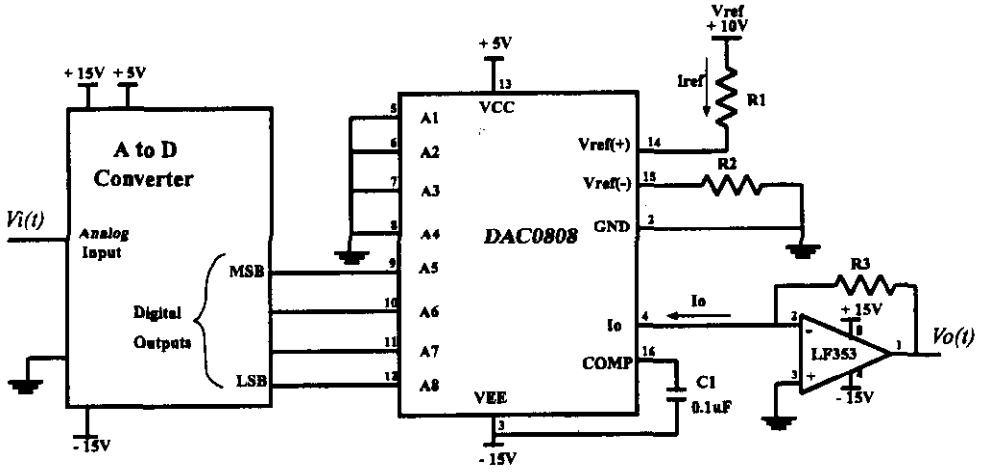
ECEN 4618
Advanced Electronics Lab
Spring 1999
Quiz # 6

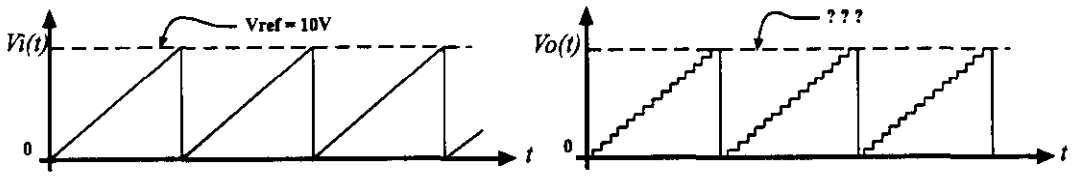
Name: SOLUTION



In order to test the operation of your group's 4-bit A/D converter, your lab partner assembles the (D/A) test circuit shown above. The test circuit output voltage *Vo* is given by the following expression:

$$Vo = Vref\left(\frac{R3}{R1}\right)\left(\frac{1}{2^n}\sum_{k=1}^{n} A_k\, 2^{(n-k)}\right)$$

where n = 8 for an 8-bit D/A chip (like the DAC0808), k is the index of the input to the D/A chip, and $A_k = \{0,1\}$ depending on the digital state {low, high} of the k^{th} input bit. An input signal *Vi(t)* is applied to the input of your A/D converter, and the output of the test circuit *Vo(t)* is displayed on an oscilloscope. Plots of these two waveforms are shown below:



(5 points) If R1 = R2 = R3 = 1kΩ, what is the amplitude (maximum value) of *Vo(t)*?
(Hint: It is not the same as the amplitude of *Vi(t)*!)

PLUGGING INTO THE EQUATION ABOVE GIVES

$|V_o| \cong 0.586\ V$ FOR A MAXIMUM DIGITAL OUTPUT (1111)

(5 points) Briefly explain why the two amplitudes are different.

THE A/D OUTPUTS ARE CONNECTED TO THE D/A'S 4 LEAST SIGNIFICANT BITS, INSTEAD OF THE 4 MOST SIGNIFICANT BITS.

(5 points) What should the value of R3 be changed to so that the amplitude of *Vo(t)* will be the same as the amplitude of *Vi(t)*?

CHANGE R TO BE $\cong$ 17 KΩ