

CSCI 254: *Introduction to Computer Organization*
Midterm 1 -- September 24, 1993

This is an open book, open notes exam. It is to be turned in by 3:05 PM.

Name: _____

Problem 1. (15 points)

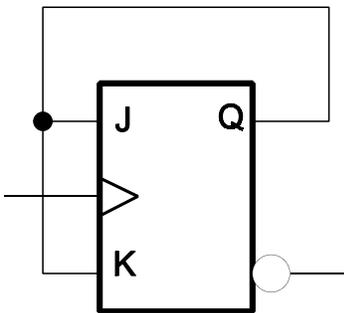
Show how to simplify the Boolean expression $(ABC'+C)(A+C)$ to be $A B + C$ using Boolean algebra.

Problem 2. (10 points)

The contents of an eight-bit shift register is initially 00110110. The register is shifted left three times with the serial input being 010. What is the contents of the shift register after each shift?

Problem 3. (15 points)

What is the value on the Q' output of the JK flipflop in the following diagram after the circuit is clocked (using the clock input, of course) for the third time?



Problem 4. (15 points)

Show how to construct a 4-to-1 multiplexer from three 2-to-1 multiplexers. (Draw your answer on the back of this page.)

Problem 5. (15 points)

Suppose you are given a $1\text{G} \times 16$ bit ROM chip.

How many address input lines does the chip have?

How many data input lines does the chip have?

How many data output lines does the chip have?

How many bytes are stored in the chip?

Problem 6. (30 points)

A sequential circuit with two inputs x and y , a single output z , and one D flip-flop A is described by the following equations.

$$z = A + x y$$

$$D_A = A' + x'$$

Suppose you have to recreate the circuit, *but* using a JK flipflop rather than a D flipflop. What are the logical functions you'd use to compute J_A and K_A ?

$$J_A =$$

$$K_A =$$

You may find the following tables useful. (You really don't need to do the z output to complete this problem.)

A	x	y	D_A	z	J_A	K_A
0	0	0				
0	0	1				
0	1	0				
0	1	1				
1	0	0				
1	0	1				
1	1	0				
1	1	1				

for Karnaugh maps