Mixed-Signal VLSI **Quiz 3** **FALL 1998**

Name: _____

Student Number: _____

Do NOT begin until told to do so
Make sure that you have all pages before starting
You may not leave the room during the exam
No calculators, open book, open notes

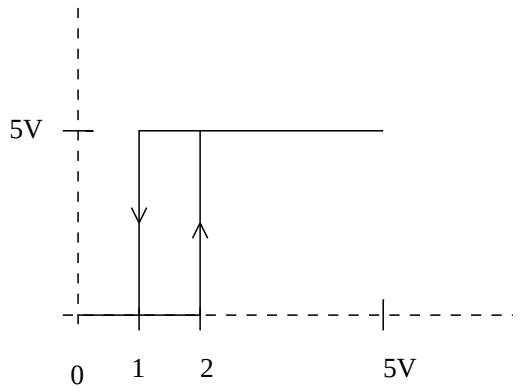
ACADEMIC INTEGRITY:
Students have the responsibility to know and observe the requirements of The UNCC Code of Student Academic Integrity (1997-99 Catalog page 336). This code forbids cheating, fabrication or falsification of information, multiple submission of academic work, plagiarism, abuse of academic materials, and complicity in academic dishonesty.

Useful constants, etc:

$$\begin{array}{cccc} e \approx 2.72 & \pi \approx 3.14 & 1/e \approx 0.37 & \sqrt{2} \approx 1.41 \\ \sqrt{3} \approx 1.73 & \sqrt{5} \approx 2.22 & \sqrt{7} \approx 2.64 & \sqrt{10} \approx 3.16 \\ ln[2] \approx 0.69 & ln[4] \approx 1.38 & ln[55] \approx 4.0 & ln[256] \approx 5.6 \\ log_{10}[2] \approx 0.30 & log_{10}[3] \approx 0.48 & log_{10}[55] \approx 4.0 & log_{10}[10] \approx 1.0 \\ log_{10}[0.1] \approx -1.0 & log_{10}[0.5] \approx -0.3 & log_{10}[e] \approx 0.43 & cos(\pi/4) \approx 0.79 \end{array} \quad (1)$$

$cos(A)cos(B) = \frac{1}{2}cos(A-B) + \frac{1}{2}cos(A+B)$
$e^{j\theta} = cos(\theta) + jsin(\theta)$
$cos^2(A) = \frac{1}{2} + \frac{1}{2}cos(2A)$

1. 20 points
   Design a bistable circuit for the following transfer function. Assume that the parts available to you are 0.1K to 1K resistors, 1 pF capacitors, and ideal op-amps. Assume the power supply is 5V. Show your design formulae, and show the final schematic.



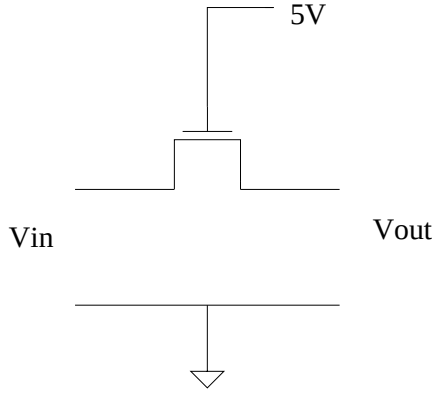
2. 20 points
   Design a 2 bit Flash analog-to-digital converter showing a schematic and any design calculations. For the output logic circuitry, do *not* draw a gate-level schematic, rather, draw a logic truth table. Assume that the parts available to you are 0.1K to 1K resistors, 1 pF capacitors, and ideal op-amps. Assume the power supply is 5V.

3. 20 points
A simple RC filter (series R, shunt C) is to be designed using a switched capacitor for the series resistor. Draw the schematic of the circuit. Assume that the parts available to you 1 pF capacitors, and ideal switches. Design the series resistor for R= 1MegOhm and let the shunt capacitor be 10 pF.

4. 20 points
   A 3-bit R2R DAC is constructed with R = 1K and a power supply of 5V. Draw a schematic of the DAC assuming ideal op-amps and ideal switches.

5. 20 points
Below:
NMOS devices: $K_p = 0.1A/V^2,\ V_t = 1V,\ W/L = 1,\ \lambda = 0$

a)Find the on-resistance and off-resistance of the NMOS switch below.



b) What is the maximum currrent that the switch can deliver to the output? Assume that the output is short-circuited and the input voltage remains between 0 and 5 Volts.