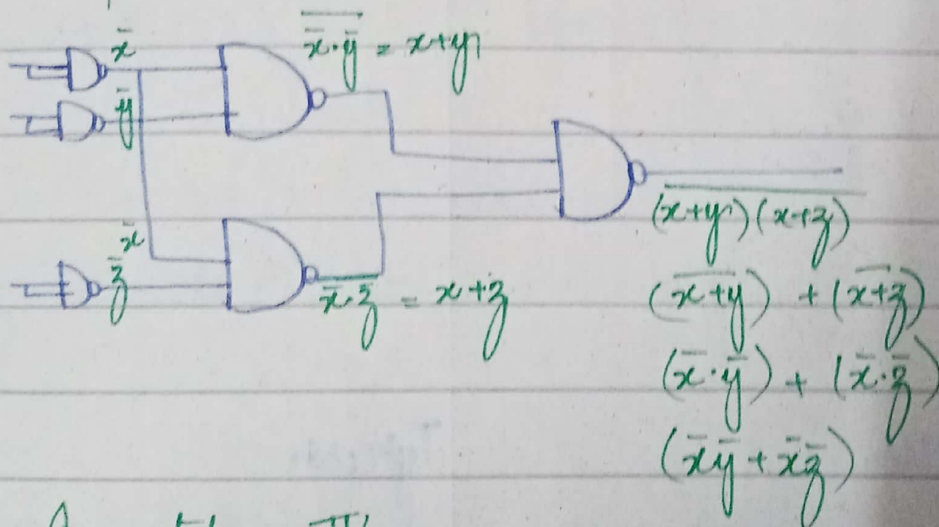
Step - II



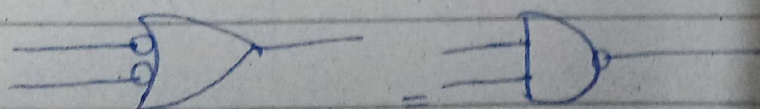
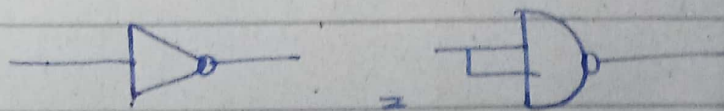
Step - III



Step - IV



In step - IV



f) Difference between RAM and Register?

Register

Register is the temporary memory location inside the CPU, where we can store data easily during the execution of the program.

Register holds the small amount of data.

Registers are faster than RAM.

Types

Accumulator reg., address reg. etc

RAM

RAM is a volatile memory that temporarily stores the files and data last only till the time the power supply is on.

RAM stores data about in GB.

RAM is slower than registers.

Types

S-RAM, D-RAM

q) Give the excitation table for D flip flop.

D	Q	Q _{next}
0	X	0
1	X	1

D	Q	Q _{next}
0	0	0
0	1	0
1	0	1
1	1	1

Characteristic table

Q	Q _{next}	D
0	0	0
0	1	1
1	0	0
1	1	1

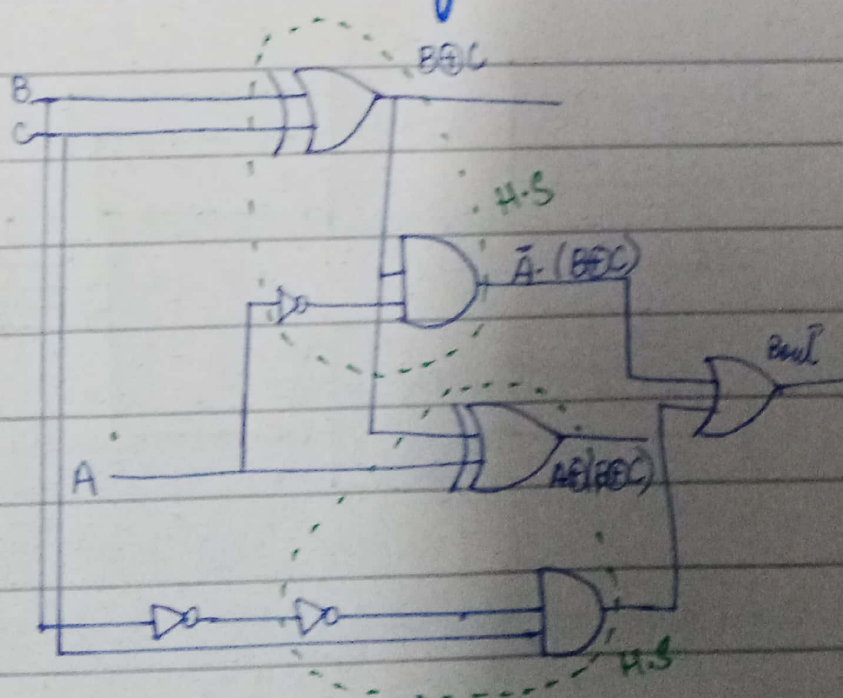
Excitation table

LONG QUESTIONS

a) Implement a full subtractor circuit with two half subtractor and an OR gate.

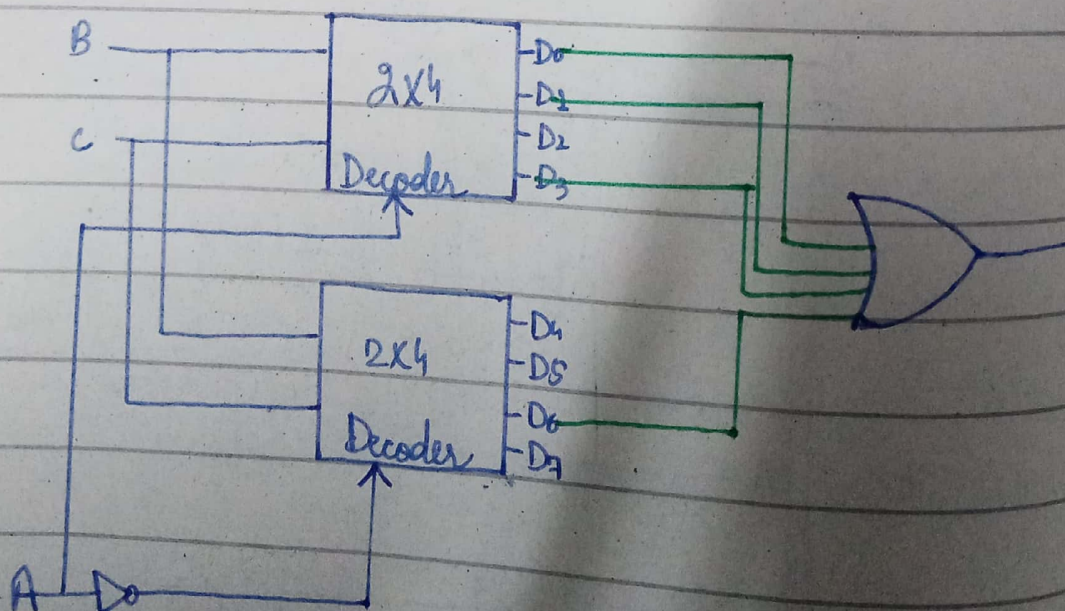
$$D = A \oplus (B \oplus C)$$

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



b, Implement $F(A,B,C) = \Sigma(0,2,3,5,6)$ using two 2×4 decoders.

A	B	C	
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0



c) Draw Full adder circuit -

A	B	Cin	S	Cont
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

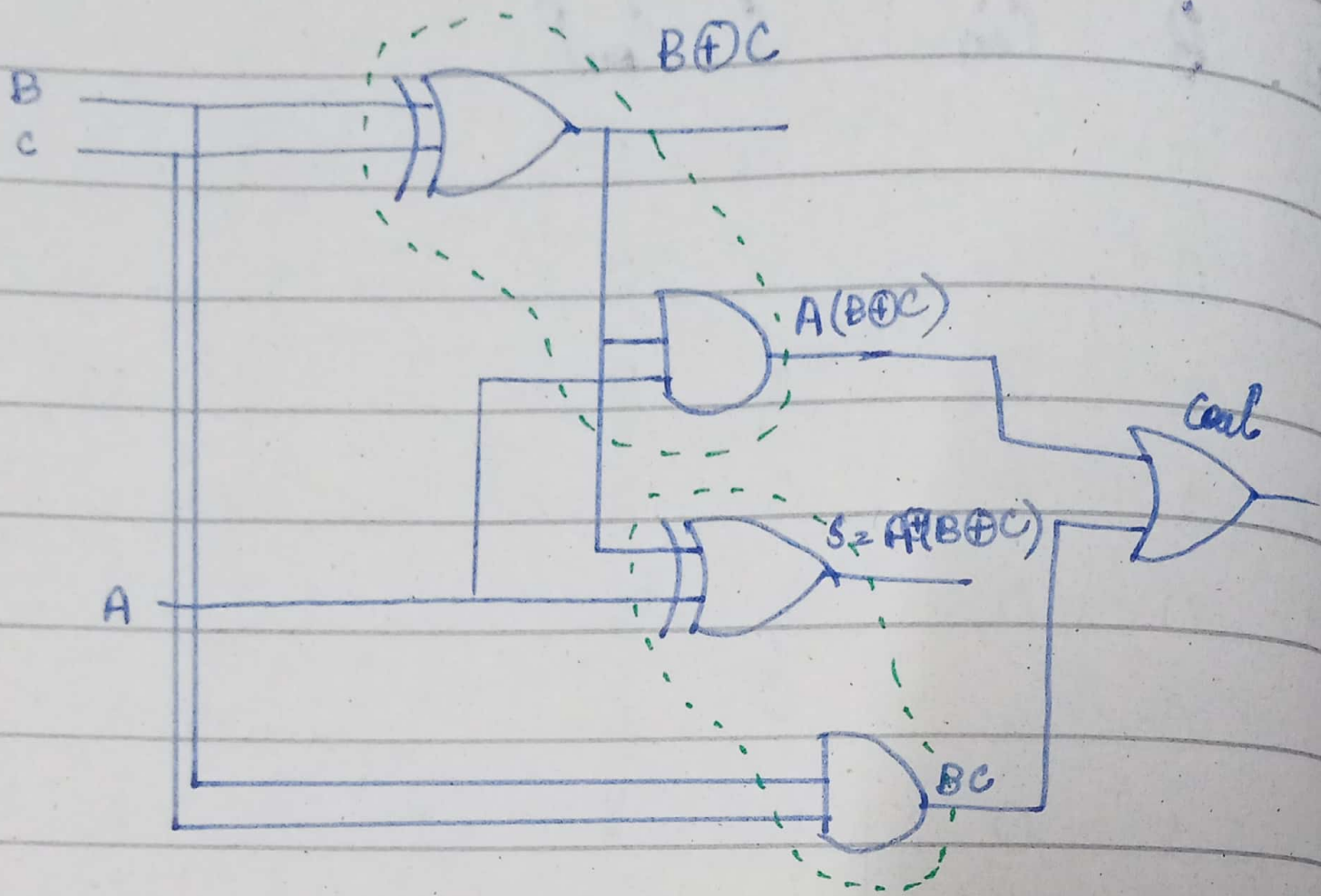
$$\begin{aligned}
 S &= \bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B}\bar{C} + ABC \\
 &= \bar{A}(\bar{B}C + B\bar{C}) + A(\bar{B}\bar{C} + BC) \\
 &= \bar{A}(B \oplus C) + A(B \odot C) \\
 &= \bar{A}(B \oplus C) + A(\overline{B \oplus C}) \\
 &= A \oplus (B \oplus C)
 \end{aligned}$$

(\odot Exclusive NOR)

$$\therefore B \odot C = \overline{B \oplus C}$$

(\oplus Exclusive OR)

$$\begin{aligned}
 \text{Cont} &= \bar{A}BC + A\bar{B}C + AB\bar{C} + ABC \\
 &= \bar{A}BC + ABC + A\bar{B}C + AB\bar{C} \\
 &= BC(\bar{A} + A) + A(\bar{B}C + B\bar{C}) \\
 &= BC + A(B \oplus C) \Rightarrow A(B \oplus C) + BC
 \end{aligned}$$



$$H \cdot A + H \cdot A = F \cdot A.$$

$$S_2 = A \oplus (B \oplus C)$$

$$\text{Carry} = A(B \oplus C) + BC$$

(*) Draw 8x3 encoder circuit

D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0	y_2	y_1	y_0
0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	1	0	0	0	1
0	0	0	0	0	1	0	0	0	1	0
0	0	0	0	1	0	0	0	0	1	1
0	0	0	1	0	0	0	0	1	0	0
0	0	1	0	0	0	0	0	1	0	1
0	1	0	0	0	0	0	0	1	1	0
1	0	0	0	0	0	0	0	1	1	1

$$y_1 = D_4 + D_5 + D_6 + D_7, \quad y_2 = D_2 + D_3 + D_6 + D_7, \quad y_0 = D_1 + D_3 + D_5 + D_7$$

