

Name _____

CSE140 Midterm 1, Monday January 25, 2016

Please read the following instructions carefully: If you are unclear about any of the questions on the exam, make the most plausible assumption to answer the question. Instructors and proctors will not answer questions on the exam material. Please write your name on the top of each page. Write the names of the students to your left and right in the space provided.

Name of student to your left: _____

Name of student to your right: _____

	Total Points	Points Awarded
Problem 1	20	
Problem 2	15	
Problem 3	15	
Problem 4	25	
Problem 5	25	
Total	100	

All the Best!

1 True or False

Circle your choice of true or false. Use one sentence to explain your choice.

1. There is no difference between a switching function system and a Boolean algebra system. **(4pts)**

True False

2. In a Boolean algebra system, the complement is unique (i.e. one and only one). **(4pts)**

True False

3. For every postulate (e.g. distributive law) in a Boolean algebra system, there is a dual equation. In other words, if we transform the postulate by swapping the identity elements 0 and 1 and exchanging the operators OR and AND, the transformed equation remains to be true. **(4pts)**

True False

4. An essential prime implicant can have its every on-set element covered by some other prime implicants. **(4pts)**

True False

5. For a K-map of n variables, each cell has exactly n neighbors. **(4pts)**

True False

2 Consensus Theorem

Prove the following equation using **Boolean algebra** (using the laws and theorems of Boolean algebra but not the techniques of switching function system) (15pts).

$$abd + a'bc + bcd = abd + a'bc.$$

3 Shannon's Expansion

Prove the equality of the following switching functions using **Shannon's expansion** (15pts).

$$(a + b + d)(a' + b + c)(b + c + d + e + f) = (a + b + d)(a' + b + c).$$

4 Karnaugh Map: Sum of Products Expressions

Use Karnaugh map to simplify function

$$f(a, b, c, d) = \sum m(0, 4, 5, 10, 11, 13, 15) + \sum d(2, 8, 9, 12).$$

List all possible minimal sum of products expressions. Show the Boolean expressions. No need for the logic diagram (25pts).

5 Karnaugh Map: Product of Sums Expressions

Use Karnaugh map to simplify function

$$f(a, b, c) = \sum m(1, 6) + \sum d(2, 7).$$

List all possible minimal product of sums expressions. Show the Boolean expressions. No need for the logic diagram (25pts).