EE40 Final Review problems

August 12, 2008

1. Fall 2002 Final Exam
For the following circuit, find Norton and Thevenin equivalents or explain why they do not exist. Assume that the transistor is in saturation mode $V_{DS} > V_{GS} - V_{TH}$

![Circuit Diagram](image)

2. Diode Clipper circuits
For the following circuits, assume that $R = 100\Omega$ and $v_{in}(t) = 8\sin(t)$ and that the diodes have a threshold voltage of 0.7 V. Plot $v_{out}(t)$.
   a. 
   ![Circuit Diagram](image)

   b. 
   ![Circuit Diagram](image)
3. Level Shifter Circuit (Fall 2007 Midterm 4)
Let \( v_{in} = \sin(2\pi \frac{t}{T}) \). Find \( v_{out}, v_c \) and plot \( v_{out} \). Plot \( v_{out}(t) \).

a.

\[
\begin{align*}
&+ \quad V_c - \\
&v_{in} \\
&+ \quad 2V \\
&\quad D_1 \\
&\quad R \\
&\quad + \quad v_{out} \\
&\quad - \\
&\quad 2V \\
&v_{in} \\
&+ \\
&\quad D_1 \\
&\quad R \\
&\quad + \quad v_{out} \\
&\quad -
\end{align*}
\]

b.

4. Second order circuits
Find the transfer function of the following circuit and plot the Bode magnitude and phase plots.

\[
\begin{align*}
&v_{in} \\
&R \\
&C \\
&L \\
&+ \quad v_{out} \\
&- \\
&v_{in} \\
&+ \\
&\quad v_{out} \\
&\quad -
\end{align*}
\]
5. Op-amp circuits
Find the gain of the following amplifier circuit:

![Op-amp circuit diagram]

6. CMOS logic
Design a circuit that takes two 2-bit inputs and adds the result together and detects when an overflow occurs. *Hint:* start by enumerating all of the possible input combinations in a truth table.