CSE350

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Sec: 07

OR Gate

V_A	V_B	V_{R_1}	V_{R_2}	I_{R_1}	I_{R_2}	$V_R = Y$
0	0	0	0	0	0	0
0	5	0	0.0065	0	4.41908×10^{-5}	4.41908
5	0	0.0065	0	4.41908×10^{-5}	0	4.41908
5	5	0.00327	0.00327	2.22006×10^{-5}	2.22006×10^{-5}	4.44012

AND Gate

V_A	V_B	V_{R_1}	V_{R_2}	I_{R_1}	I_{R_2}	$V_R = Y$
0	0	0.00326	0.00326	2.22006×10^{-5}	2.22006×10^{-5}	0.55988
0	5	0.00649	0	4.41908×10^{-5}	0	0.58092
5	0	0	0.00649	0	4.41908×10^{-5}	0.58092
5	5	0	0	0	0	5

Inverter

V_i	V_{R_1}	V_{R_2}	V_{pc}	I_1	I_2	I_B	I_c	Y
0	0.65217	4.34782	0	4.34782×10^{-5}	4.34782×10^{-5}	0	0	5
5	4.29662	5.70334	4.89188	0.0002864	5.70331×10^{-5}	0.0002294	0.0022235	0.108117

Report:

1. If we set $V_A = 0V$, $V_B = 0V$ the output is logical low.

   If we set $V_A = 0V$, $V_B = 5V$ the output is also logical low.

   If we set $V_A = 5V$, $V_B = 0V$ the output remains the same as case 2.

   However, if we set $V_A = 5V$, $V_B = 5V$, the output is logical high.

2. If $V_A = V_B = 6V$ & $V_R = 5V$

for OR gate,
there won't be any difference as for both the diodes the value of anode will be greater than that of the cathode. So, D_1 & D_2 will work.

for AND gate,
the diodes D_1 or D_2 won't work as the value of the anode $(V_R = 5V)$ will be less than the value of any of the diodes which is $6V$. As a result, D_1 & D_2 won't work.

3. The function of $R_2 = 100k$ at the base of an inverter is to control the current flow of the base terminal. To illustrate, the $100k\Omega$ resistor is connected to the base terminal so that the base terminal could channel the excessive amount of electrons from the base terminal to a lower voltage.

4.
when $v_i = 0V$,

$\qquad V_B = -0.652178 V$

$\qquad N_E = 0 V$

$\qquad \therefore V_{BE} = -0.652178V$

$\qquad \because V_{BE} < 0.5 \quad \therefore$ cutoff

when $v_i = 5V$

$\qquad I_c = 0.00222358 A$

$\qquad I_B = 0.000229409 A$

We assume $\beta_F = 30$ is in between 40 & 120

$$\frac{I_e}{I_B} = \frac{0.00222358}{0.000229409}$$

$$= 9.6926$$

$\because$ $9.6926 < \beta_F$ $\therefore$ saturation

5.

A

B

t_1 t_2 t_3 t_4 t_5 t_6 t_7 t_8

C