Digital Design Preliminary Exam

(Fall 2019)

Problem 1	20 points
Problem 2	20 points
Problem 3	15 points
Problem 4	15 points
Problem 5	15 points
Problem 6	15 points
Total	100 points

Name and Student ID: ____

Name **(Print Please)** **Student ID**

No Calculators allowed.

Problem 1

a) Simplify the following function f indicated by the truth table:

minterm	w	x	y	z	f(output)
0	0	0	0	0	0
1	0	0	0	1	0
2	0	0	1	0	1
3	0	0	1	1	0
4	0	1	0	0	1
5	0	1	0	1	1
6	0	1	1	0	1
7	0	1	1	1	0
8	1	0	0	0	0
9	1	0	0	1	0
10	1	0	1	0	1
11	1	0	1	1	0
12	1	1	0	0	1
13	1	1	0	1	0
14	1	1	1	0	1
15	1	1	1	1	1

Problem 1 Cont'd

b) Draw the circuit at the gate level for the simplified function.

Problem 2

Design a sequential counter which counts the following sequence in the order listed: (0,1,2,3,4,5,6,0). The sequence starts at zero and ends at zero. Implement with a T-flip flop or D-flip flop. Specific the flip flop you will use.
Note: Unused states are don’t care conditions.

a. Illustrate the State Table

b. Illustrate the State Diagram

c. Draw the Sequential Circuit

Problem 3

Implement the following functions using a) Programmable Logic Array (PLA) and b) Programmable Array Logic (PAL). Illustrate the Programming Tables.

$F1 = ABC + A'BC + A'B'C'$

$F2 = AB' + A'CD$

Problem 4

Design a multiplexer to implement the following function. Use an 8 to1 or 4 to 1 implementation: Draw the multiplexer in block form.

$F(w,x,y) = w'x'y' + w'x'y + wxy + wxy'$

Problem 5

a. What is the difference between a sequential circuit and an asynchronous circuit? Give an example of both with drawings.

b. Illustrate the timing diagram of a 3 bit sequential counter that counts from 0 to 7 and is positively edge-triggered.

Problem 6

a. Explain the difference between RAM and ROM. You may do so using block diagrams.

b. Name 2 types of ROM memory.

c. How many bits (inputs) to a ROM circuit must exist if there are 256 addresses (outputs)?