UNIVERSITY OF CALIFORNIA
College of Engineering
Department of Electrical Engineering
and Computer Sciences

Professor Oldham Spring 2001

EECS 42 — MIDTERM #2

5 April 2001

Name: _____ **Student ID: _____**
Last, First

Signature: _____

Guidelines:

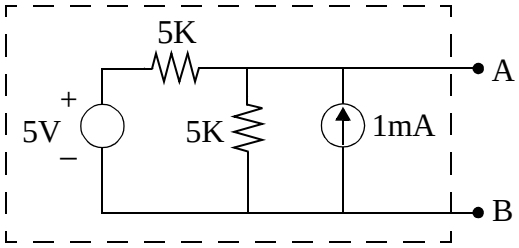
1. Closed book. A 3-page summary with formulas is provided at the end of the exam.
2. Show ***all your work and reasoning on the exam*** in order to receive credit.
3. **Warning**: Some problems will be graded with no partial credit, so check your answers.
4. You may use a calculator.
5. Do not unstaple the exam.
6. This exam contains 5 problems worth 20 points each, and corresponding worksheets plus the cover page and the 3-page summary with formulas.
7. **Please do not ask questions** except to point out possible errors or typographical mistakes.

Problem	Points Possible	Your Score
1	20	
2	20	
3	20	
4	20	
5	20	
Total	**100**	

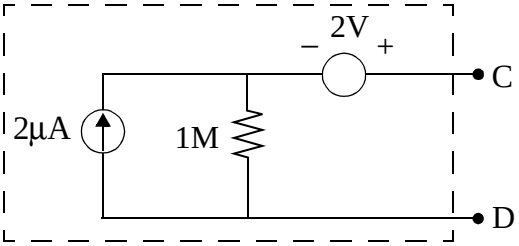
Problem 1 (20 points)

You are to find the Thevénin equivalent circuit for each of the following circuits. NOTE: You must fill in the answer boxes on the page opposite to receive full credit. Show the Thevénin equivalent circuit and indicate the values of R_T and V_T.

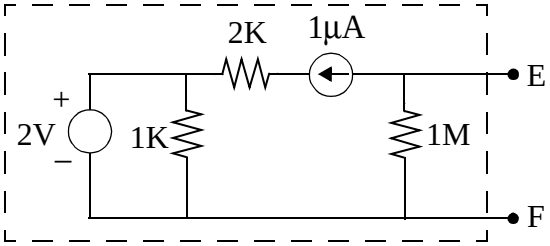
(a)



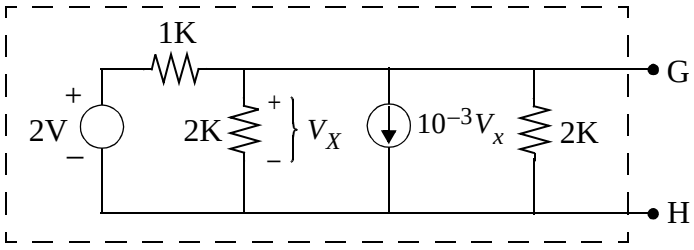
(b)



(c)

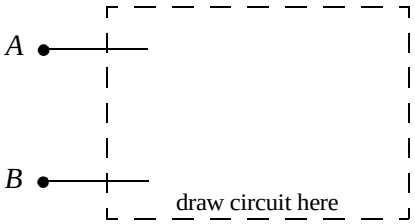


(d)



Problem 1 Answer Sheet

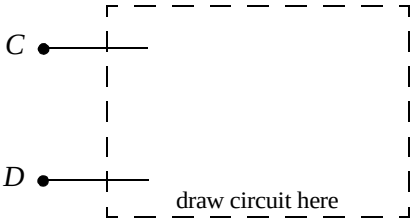
(a)



R_T = _____Ω

V_T = _____V

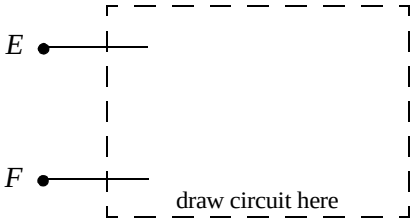
(b)



R_T = _____Ω

V_T = _____V

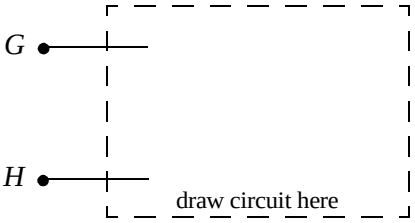
(c)



R_T = _____Ω

V_T = _____V

(d)



R_T = _____Ω

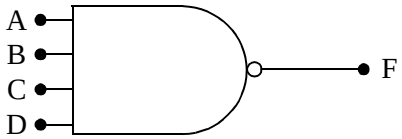
V_T = _____V

Problem 2 (20 points)

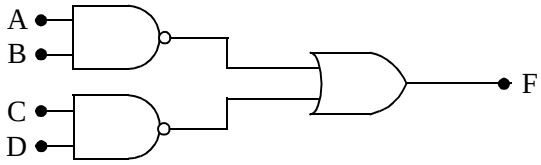
As you know, sometimes two quite different circuits are equivalent. Consider the five following circuits. Indicate by circling which circuits are equivalent to each other.

NOTE: Do not guess; you MUST actually demonstrate that the circuits are equivalent. If you do not show the basis for your assertions of equivalence, you cannot receive credit. (Please do not ask a question of how to demonstrate equivalence–you are responsible for knowing that.) The grading will reward for correct answers with appropriate basis for the choices and will subtract for wrong answers.

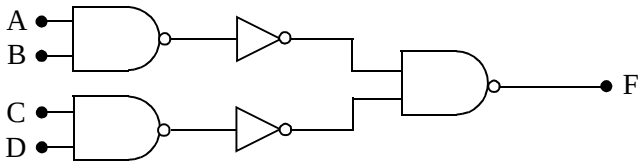
(a)



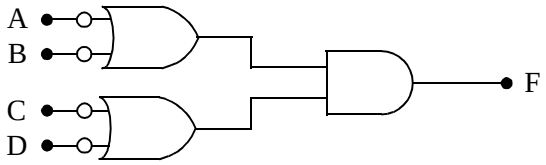
(b)



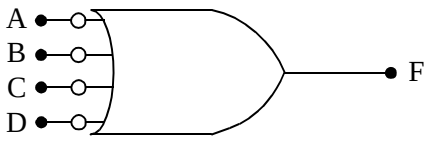
(c)



(d)



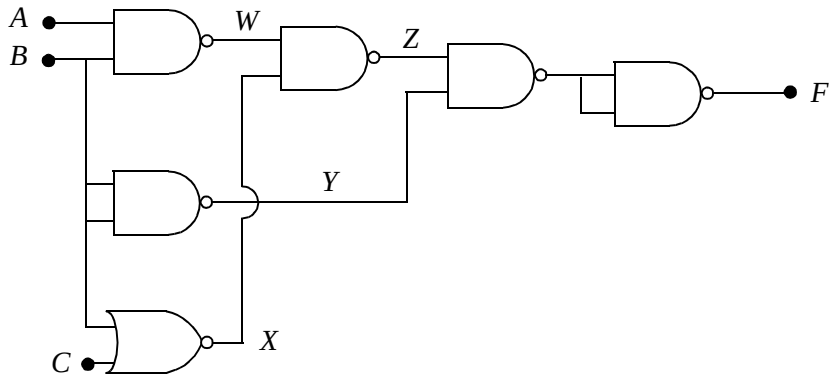
(e)



Problem 2 Worksheet

Problem 3 (20 points)

Consider the following logic circuit:



(a) Fill out the truth table (opposite), showing the intermediate values W, X, Y, Z as well as the output F.

(b) Write an expression for F in the "sum of products" form (in terms of inputs A, B, C).

(c) Simplify the expression (if you can).

(d) Implement (synthesize) the function for F with NAND gates (show the NAND-gate circuit).

Problem 3 Answer- and Worksheet

(a)

A	B	C	*W*	*X*	*Y*	*Z*	*F*
0	0	0					
0	0	1					
0	1	0					
0	1	1					
1	0	0					
1	0	1					
1	1	0					
1	1	1					

(b)

F = _____

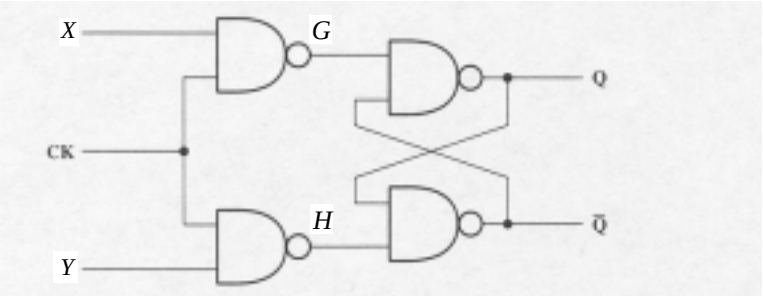
(c)

F = _____

(d)

Problem 4 (20 points)

(a) Consider the circuit below:

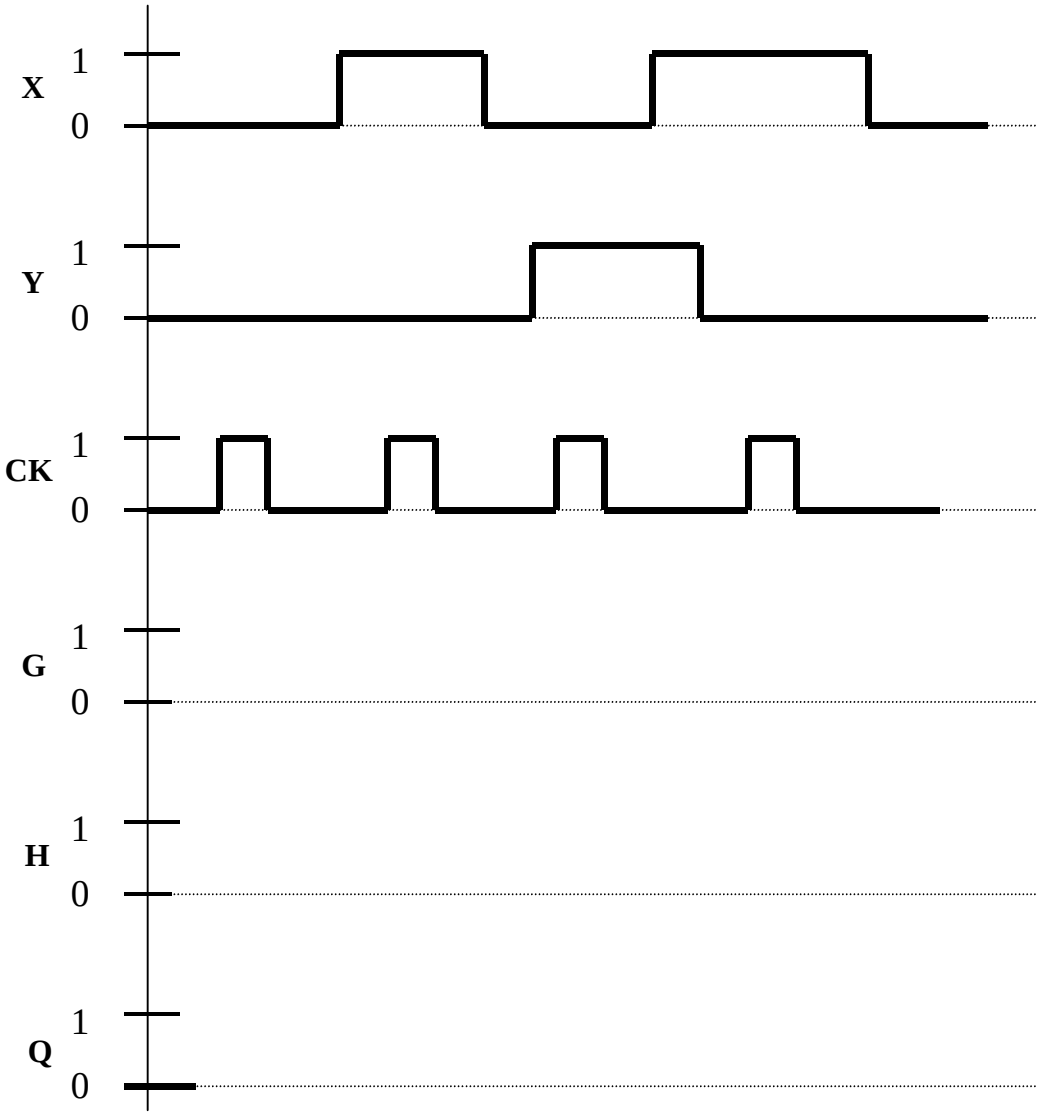


Fill in the value for Q in the timing diagram opposite. But to show your work, you must also show values for G and H. Note that the initial value of Q is 0, as shown by heavy dark line on the timing diagram. Ignore stage delay.

(b) For the same circuit, fill in the table, opposite.

Problem 4 Answer Sheet

(a)

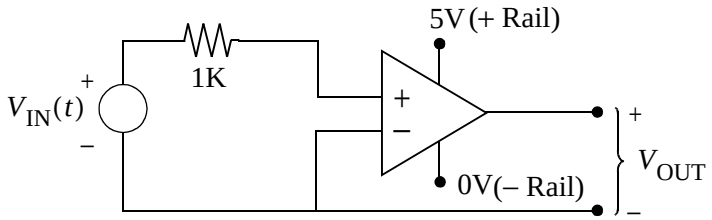


(b) The table below is intended to show the value of *Q* after CK goes high. Fill in the "**Q**" column with **0** or **1** or "$\mathbf{Q_{old}}$".

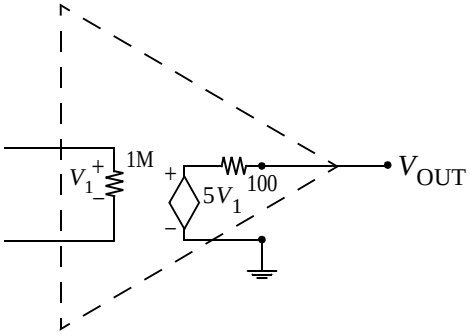
X	*Y*	*Q* (after CK=1)
0	0	
0	1	
1	0	

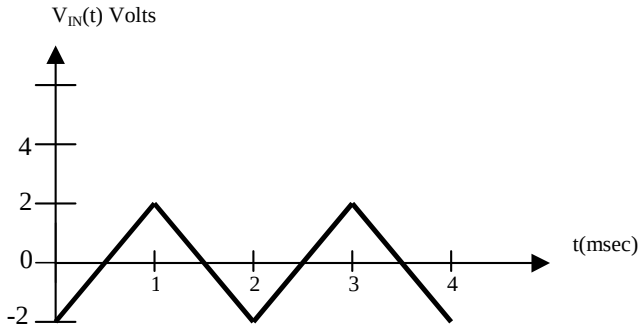
Problem 5 (20 points)

(a) For the circuit below and the input shown, neatly sketch the output voltage waveform on the axes provided.

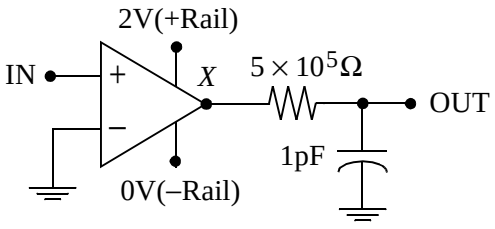


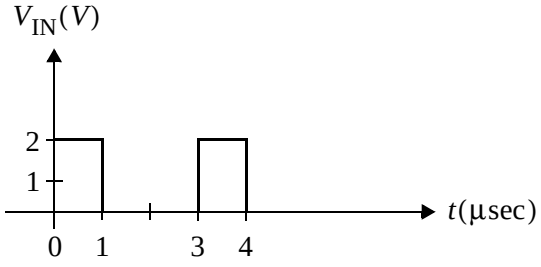
Circuit Model for Linear Range of Amplifier:





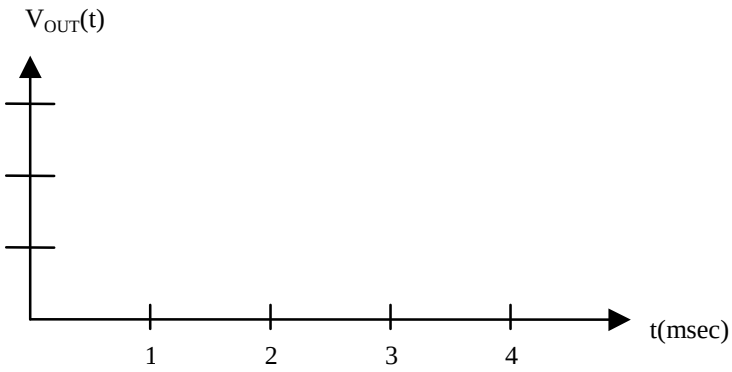
(b) For the circuit shown below, neatly and carefully sketch the voltage at node X and the output on the page opposite. The amplifier is a high-gain amplifier with a gain of greater than a million, an input resistance of greater than $1\text{M}\Omega$, and an output resistance of less than 100Ω.





Problem 5 Worksheet and Answersheet

(a)



(b)