Université d'Ottawa
Faculté de génie

uOttawa

L'Université canadienne
Canada's university

University of Ottawa
Faculty of Engineering

ITI 1100

SAMPLE FINAL EXAM

Name:

Student Number:

Good Luck!

Question 1 (8 points)

a. The solutions to the quadratic equation $x^2 - 10x + 14 = 0$ are $x = 2$ and $x = 6$. What is the base of the numbers? Show your work.

b. Show that the dual of the exclusive-OR is equal to its complement.

c. Find the complement of $F = wx + yz$; What is the value of FF' ?

Question 2 (8 points)

A majority circuit is a combinational circuit whose output is equal to 1 if the input variables have more 1's than 0's. The output is 0 otherwise.

Design a 3 input majority circuit by finding the circuit's truth table, Boolean equation and a logic diagram.

Question 3 (11 points)

Design a combinational circuit that generates the 9's complement of a BCD digit by finding the circuit's truth table, Boolean equation and a logic diagram.

Question 4 (5 points)

A combinational circuit is specified by the following two Boolean functions:

$F_1(A,B,C) = \sum(1,4,6)$
$F_2(A,B,C) = \sum(3,5)$

Implement the circuit with a decoder. Use a block diagram for the decoder and use NAND gates for the gates connected to the decoder outputs.

Question 5 (8 points)

Implement the following Boolean function with a multiplexer.

$F(A,B,C) = \sum(2,4,6)$

Question 6 (11 points)

A PN flip-flop has four operations: clear to 0, no change, complement, and set to 1, when the inputs P and N are 00, 01, 10, and 11, respectively.

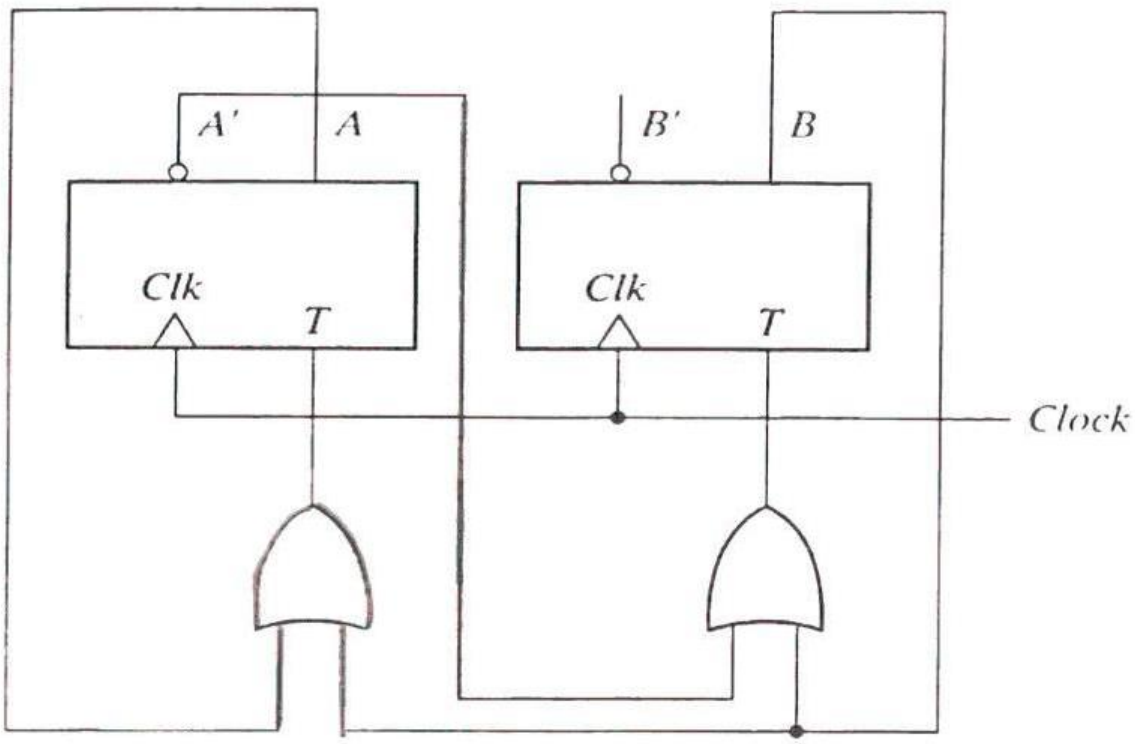
a. Tabulate the characteristic table.

b. Derive the characteristic equation.

c. Tabulate the excitation table or the transition table.

Question 7 (8 points)

Derive the state table, state equations and the state diagram of the following sequential circuit:



Question 8 (10 points)

For the following state table:

Present State	Next State		Output	
	x = 0	x = 1	x = 0	x = 1
a	e	d	0	0
b	d	c	0	1
c	a	e	1	0
d	a	b	1	0
e	d	c	0	1

a. Draw the corresponding state diagram.

b. Tabulate the reduced table.

c. Draw the state diagram corresponding to the reduced state table.

d. Starting from state a, and the input sequence 0111000, determine the output sequence for the above reduced state table.

Question 9 (12 points)

a. The contents of a four-bit register is initially 0110. The register is shifted six times to the right with the serial input being 1011100. What is the content of the register after each shift.

b. List the sequence of states produced with 3 and 4 flip-flops in a Johnson counter. The initial value of the register is 000 and 0000 respectively.

c. A Johnson counter with *n* flip-flops produces a sequence of many states?

d. What is the characteristic equation for the complement output of a JK flip-flop?

Question 10 (8 points)

Using D flip-flops,

a. Design a synchronous counter with the following repeated binary sequence 0, 1, 2, 4, 6.

b. Draw the logic diagram of the counter.

Question 11 (11 points)

Design a 3-bit ring counter using T Flip-flops. The initial value of the register is 100. Draw the logic diagram of the counter.