Key

Quiz # 4

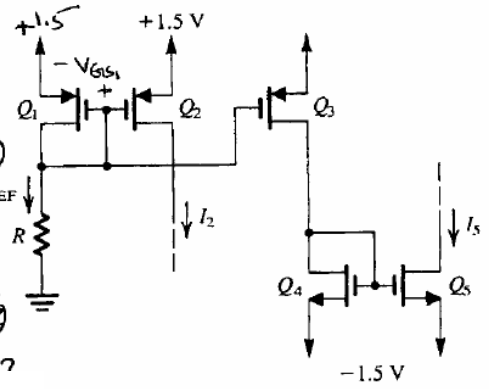
Name: ID#

a) Find R in the current source shown below to have I_{REF}= 20uA, where $(W/L)_1$=10.

b) Design the (W/L) ratios so that have I_2= 100uA, I_3= I_4= 20uA, and I_5= 40uA
(PMOS transistors have k'_p=80uA/V^2, V_{tp}=-0.6V)

a)

R = ??



$$I_{REF} = \frac{V_{GS1}+1.5}{R} \Rightarrow R = \frac{V_{GS1}+1.5}{I_{REF}} \quad (1)$$

From Sat. Equ.

$$I_{REF} = \frac{1}{2} K'_p \left(\frac{W}{L}\right)_1 (V_{GS1}-V_{t_1})^2 \quad (2)$$

$$20u = \frac{1}{2} \quad 80u \quad 10 \quad (V_{GS1}+0.6)^2$$

$$V_{GS1} = -.825V \qquad R = \frac{-0.825+1.5}{20u} = 33750\Omega$$

b)

$$I_2 = \frac{(W/L)_2}{(W/L)_1} I_{REF} \Rightarrow \left(\frac{W}{L}\right)_2 = \frac{I_2}{I_{REF}} \left(\frac{W}{L}\right)_1$$

$$\left(\frac{W}{L}\right)_2 = \frac{100\mu}{20\mu}(10) = 50$$

$$\left(\frac{W}{L}\right)_3 = \left(\frac{W}{L}\right)_1 = 10$$

$$\left(\frac{W}{L}\right)_5 = (W/L)_4 \frac{I_5}{I_4} = 20$$