

⇒ Decoder :-

→ Decoder is a combinational ckt which have many i/ps and many o/ps

→ It is basically used to convert Binary data to

Other codes

→ Binary to octal

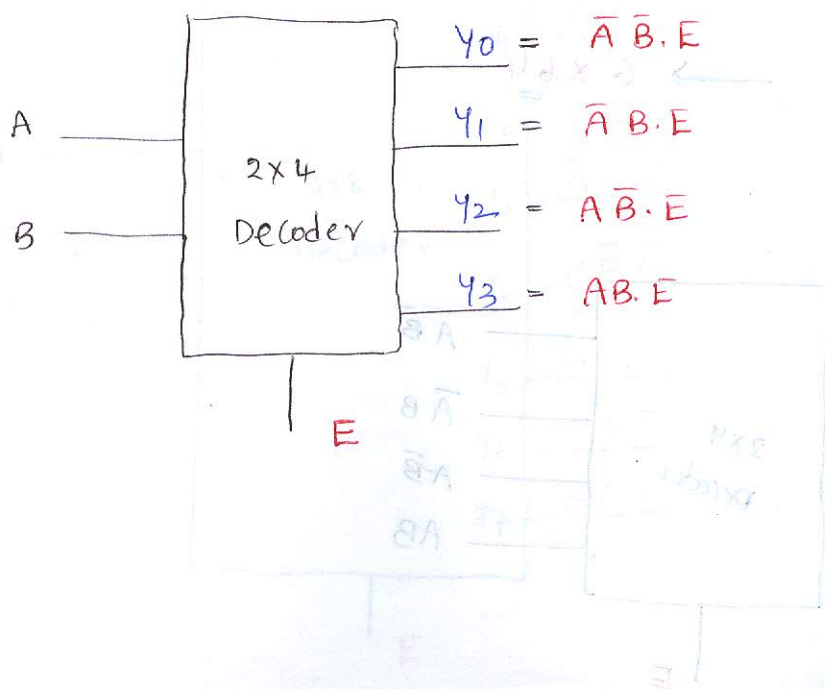
→ BCD to decimal

→ Binary to Hexadecimal.

→ Decoders can be also used to generate chip select signal in microprocessor based systems (address decoding purpose)

⇒ 2x4 Decoder :-

→



⇒ Truth Table:-

<u>E</u>	<u>A</u>	<u>B</u>	<u>Y₃</u>	<u>Y₂</u>	<u>Y₁</u>	<u>Y₀</u>
0	X	X	0	0	0	0
1	0	0	0	0	0	1
1	0	1	0	0	1	0
1	1	0	0	1	0	0
1	1	1	1	0	0	0

⇒ Note:-

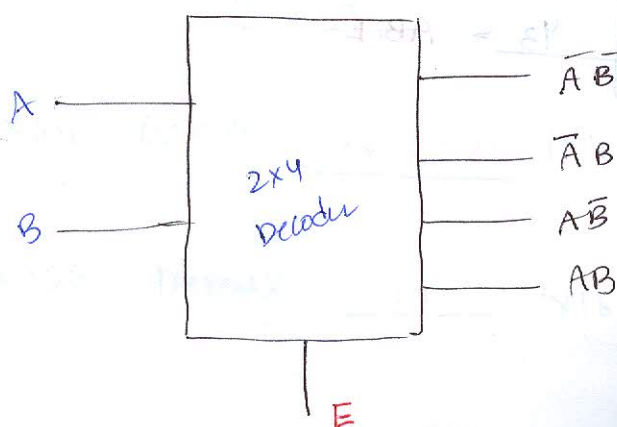
Decoder and De mux internal ckt remains
Same

1x4 → 2x4

1x8 → 3x8

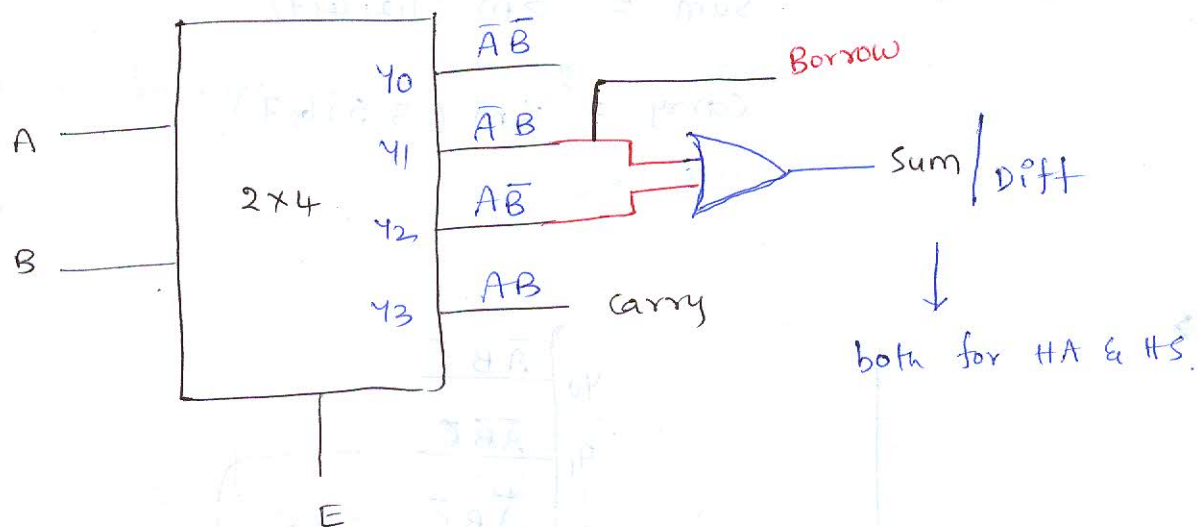
1x64 → 6x64

→



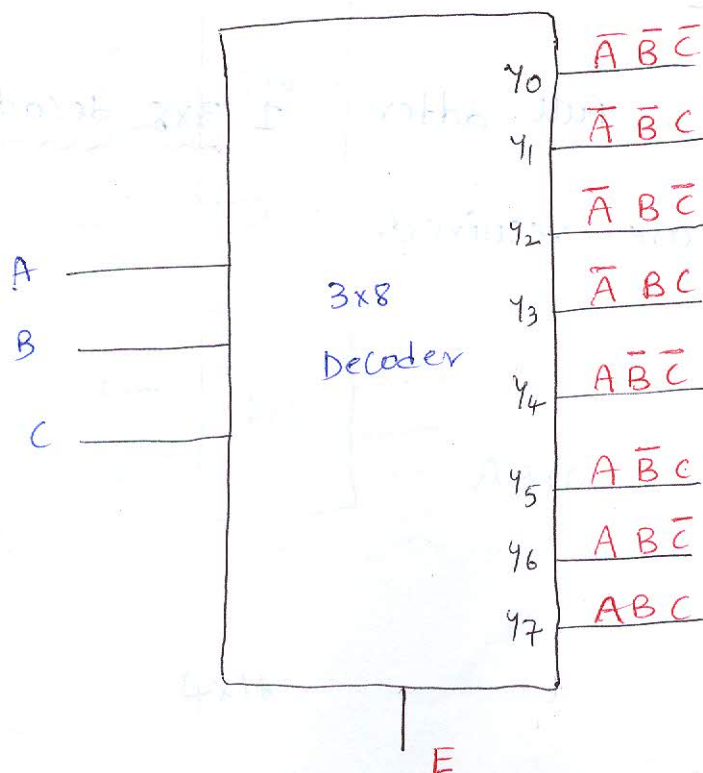
⇒ implementation of Half adder using 2x4 Decoder :-

→



→ To implement Half adder and Half Subtractor one 2x4 decoder and one OR gate is required.

⇒ 3x8 Decoder :-

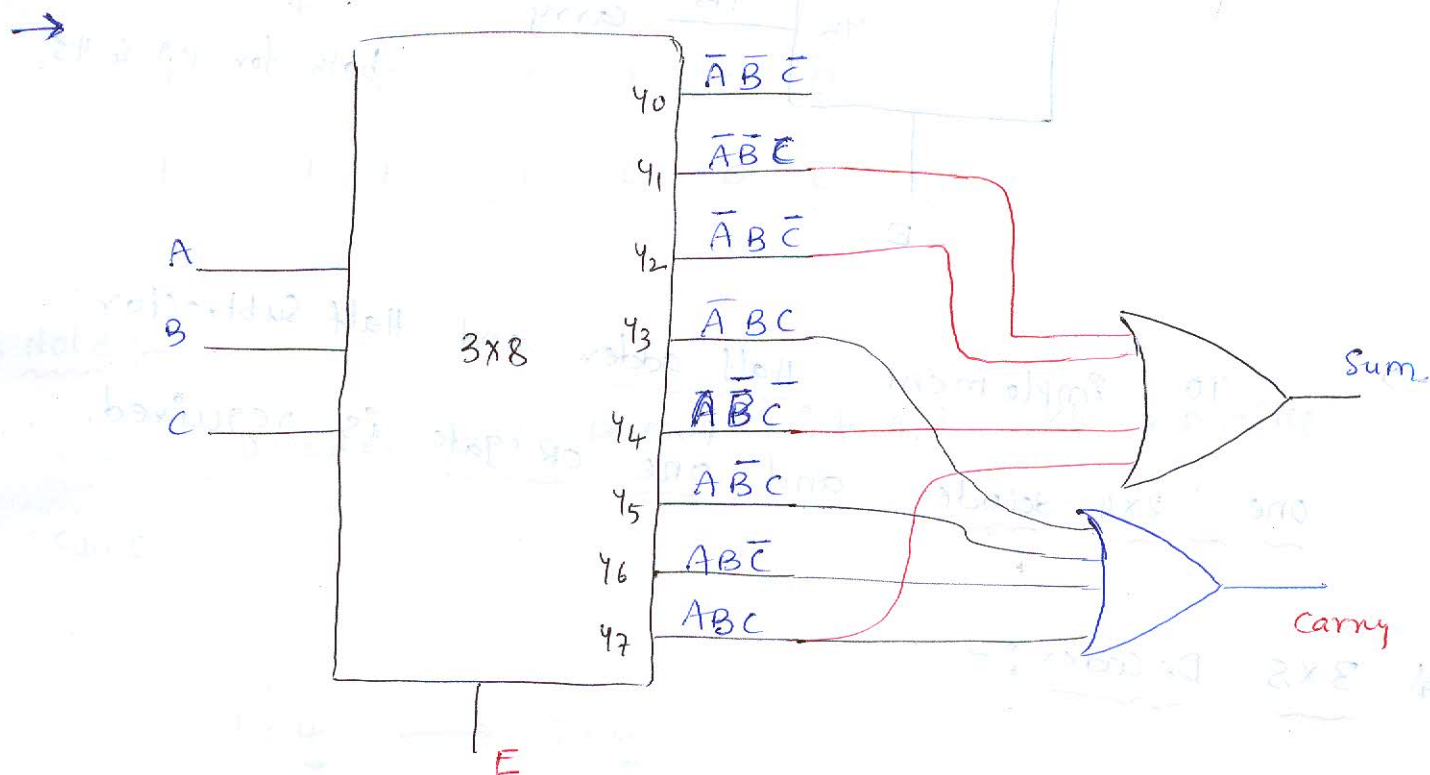


⇒ Implement Full adder using 3x8 Decoder :-

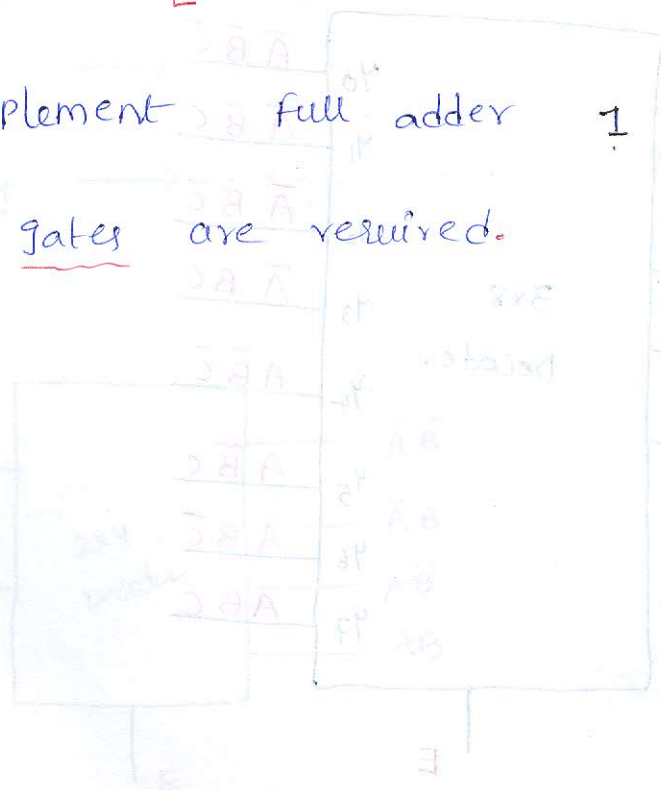
→ FA

$$\text{Sum} = \sum m(1, 2, 4, 7)$$

$$\text{Carry} = \sum m(3, 5, 6, 7)$$



→ To implement full adder 1 3x8 decoder and 2 OR gates are required.

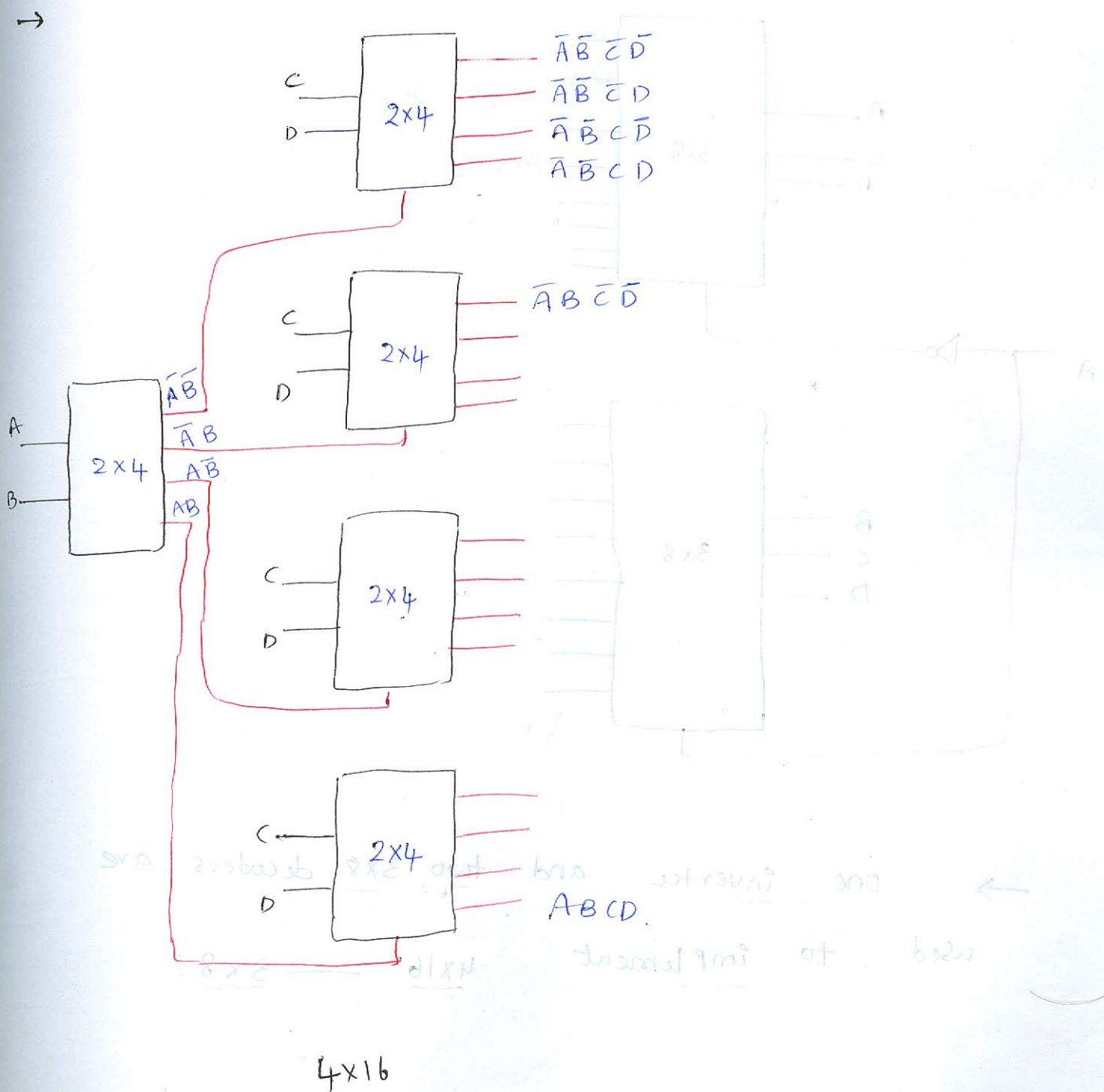


II. Higher order Decoders using Lower order :-

→ 4x16 Decoder 5 2x4 Decoder

1x16 Demux 5 2x4 Demux

16x1 mux 5 4x1 mux

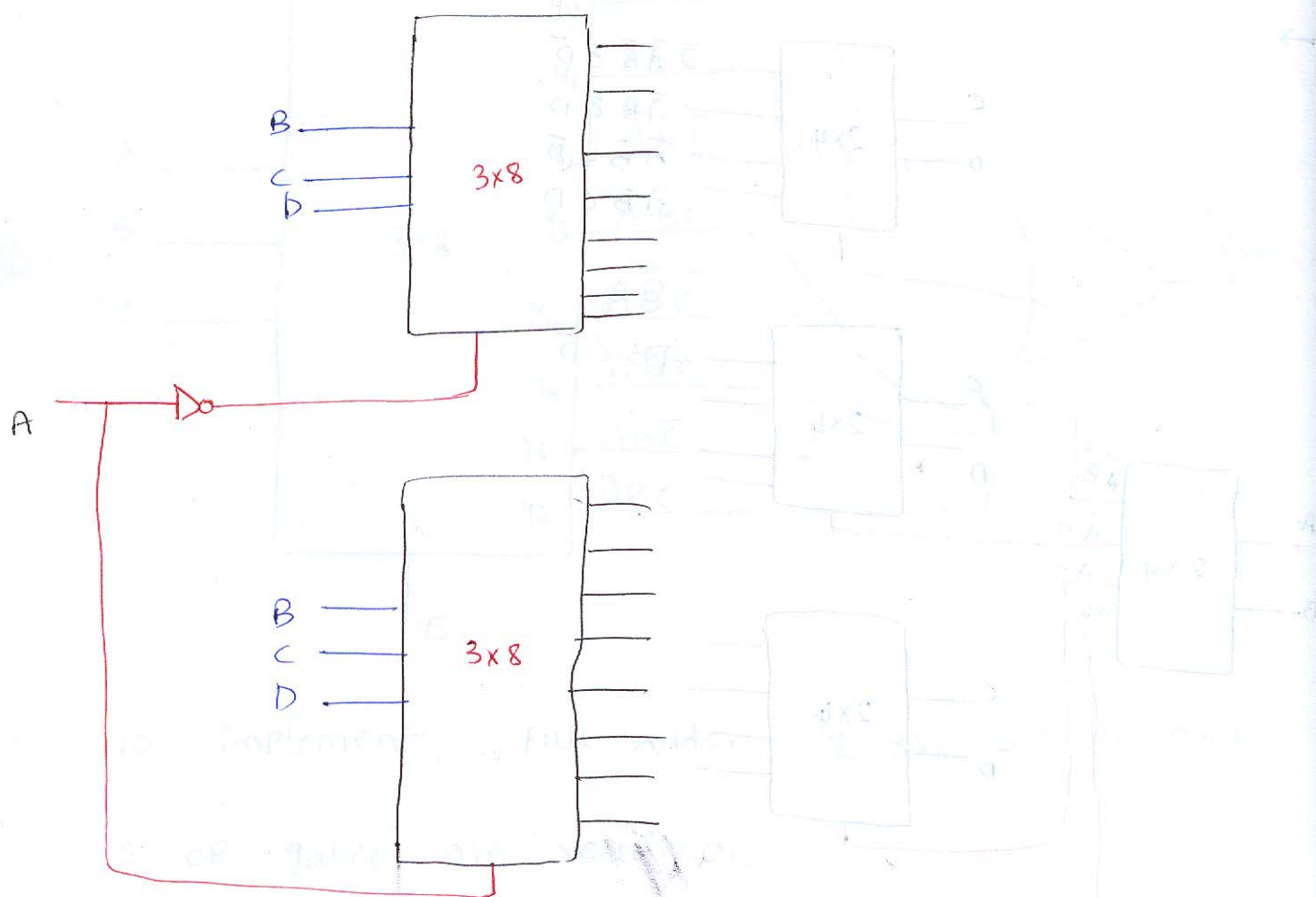


→ 6x4 Decoder 21 2x4 Decoder

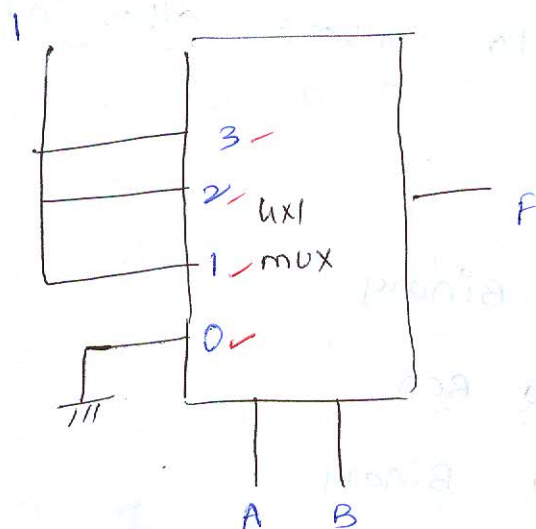
1x64 Demux 21 1x4 Demux

→ 6x4 Decoder 9 3x8 Decoder

→ 4x16 Decoder 2, invert. 3x8 decoder



→ one inverter and two 3x8 decoders are
used to implement 4x16 — 3x8



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

⇒ Encoder :-

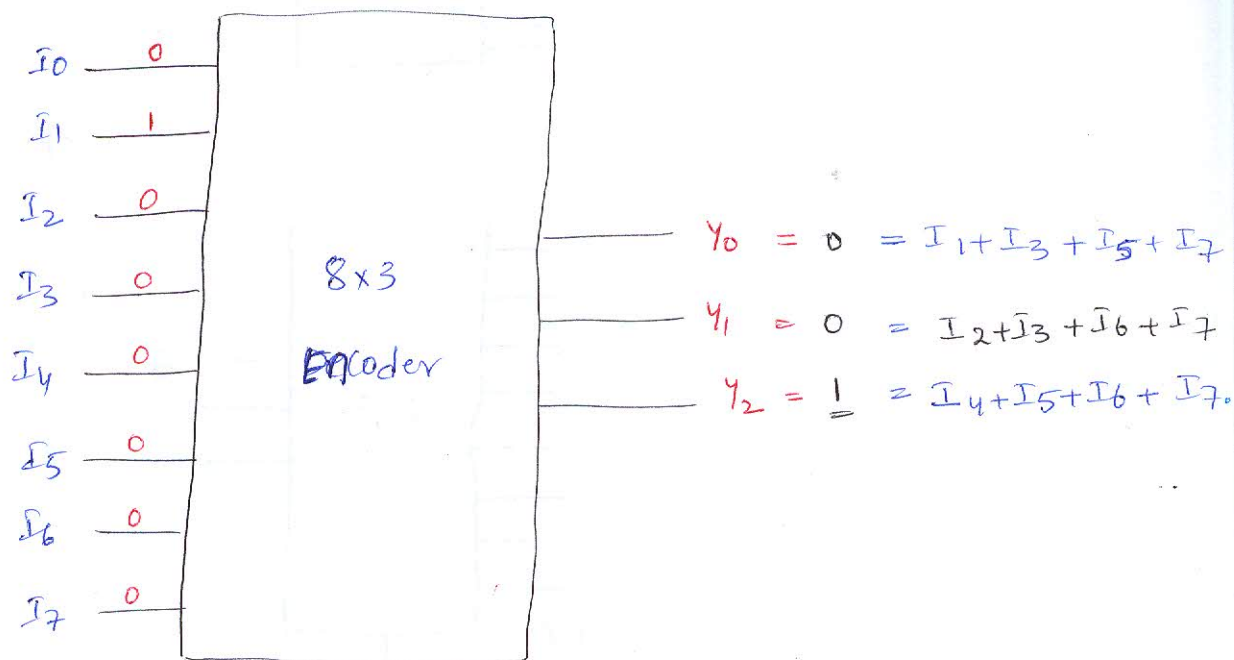
→ Encoder is used to convert other codes to binary such as

→ Octal to Binary

→ Decimal to BCD

→ Hex to Binary.

⇒ Octal to binary 8x3 Encoder :-



→ in normal Encoder one of input line is High and corresponding binary available at the o/p.

→

I_7 I_6 I_5 I_4 I_3 I_2 I_1 I_0 Y_2 Y_1 Y_0

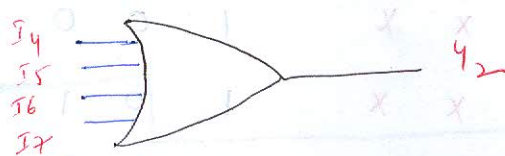
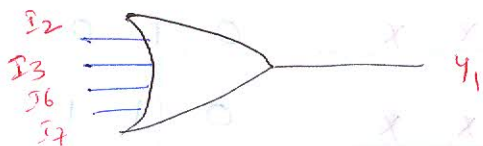
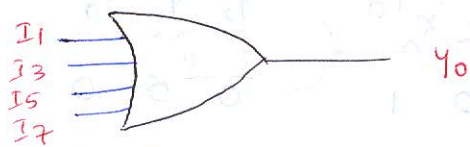
0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	<u>1</u>	0	0	0	①
0	0	0	0	0	1	0	0	0	1	0
0	0	0	0	<u>1</u>	0	0	0	0	1	①
0	0	0	1	0	0	0	0	1	0	0
0	0	<u>1</u>	0	0	0	0	0	1	0	①
0	1	0	0	0	0	0	0	1	1	0
<u>1</u>	0	0	0	0	0	0	0	1	1	①

$$\rightarrow Y_0 = I_1 + I_3 + I_5 + I_7$$

$$\rightarrow Y_1 = I_2 + I_3 + I_6 + I_7$$

$$\rightarrow Y_2 = I_4 + I_5 + I_6 + I_7$$

→



→ Encoder — OR

Decoder - AND

mux - And, or

Demux - AND

→ ROM is combinational ckt

↓

(Decoder, Encoder)
Combination

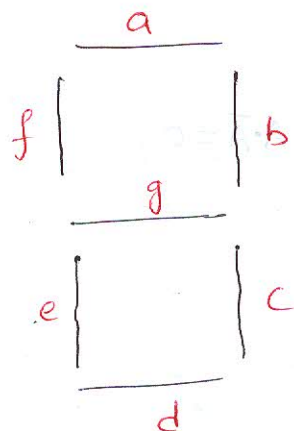
⇒ Priority Encoder :-

→ In Priority Encoder any No. of inputs can be high but depending on priority. Highest priority input corresponding binary is available at the o/p.

[illegible]

⇒ Seven Segment display :-

→



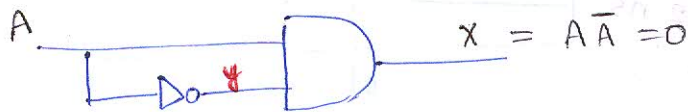
go through Theory book.

⇒ Hazards :-

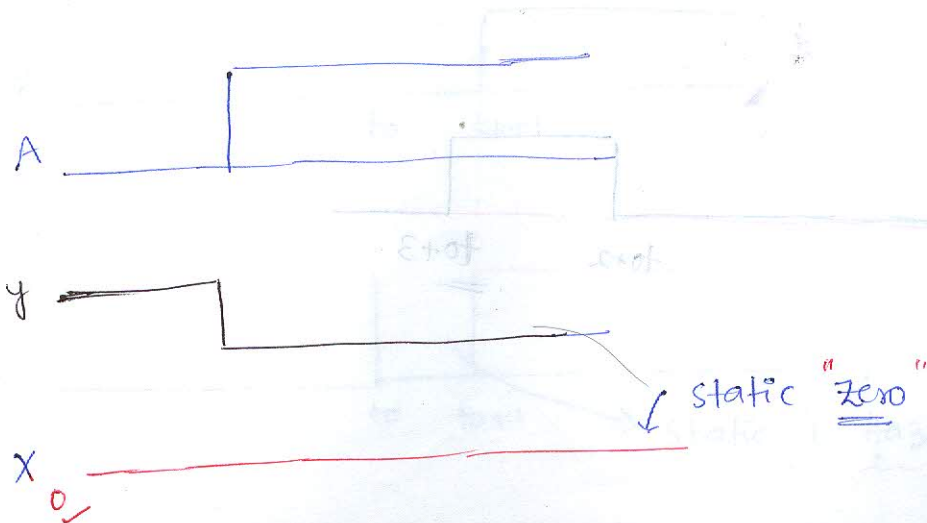
→ Hazards are unwanted change in olps due to

Propagation delay

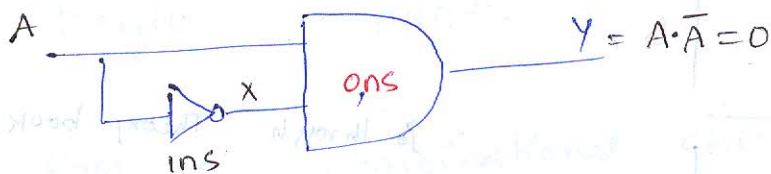
→ For the given ckt draw o/p waveform x when i/p A is shown in fig.



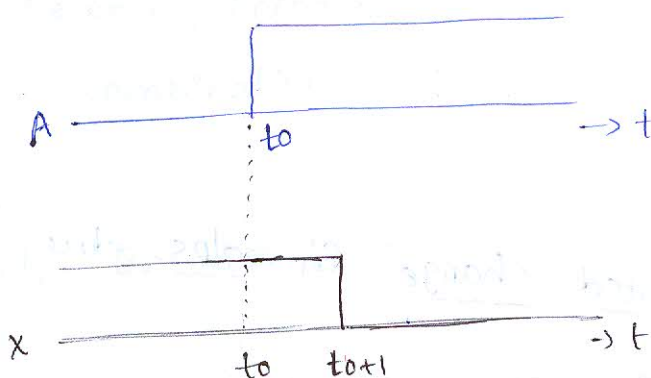
Sol:-



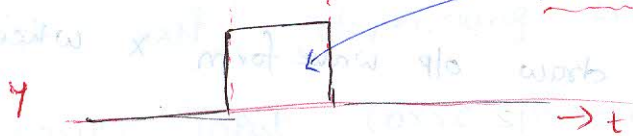
2) For the given ckt Not gate have Propagation delay of 1ns Nand gate delay is 0ns det o/p wave form for the given i/p



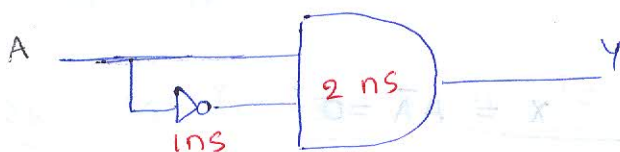
Sol:-



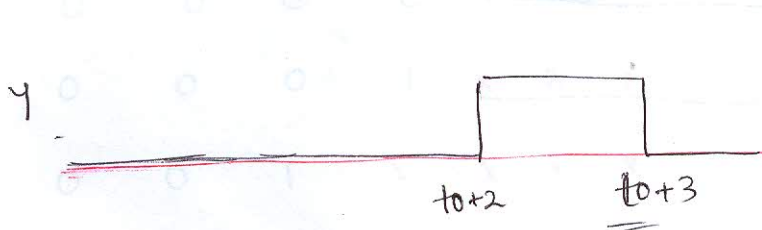
static '0' Hazard



3)



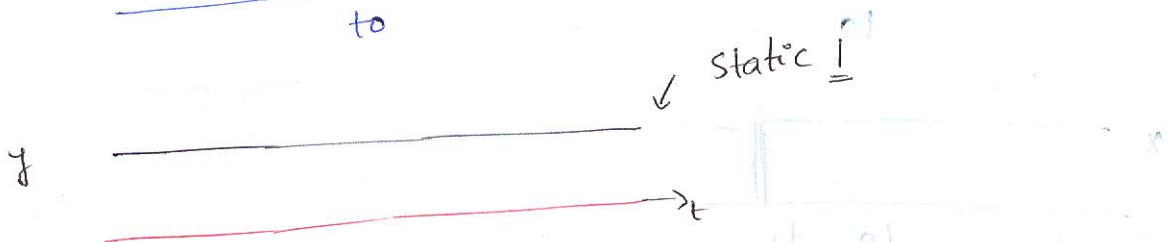
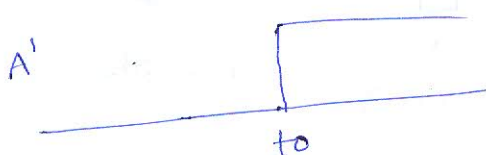
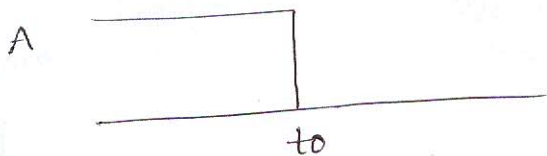
Sol:-



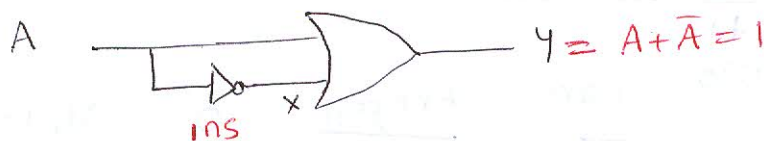
1)



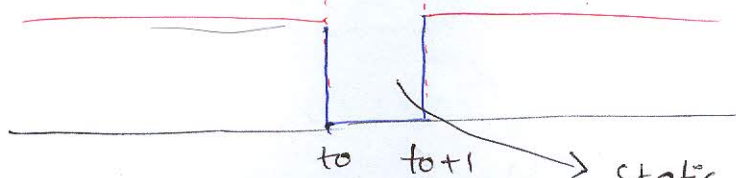
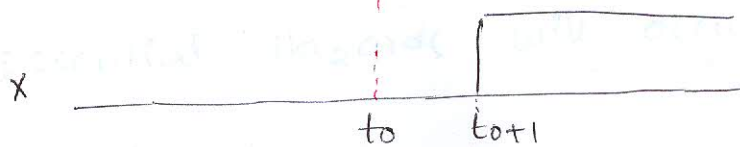
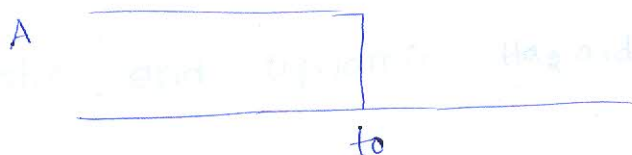
Sol



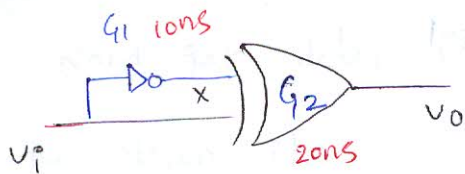
2)



Sol



Q)



$$t_1 = t_0 + 10\text{ns}$$

$$t_2 = t_0 + 20\text{ns}$$

$$t_3 = t_0 + 30\text{ns}$$

V_i

x

V_o

V_o

(ex-OR 20ns)

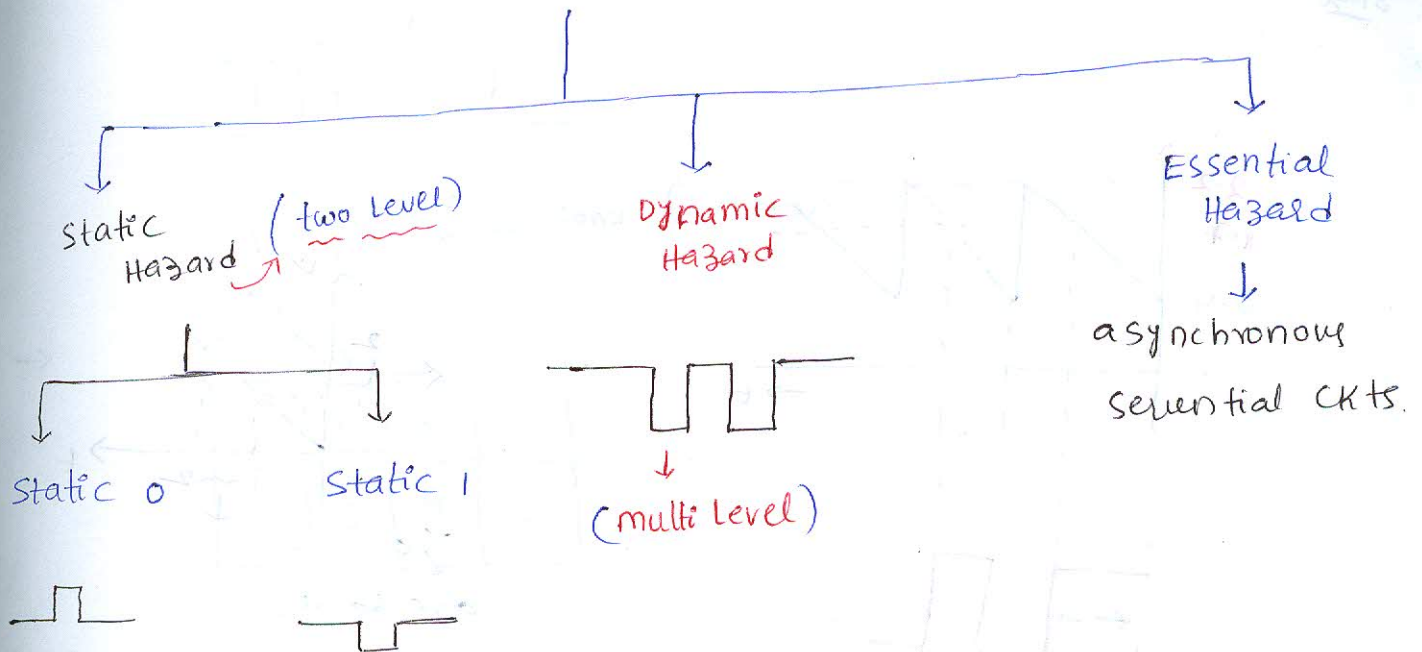
t_2

t_3

bring off '1' state

→

Hazards



→ static '1' Hazards may occur in two level

(And - OR) gate circuits.

(SOP)

→ static '0' Hazards may occur in two level

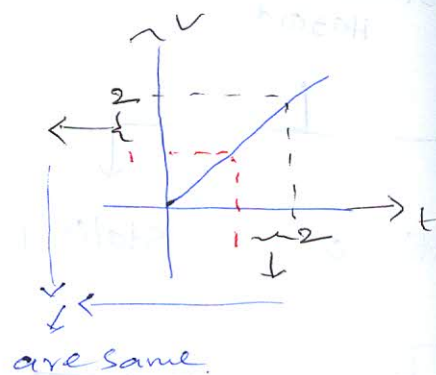
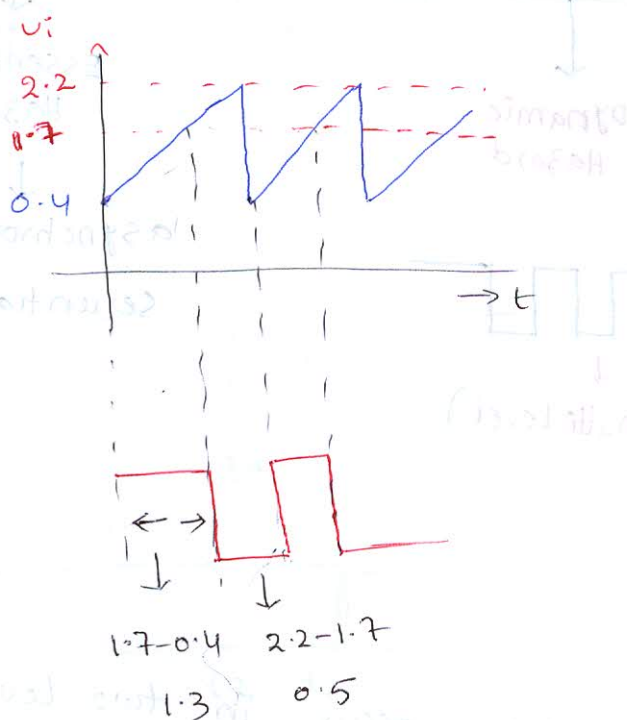
(POS) (OR - And) circuits

→ static and Dynamic Hazards occurs in Combinational CKts.

→ Essential Hazards will occur in asynchronous sequential CKts.

25/06/11.

Q> 8 Page
5>



$$\rightarrow \text{Duty Cycle} = \frac{t_{on}}{t_{on} + t_{off}} \times 100 = \frac{1.3}{1.8} \times 100\%$$

→ NAND Dual → NOR

EX OR Dual → EX NOR

NOT Dual → NOT

→ $A + BC \rightarrow A \cdot A + BC$

⇓

require 3 Nand gates.

→

x y z

1	0	1	0
1	1	1	1

$f_1 = \text{some function}$

→

0	1	0	1
0	0	0	0

$$\boxed{f_2 = \bar{f}_1}$$

Q) 26

$$W = \underline{R + \bar{P}Q + \bar{R}S}$$

RS

PQ	$\bar{R}\bar{S}$	$\bar{R}S$	RS	$R\bar{S}$
$\bar{P}\bar{Q}$		1	1	1
$\bar{P}Q$	1	1	1	1
PQ		1	1	1
$P\bar{Q}$		1	1	1

→

$$f = \underline{\bar{x} + y}$$

↓

$$\underline{100Y + 10R}$$

Q)

$$x \oplus y \oplus xy = \overset{A}{(\bar{x}y + x\bar{y}) \oplus xy}$$

$$= (\bar{x}y + x\bar{y})\bar{xy} + (\bar{x}y + x\bar{y})xy$$

$$= (\bar{x}y + x\bar{y})(\bar{x} + \bar{y}) + (\bar{x}y + x\bar{y})xy$$

$$= \bar{x}y + x\bar{y} +$$