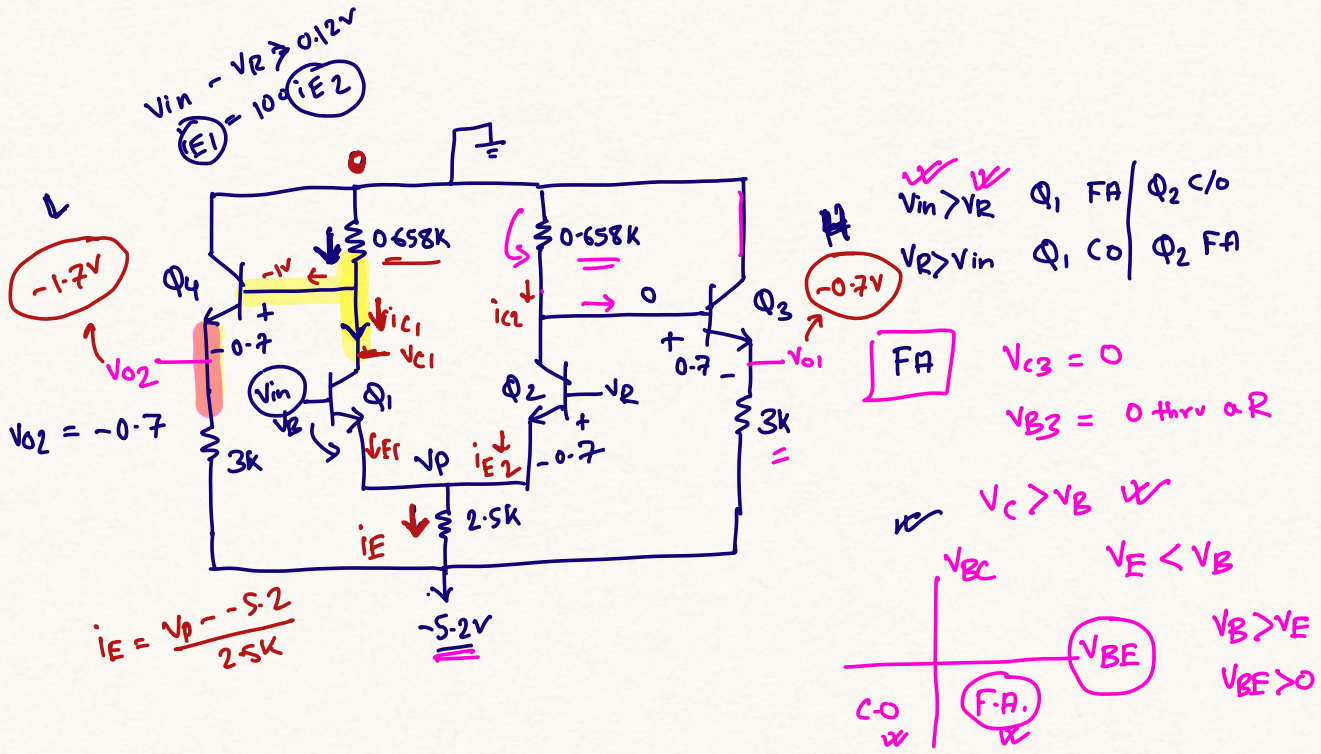


Vin	VR	Q1	Q2	Vo1	Vo2
① -1.7	-1.35	C/O	F/A	-1.7	-0.7
② -0.7	-1.35	F.A	C/O	-0.7	-1.7

① $V_R \rightarrow V_H$, V_L

$$\frac{V_H + V_L}{2} \simeq V_R$$

② output → high / Low
input → high / Low
} same values

(a) Vin logical Low ✓ $V_{in} < V_R$

$V_{o2} = -0.7V$ (Logic high) input -0.7

(b) Vin → logical high (-0.7V) $V_{in} > V_R$

$Q_1 \rightarrow$ F.A $Q_2 \rightarrow$ C/O $i_{C2} = 0$

$V_{B3} = 0$ $Q_3 \rightarrow$ F.A $V_{o1} = -0.7V$

$\because$ Q_1 F·A

$$V_{BE1} = V_{in} - V_p = 0.7$$

$$\uparrow$$

$$-0.7$$

$$\Rightarrow V_p = -1.4V$$

$$i_E = \frac{-1.4 - -5.2}{2.5K} = 1.52mA$$

(sum of $i_{E1} + i_{E2}$)

$$i_{C1} \simeq i_{E1} \simeq i_E = 1.52mA$$

$$\frac{0 - V_{c1}}{R} = i_C = 1.52$$

$R \rightarrow 0.658K$

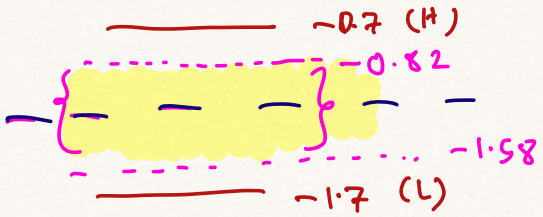
$$V_{C1} = 0.658 \times 1.52 = -1V$$

$\because V_{C1} = -1V$,

$\therefore V_{O2} = -1 - 0.7 = -1.7V$

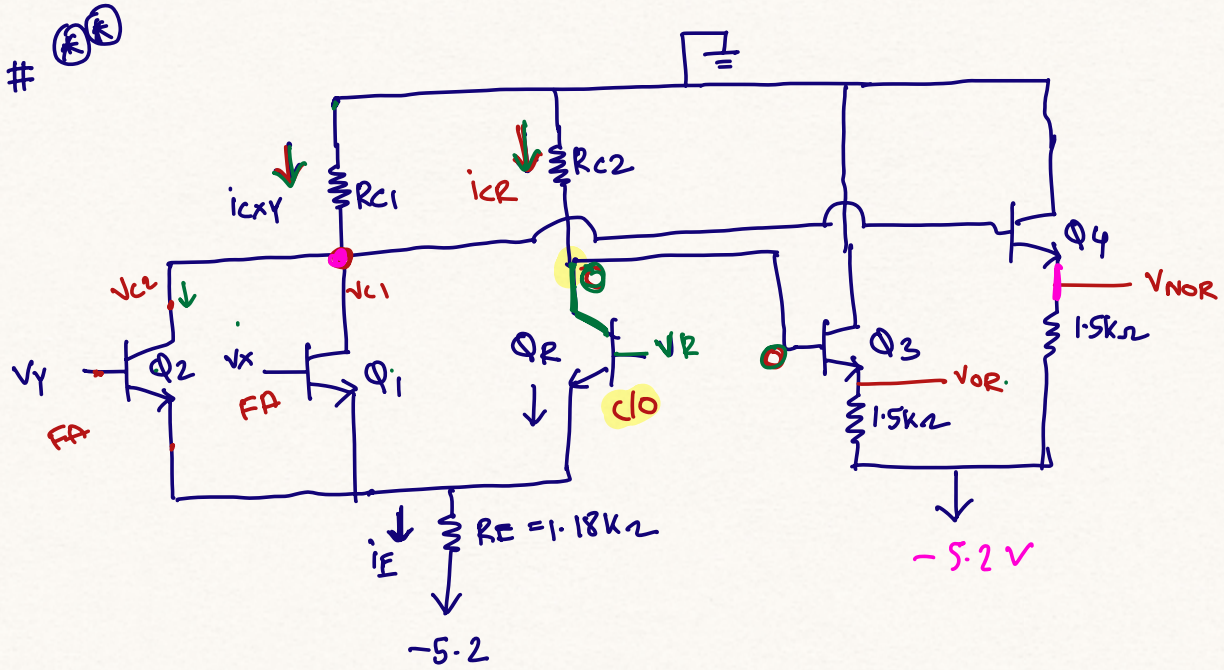
$$V_R = \frac{(-0.7) + (-1.7)}{2} = -1.35V$$

100



$-0.82 < V_R < -1.58$

(**)



Q. Determine R_{C1}, R_{C2} → when Q_1, Q_2 conducting

$V_{BC} = 0$ (Q_1, Q_2)

$V_{C1} = V_X = -0.7V$ $V_{OR} = -0.7V = V_H$ $V_{OH} = V_{IH}$

$V_{C2} = V_Y = -0.7V$

$V_{NOR} = V_{B_4} - V_{E_4} = -0.7V - 0.7V = -1.4V$

$V_{OR} = -0.7$

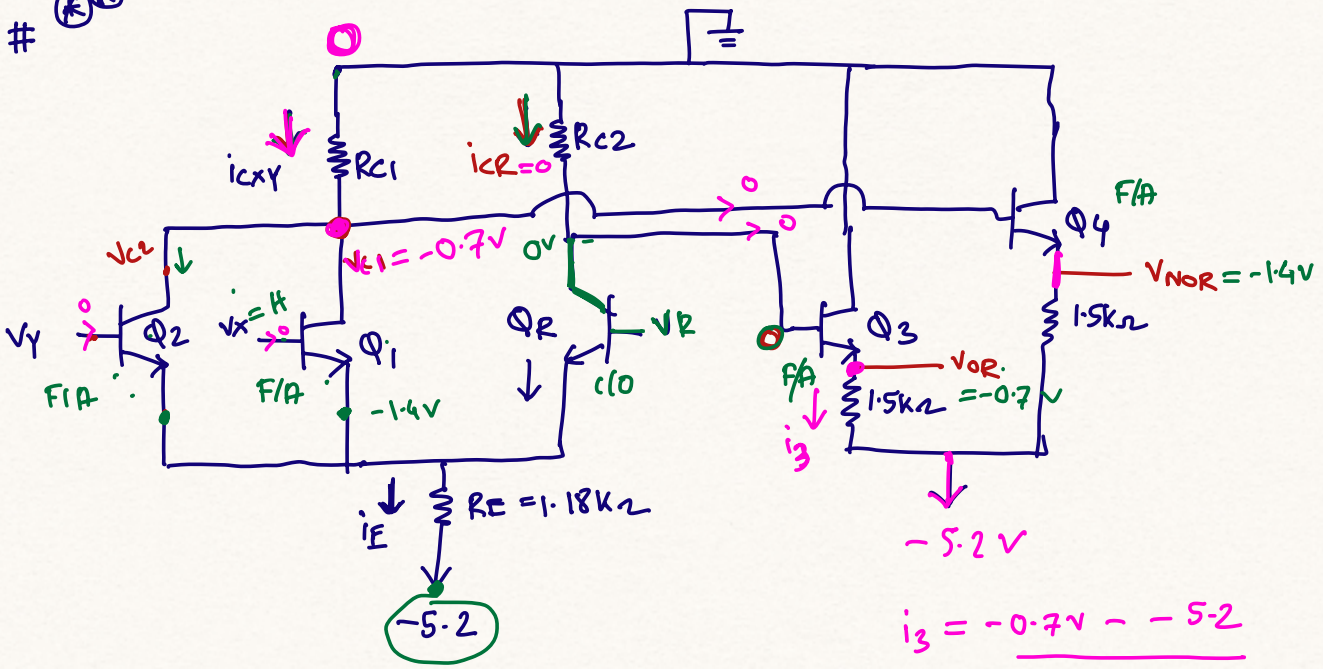
$$V_R = \frac{V_H + V_L}{2} = \frac{-1.4 - 0.7}{2} = -1.05\,V$$

$V_H = -0.7V$

$V_L = -1.4V$

$V_R = -1.05V$

(K)(K)



$$i_3 = \frac{-0.7V - -5.2}{1.5K}$$

$$i_3 = 3mA$$

$V_{BE} = 0.7V$ $\quad V_B = H = -0.7V$

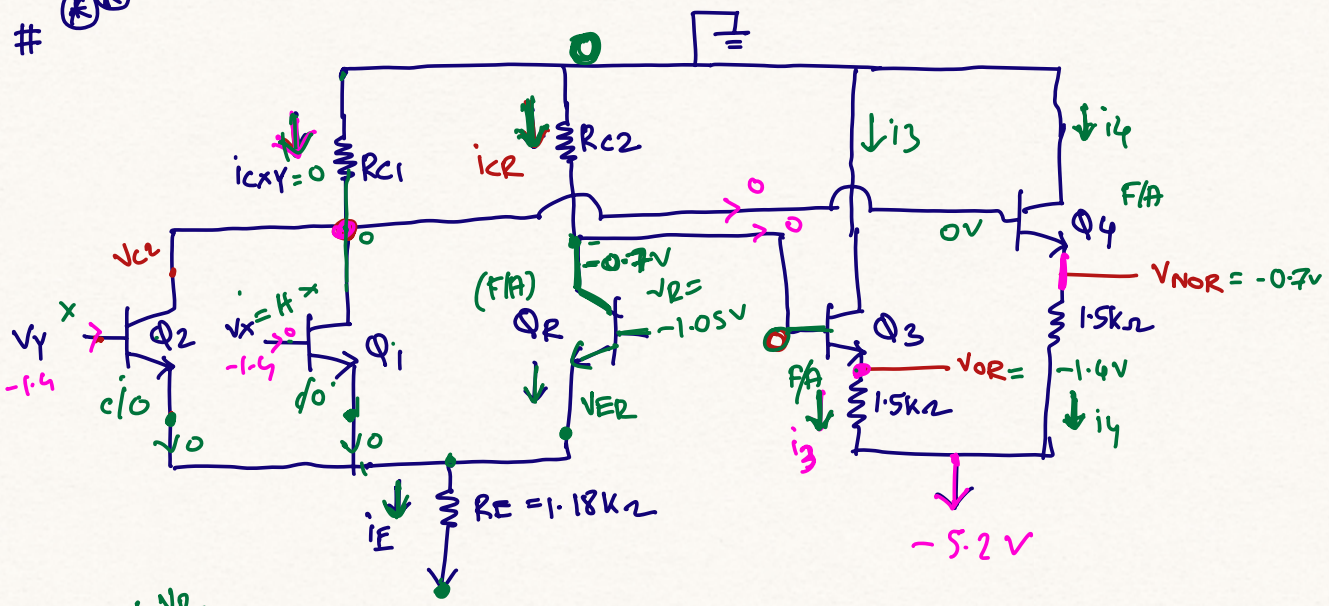
$V_E = -0.7 - 0.7 = -1.4V$ //

$$i_E = \frac{-1.4 - -5.2}{1.18K} = 3.22mA$$ //

$$i_{CXY} = i_E = 3.22mA$$

$$R_{C1} = \frac{0 - -0.7}{i_{CXY}} = \frac{0.7}{3.22} = 0.217k$$

(K)(K)



$V_X = V_Y$ ∠ VR

Q_R

$V_{BE} = 0.7V$ $\quad V_B = -1.05V$

$V_E = -1.75\,V$

$$i_E = \frac{-1.75 - -5.2}{1.18K} = \underline{\underline{2.92mA}}$$

$$i_{CR} = \underline{i_{ER}} = \underline{i_E} = 2.92mA$$

considering Q_3 $\quad V_{OR} = -1.4V$ $\quad V_{E3} = -1.4V$

$V_{B3} = -1.4 + 0.7V = -0.7V$

$V_{CR} = -0.7V$

$$R_{C2} = \frac{0 - -0.7V}{2.92mA} = 0.24K\Omega$$

Not in final syllabus!

Calculate the power dissipation for the case $V_X = V_Y = -0.7V$ (Logic high)

$Q_1, Q_2 \rightarrow$ F.A.

$Q_{1,2}$ $V_E = -0.7 - 0.7 = -1.4V$ $\quad i_E = \frac{-1.4 - -5.2}{1.18K} = 3.22mA$

$i_{CXY} = i_E = 3.22mA$

$i_{CR} = 0$

$V_{NOR} = -1.4V \quad V_{OR} = -0.7V \quad i_3 = \frac{-0.7 + 5.2}{1.5K} = 3mA$

$i_4 =$ ═══

$xy + \bar{z} = f$

① ADC/DAC

② ECL

③ power supply

⑤ MOSFET

⑤ TTL → mid