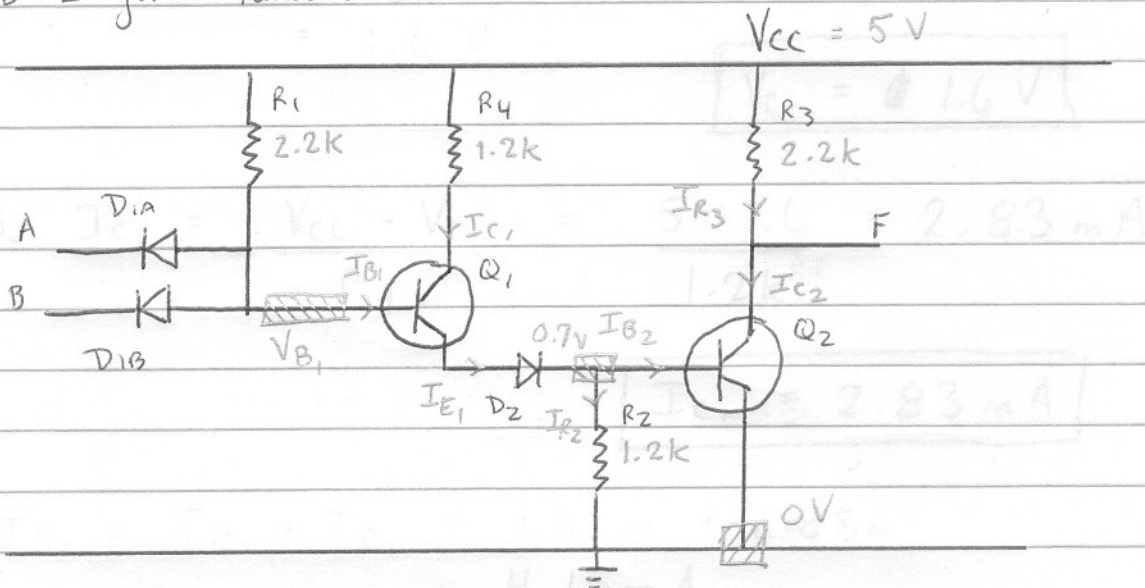


DTL gate fanout.



$$V_D = 0.7V = V_{BE(sat)}$$

$$V_{CE(sat)} = 0.2V$$

$$\beta_F = 20$$

$$V_{B1} = V_{BE2} + V_{D2} + V_{BE1}$$

$$= 3(0.7)$$

$$= 2.1V$$

$$V_{B1} = 2.1V$$

$$I_{B1} = \frac{V_{CC} - V_{B1}}{R_1} = \frac{5 - 2.1}{2.2k} = 1.32mA$$

$$I_{B1} = 1.32mA$$

Assuming Q1 is ~~saturated~~ not saturated

$$I_{C1} = \beta_F I_{B1} = (20)(1.32m) = 26.4mA$$

$$I_{C1} = 26.4mA$$

Then, $V_{C1} = V_{CC} - R_4 I_{C1} = 5 - (1.2k)(26.4m)$
 $= 5 - 31.68$
 $\neq -26.68V$

So, Q1 is saturated

$$\text{Hence, } V_{c_1} = V_{BE_2} + V_{D_2} + V_{CE(sat)_1}$$

$$= 0.7 + 0.7 + 0.2$$

$$= 1.6 \text{ V}$$

$$V_{c_1} = 1.6 \text{ V}$$

$$\text{So } I_{c_1} = \frac{V_{cc} - V_{c_1}}{R_4} = \frac{5 - 1.6}{1.2 \text{ k}} = 2.83 \text{ mA}$$

$$I_{c_1} = 2.83 \text{ mA}$$

$$I_{E_1} = I_{B_1} + I_{c_1} = 1.32 \text{ m} + 2.83 \text{ m}$$

$$= 4.15 \text{ mA}$$

$$I_{E_1} = 4.15 \text{ mA}$$

$$I_{B_2} = I_{E_1} - I_{R_2}$$

$$= (4.15 \text{ m}) - \frac{V_{BE_2}}{R_2} = (4.15) - \frac{0.7}{1.2 \text{ k}}$$

$$= 3.57 \text{ mA}$$

$$I_{B_2} = 3.57 \text{ mA}$$

$$I_{c_2(\text{max})} = \beta_F I_{B_2} = (20)(3.57 \text{ m})$$

$$= 71.4 \text{ mA}$$

$$I_{c_2(\text{max})} = 71.4 \text{ mA}$$

$$I_{\text{LOAD}} = \frac{V_{cc} - V_{CE(sat)} - V_D}{R_1} = \frac{5 - 0.2 - 0.7}{2.2 \text{ k}}$$

$$= 1.86 \text{ mA}$$

$$I_{\text{LOAD}} = 1.86 \text{ mA}$$

But $I_{C2(max)} = N I_{LOAD} + I_{R3}$

$I_{R3} = \frac{V_{CC} - V_{CE(sat)}}{R_3} = \frac{5 - 0.2}{2.2k} = 2.18 \text{ mA}$

$I_{R3} = 2.18 \text{ mA}$

$I_{C(max)} = N I_{LOAD} + I_{R3}$
 $71.4 \text{ mA} = N \cdot (1.86 \text{ mA}) + 2.18 \text{ mA}$

$N = \frac{71.4 - 2.18}{1.86} = 37.22$

Therefore fanout = $N = 37$ *

YB. Q completed in 19:16

$V_{B1} = 2.1 \text{ V}$

$I_{B1} = \frac{V_{CC} - V_{B1}}{R_1} = \frac{5 - 2.1}{2.2k} = 1.32 \text{ mA}$

$I_{B1} = 1.32 \text{ mA}$

Assuming Q1 is saturated not saturated

$I_{C1} = \beta_F I_{B1} = (20)(1.32 \text{ mA}) = 26.4 \text{ mA}$

$I_{C1} = 26.4 \text{ mA}$

Then $V_{C1} = V_{CC} - R_4 I_{C1} = 5 - (1.2k)(26.4 \text{ mA})$
 $= 5 - 31.68$
 $= -26.68 \text{ V}$

∴ Q1 is saturated