CMSC 311 Midterm #1 - Fall 1994

Name ___________________________________ Signature _________________________________

(1) This exam is closed book, closed notes, and closed neighbor.

(2) You have 70 minutes to complete this exam. If you finish early, you may turn in your exam at the front of the room and leave. However if you finish during the last ten minutes of the exam please remain seated until the end of the exam so you don't disturb others.

(3) Write all answers on the exam. If you need additional paper, I will provide it. Make sure your name is on any additional sheets.

(4) Partial credit will be given for most questions assuming I can figure out what you were doing.

(6) Please write neatly. Print your answers if your handwriting is hard to read. If you write something, and wish to cross it out, simply put an X through it. Please indicate if your answer continues onto another page.

Question	Possible	Score
1	15	
2	15	
3	25	
4	20	
5	25	
Total	100	

Name of the person Sitting to your

left ________________________________ right ________________________________

1.) (15 points) Define the following terms:

a.) propagation delay

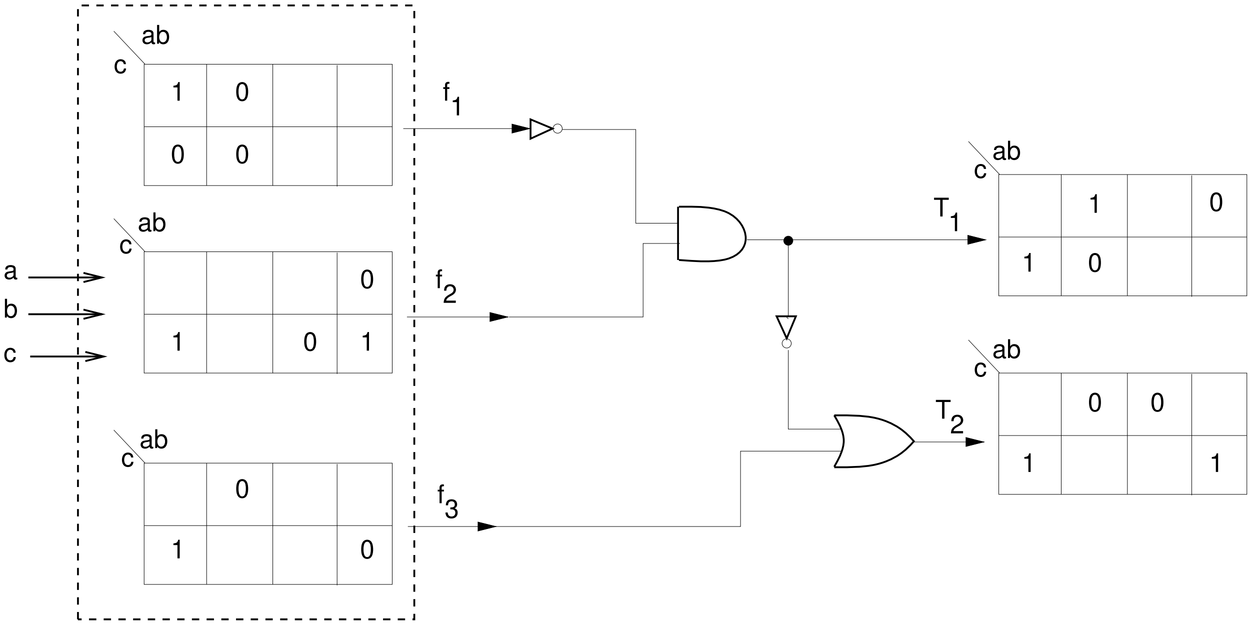
b.) ROM

c.) clock

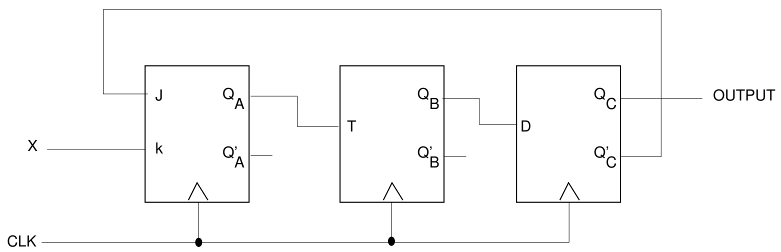
d.) multiplexor

e.) Boolean expression

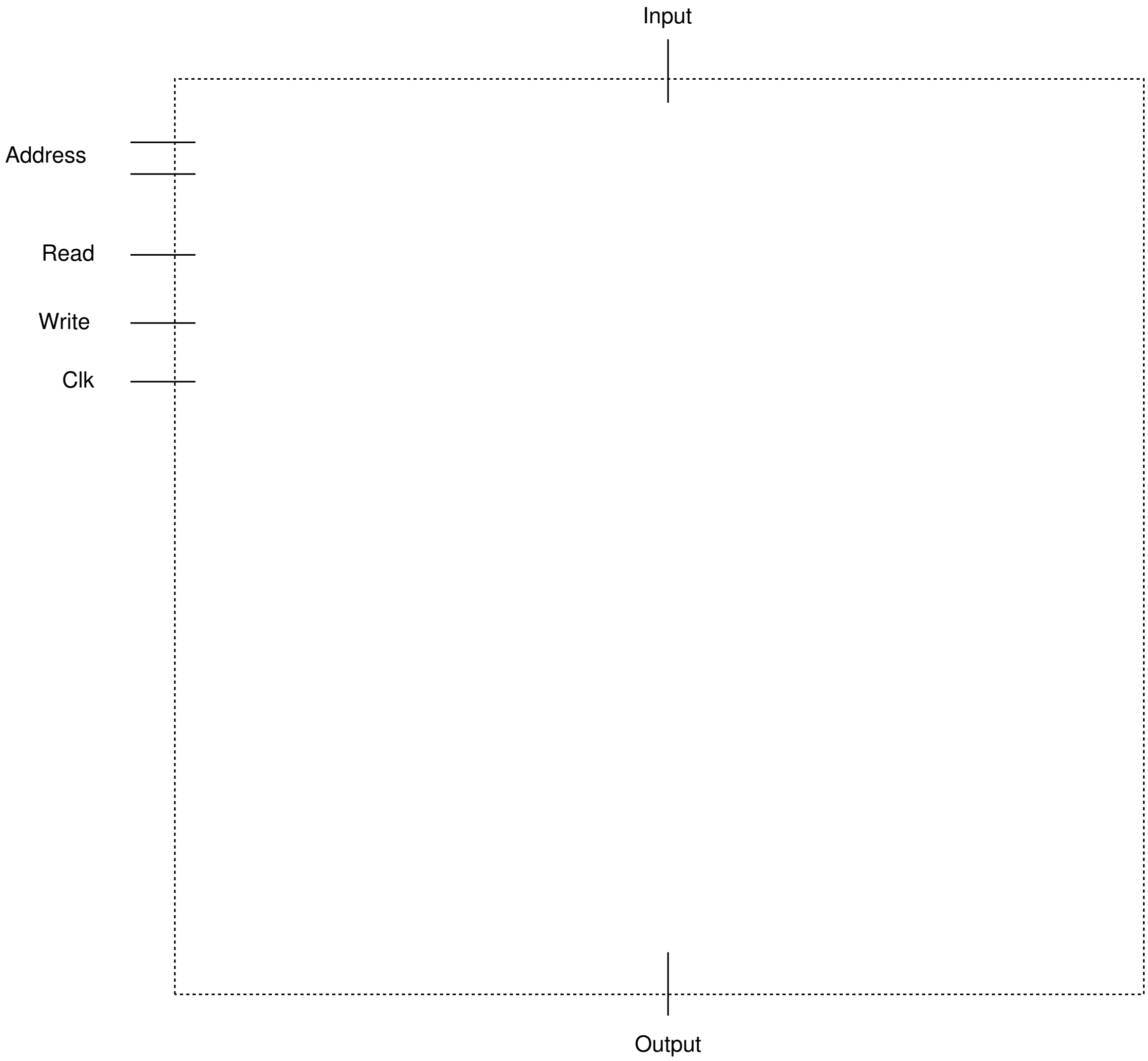
2.) (15 points) For the combinational circuit shown below you are given partial K-Maps for the intermediate functions f_1, f_2, f_3 and the output functions T_1, T_2. **Complete** the K-Maps so as to satisfy all necessary relations. Use as many don't cares as you can.



3.) (25 points) Consider the circuit shown below. First, show the state diagram for the circuit (make sure you show **all** states). Second, starting in state 000, indicate the output sequence for the input 1111. Note the varying Flip-Flop types and proceed carefully.



4.) (20 points) Design a four word RAM with 1 bit words using a decoder with enable, an encoder, and four D flip-flops.



5.) (25 points) Design a vending machine controller using a sequential circuit. It should take three inputs (NICKEL, DIME, and QUARTER). When the total amount of money received reaches 25 cents (or more) the output signal VEND should transition from 0 to 1 for one clock pulse. Your controller should also indicate if change is due as a three bit number representing the number of nickels to return (call the outputs C_0, C_1, and C_2). For example, if the machine has received 20 cents and a quarter is placed in the machine, VEND should transition to 1 for one clock pulse, and the number three (011) should be output. You may assume that only one coin is deposited per clock pulse, and that no change will be inserted while VEND is equal to 1. The output of the circuit should only change on clock pulses.

a.) Draw the state diagram for your circuit.

b.) Show the state table for your circuit.