TUTORIAL-10

PRE-TUTORIAL ASSIGNMENT- SOLUTION

Solution:

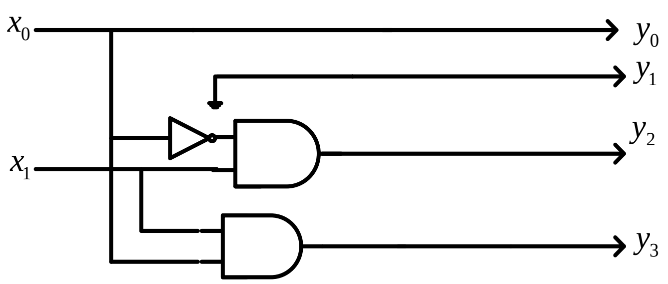
Let inputs be x_1 and x_0. x_1 is MSB. Four outputs are required. Let the outputs be y_3, y_2, y_1 and y_0. y_3 is MSB and y_0 is LSB

Inputs		Outputs			
x_1	x_0	y_3	y_2	y_1	y_0
0	0	0	0	0	0
0	1	0	0	0	1
1	0	0	1	0	0
1	1	1	0	0	1

$$\therefore y_0 = \overline{x_1}x_0 + x_1x_0 = x_0$$

$$y_1 = 0\,;\ y_2 = x_1\overline{x_0}\ ;\ y_3 = x_1x_0$$

Logic diagram: -



TUTORIAL-10: SOLUTIONS

Solution-1:

No. of inputs = 3

Maximum value of the output obtained is 7×3 = 21

To represent 21 in binary 5 outputs are required

Let x_2, x_1, x_0 are the inputs with x_0 as LSB and x_2 as MSB

y_4, y_3, y_2, y_1, y_0 are output with y_0 being LSB and y_4 being MSB

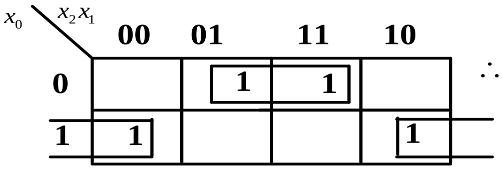
Truth table

Inputs			Outputs				
x_2	x_1	x_0	y_4	y_3	y_2	y_1	y_0
0	0	0	0	0	0	0	0
0	0	1	0	0	0	1	1
0	1	0	0	0	1	1	0
0	1	1	0	1	0	0	1
1	0	0	0	1	1	0	0
1	0	1	0	1	1	1	1
1	1	0	1	0	0	1	0
1	1	1	1	0	1	0	1

$\therefore y_0 = \sum m(1,3,5,7)$ $\qquad$ $\therefore y_0 = x_0$ This can also be obtained by the observation

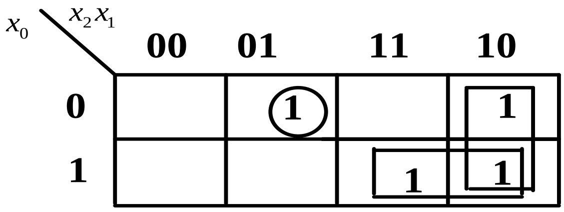
$x_0 \backslash x_2x_1$	**00**	**01**	**11**	**10**
0				
1	**1**	**1**	**1**	**1**

$y_1 = \sum m(1,2,5,6)$



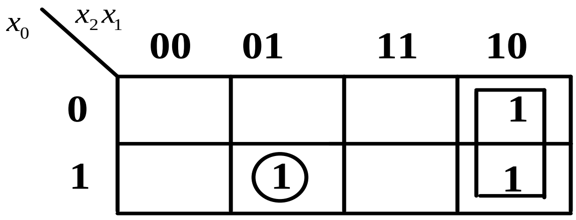
$$\therefore y_1 = x_1\overline{x_0} + \overline{x_1}x_0$$
$$= x_1 \oplus x_0$$

$$y_2 = \sum m(2,4,5,7)$$



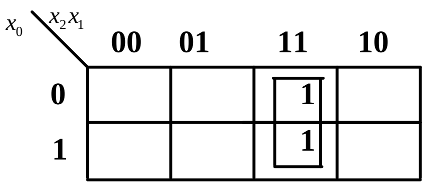
$$\therefore\ y_2 = \overline{x_2}x_1\overline{x_0} + x_2\overline{x_1} + x_2x_0$$

$$y_3 = \sum m(3,4,5)$$

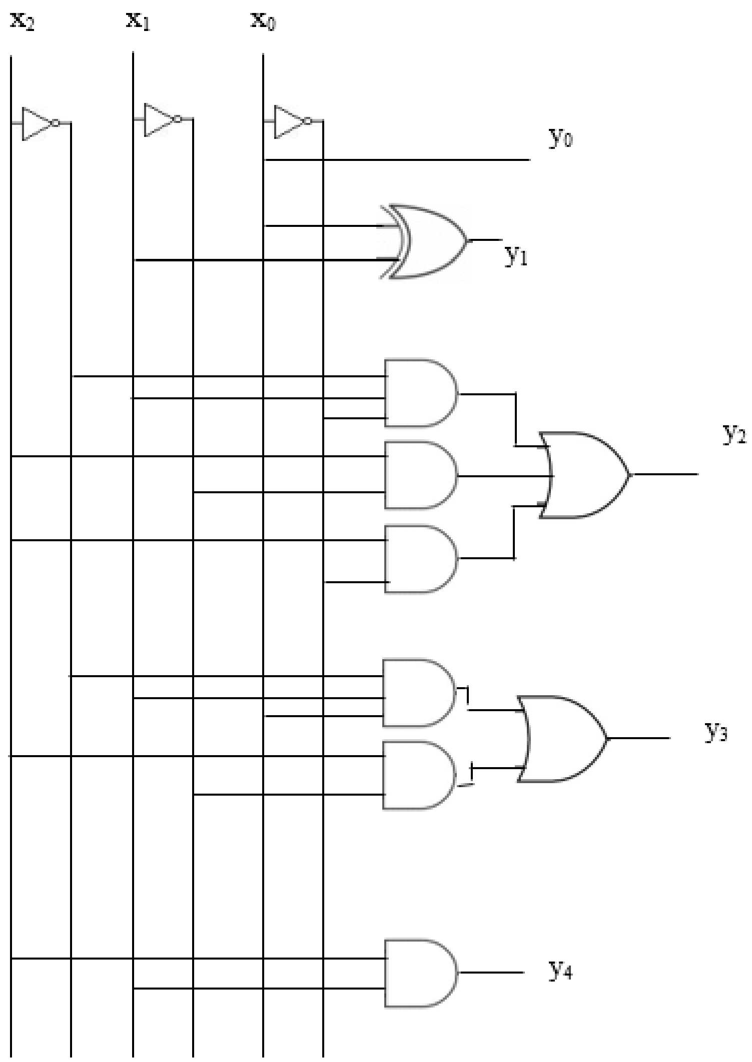


$$\therefore y_3 = \overline{x_2}x_1x_0 + x_2\overline{x_1}$$

$$y_4 = \sum m(6,7)$$



$$\therefore\ y_4 = x_2x_1$$



Solution-2:

Let the inputs of full adder are *x , y , z* and outputs are *S* and *C*.

We know that

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

$$C = x\,y + y\,z + z\,x$$

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

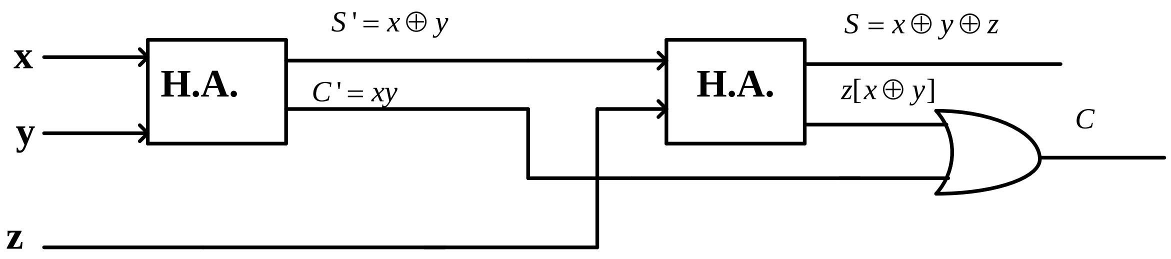
$$= x\,y + x\,y\,z + \overline{x}\,y\,z + x\,y\,z + x\,\overline{y}\,z$$

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

$$= x\,y + z\,[x \oplus y] \quad \text{-------------------} \quad (1)$$

If x and *y* are inputs of first half adder the outputs $S` = x \oplus y$ and $C` = x\,y$ ----------------- (2)

Using (1) and (2), we can obtain the following realization



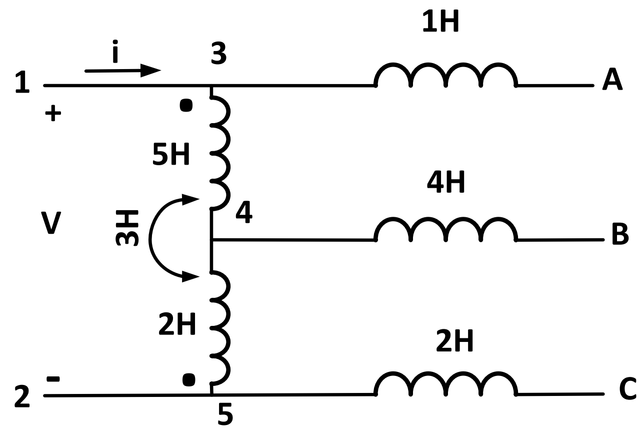
Solution-3:

Voltage induced in a coil due to a current in the second coil will have its +ve polarity at the dotted terminal, if the current enters into the dotted terminal at the second coil. Similarly, the induced voltage will have –ve polarity if the current leaves the dotted terminal.

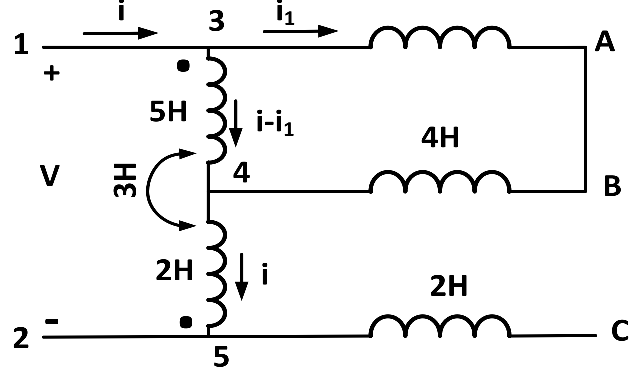
(a) Applying KVL in the loop 134521,

$$v - 5\frac{di}{dt} + 3\frac{di}{dt} - 2\frac{di}{dt} + 3\frac{di}{dt} = 0 \Rightarrow v - \frac{di}{dt} = 0$$

Leq = 1 H



(b)



Applying KVL in the loop 134521,

$$V - 5\frac{d(i-i_1)}{dt} + 3\frac{di}{dt} - 2\frac{di}{dt} + 3\frac{d(i-i_1)}{dt} = 0 \Rightarrow V - \frac{di}{dt} + 2\frac{di_1}{dt} = 0 \ (1)$$

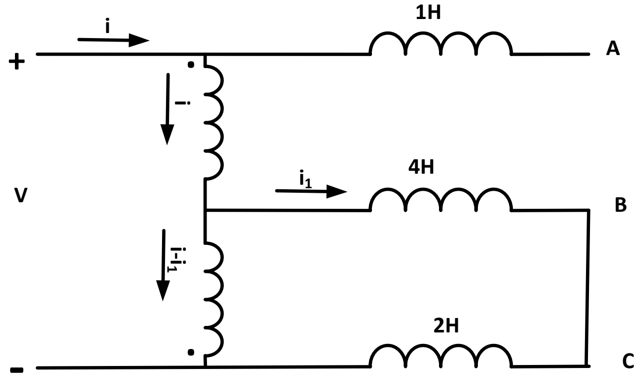
Applying KVL in the loop 3AB43,

$$-\frac{di_1}{dt}-4\frac{di_1}{dt}+5\frac{d(i-i_1)}{dt}-3\frac{di}{dt}=0 \Rightarrow \frac{di_1}{dt}=\frac{1}{5}\frac{di}{dt} \quad \text{---------------------(2)}$$

Replacing the value of $\frac{di_1}{dt}$ from (2) in equation (1)

$$V-\frac{di}{dt}\left(1-\frac{2}{5}\right)=0 \Rightarrow L_{eq}=\frac{3}{5}\ H$$

(c)



$$V-5\frac{di}{dt}+3\frac{d(i-i_1)}{dt}-2\frac{d(i-i_1)}{dt}+3\frac{di}{dt}=0 \Rightarrow v-\frac{di}{dt}+\frac{di_1}{dt}=0 \text{ --- (1)}$$

$$-4\frac{di_1}{dt}-2\frac{di_1}{dt}+2\frac{d(i-i_1)}{dt}-3\frac{di}{dt}=0 \Rightarrow -8\frac{di_1}{dt}-\frac{di}{dt}=0 \Rightarrow \frac{di_1}{dt}=-\frac{1}{8}\frac{di}{dt} \text{ -- (2)}$$

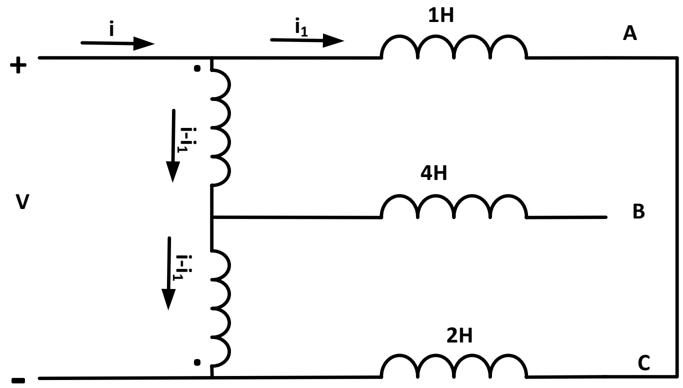
$$V-\frac{di}{dt}\left(1-\frac{1}{8}\right)=0 \Rightarrow L_{eq}=\frac{7}{8}\ \text{H}$$

(d) $V-\frac{di}{dt}+\frac{di_1}{dt}=0$ -------------- (1)

$$-\frac{di_1}{dt}-2\frac{di_1}{dt}+2\frac{d(i-i_1)}{dt}-3\frac{d(i-i_1)}{dt}+5\frac{d(i-i_1)}{dt}-3\frac{d(i-i_1)}{dt}=0$$

$\Rightarrow \frac{di_1}{dt}=\frac{1}{4}\frac{di}{dt}$ -------------------- (2)

$$V-\frac{di}{dt}\left(1-\frac{1}{4}\right)=0 \Rightarrow L_{eq}=\frac{3}{4}\ \text{H}$$



Solution-4:

When current enters into a dotted terminal, it will induce a voltage in the other coil where the positive polarity of the induced voltage will be the corresponding dotted terminal.

$$\boldsymbol{V_{AD} = 20\frac{di_{s1}(t)}{dt} + 4\frac{di_{s2}(t)}{dt}}$$
$$\boldsymbol{= 20 \times 4 + 4 \times 10 = 120\ V}$$
$$\boldsymbol{V_{CD} = \ -6\frac{di_{s1}(t)}{dt} = -6 \times 4 = -24V}$$
$$\boldsymbol{V_{BD} = V_{BC} + V_{CD} = 3\frac{di_{s2}(t)}{dt} + 4\frac{di_{s1}(t)}{dt} - 6\frac{di_{s1}(t)}{dt}}$$
$$\boldsymbol{= 3 \times 10 + 4 \times 4 - 6 \times 4 = 22V}$$