# Digital Design Preliminary Exam 

(Spring 2019)

Name and Student ID: $\qquad$
Name (Print Please) Student ID

No Calculators allowed.

## Problem 1

Simplify the following function, $\mathrm{f}=\mathrm{A}^{\prime} \mathrm{B}^{\prime} \mathrm{C}^{\prime} \mathrm{D}+\mathrm{A}^{\prime} \mathrm{B}^{\prime} \mathrm{CD}^{\prime}+\mathrm{ACD}+\mathrm{ABC} \mathrm{C}^{\prime} \mathrm{D}+\mathrm{AB} \mathrm{C}^{\prime} \mathrm{D}$ using a $\mathrm{K}-$ map.

## Problem 2

Design a sequential counter which counts the following sequence in the order listed: ( $0,1,4,5,7,0$ ). The sequence starts at zero and ends at zero. Implement with a T-flip flop or D-flip flop. Specify 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.
$\mathrm{F} 1=\mathrm{A}^{\prime} \mathrm{BC}+\mathrm{A}^{\prime} \mathrm{BC}^{\prime}+\mathrm{AB}^{\prime} \mathrm{C}$
$\mathrm{F} 2=\mathrm{ABC}+\mathrm{A}^{\prime} \mathrm{B}^{\prime} \mathrm{C}^{\prime} \mathrm{D}^{\prime}$

## Problem 4

Design a 4 to 1 multiplexer to implement the following function:
$F(w, x, y)=w^{\prime} x y^{\prime}+w x y+w x y^{\prime}+w^{\prime} x^{\prime} y^{\prime}$
Draw the multiplexer in block form.

## Problem 5

a. Describe two types of clocking in a sequential circuit.
b. (1) Describe the difference between an asynchronous circuit and a synchronous circuit.
(2) Illustrate a timing diagram for each type of circuit using circuits of your creation.

## Problem 6

a. Perform the following mathematical operation using 2's complement. Both numbers are unsigned.
01000101-00111011
b. Convert A45F in hexadecimal to:
(1) binary.
(2) octal

