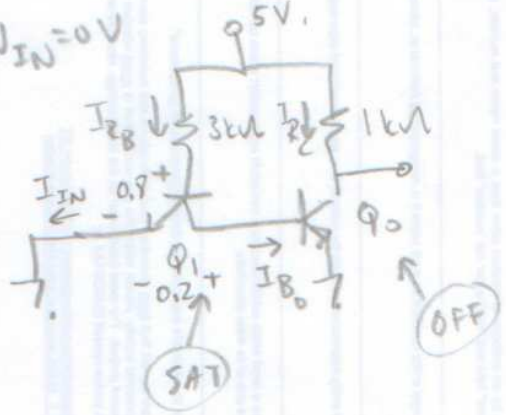
EE 282
HW #6 Solutions

(1) a) $V_{IN}=0V$



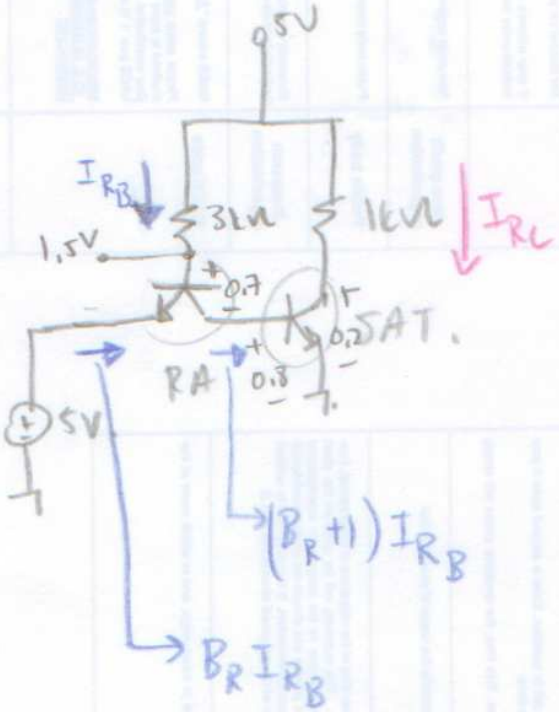
$$I_{R_B} = \frac{5-0.8}{3k\Omega} = \frac{4.2}{3} = 1.4\,mA$$

$$I_{B_0} = 0$$

$$I_{R_L} = 0$$

$$I_{IN} = 1.4\,mA.$$

b)



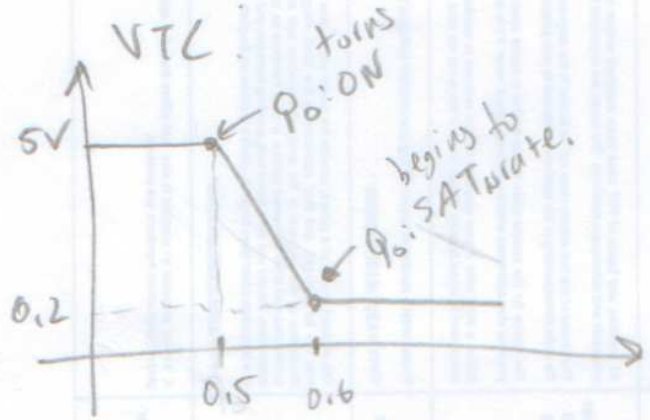
$$I_{R_B} = \frac{5-1.5}{3k\Omega} = \frac{3.5}{3} = 1.1\overline{6}\,mA.$$

$$I_{R_L} = \frac{5-0.2}{1k\Omega} = 4.8\,mA.$$

$$I_{B_0} = (B_R+1)\,I_{R_B} = 1.28\overline{3}\,mA.$$

$$I_{IN} = -0.11\overline{6}\,mA.$$

(2)

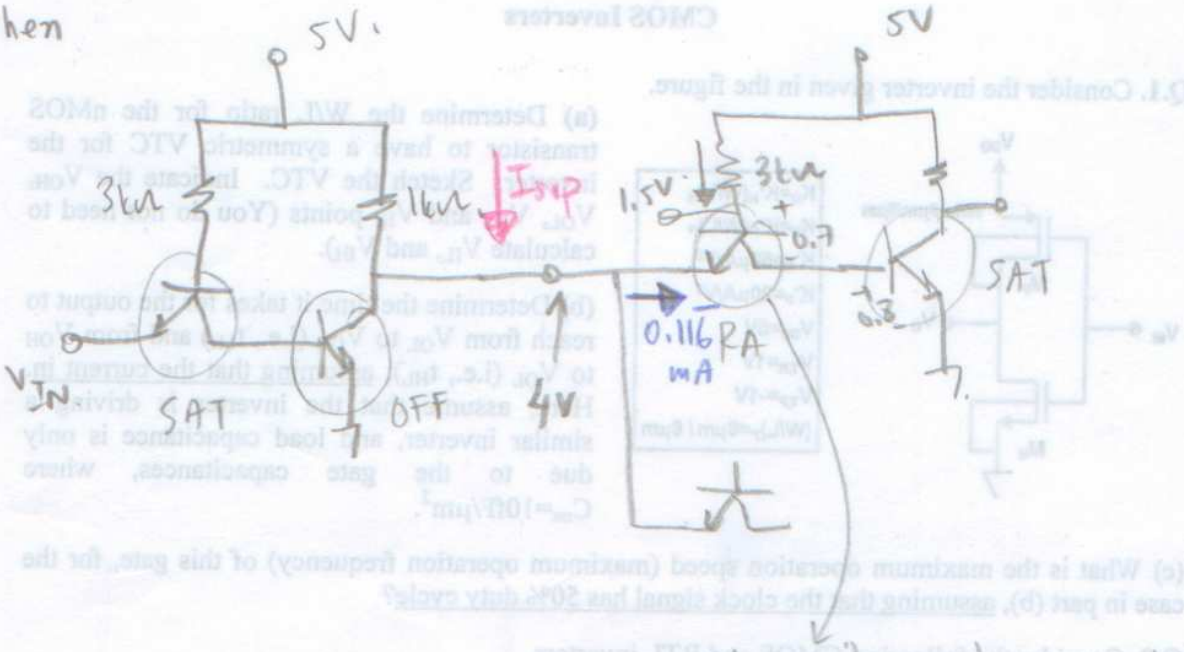


③ OH:

$V_{output}^{max} = V_{OH} - 1V = 4V$

(5V; 1V: given tolerance)

When



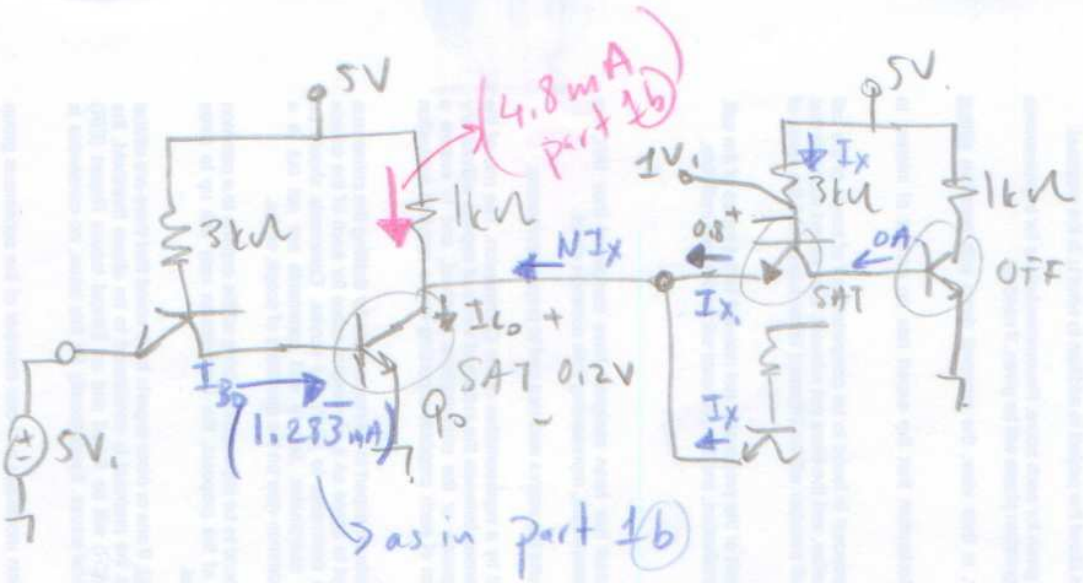
This transistor remains in RA at 4V input voltage (as in Problem 1 part b.).
(Check that V_{BC}: ON V_{BE}: OFF)

$I_{sup} = \frac{5-4}{1k\Omega} = 1mA.$

$N_{OH} = \frac{1mA}{0.116} = 8.62$

$N_{OH} = 8$ ✗.

OL:



$$I_x = \frac{5-1}{3k\Omega} = 1.\bar{3}\ mA.$$

then $$G_{SAT} = \frac{I_{C0}}{\beta_F I_{B_0}} = 0.85.$$

$$I_{C_0} = 4.8mA + N I_x = 4.8mA + N(1.\bar{3})\ mA.$$

$$G_{SAT} = 0.85 = \frac{4.8 + N(1.\bar{3})}{100\ (1.28\bar{3})}$$

$$109 = 4.8 + N(1.\bar{3})$$

$$N = 80.2$$

$$N_{OL} = 80$$

Fan-out = 8