

Name:

CSE 1400

Applied Discrete Mathematics

Spring 2015

Quiz 1

Score

1. (15 pts) Boolean algebra studies operations on **True** and **False**.

(a) How many truth assignments are there on n Boolean variables?

(b) How many bit strings of length n are there?

(c) How many Boolean functions ($\mathbb{B}^n \mapsto \mathbb{B}$) can be defined on n Boolean variables?

Score

2. (15 pts) Set theory preserves the algebraic structure of Boolean algebra. You could say set theory provides a visualization of Boolean algebra.

(a) Here are three Boolean operations: \vee , \wedge , and \neg . What are the corresponding set theoretic operations? (Write the symbol, name it, and explain it)

(b) How many regions are there in a diagram (universe, rectangle) with n fully intersecting sets?

(c) How many shadings are there in diagram with n fully intersecting sets?

Score

3. (15 pts) Counting can be generalized from bits to other alphabets.

(a) In how many ways can values from \mathbb{H} be assigned to n variables?

(b) How many hexadecimal strings of length n are there?

(c) How many functions ($\mathbb{H}^n \mapsto \mathbb{H}$) can be defined on n hexadecimal variables?

Score

4. (10 pts) The ability to compute quotients and remainders is important.

(a) I was given 237 widgets and told to *put* them equally into 13 boxes and count the number left over. (To put equally means put the same number in each box)

How many widgets did I put in each box and how many were left over?

(b) I was then told to *take* widgets equally from 13 boxes until 237 were taken away (-237). To keep the number taken from boxes equal, I had to take a few more.

How many widgets did I take from each box and how many extras did I have to take?

Score

5. (15 pts) Sheldon rushed in to claim the discovery a new tautology. He wrote on the board:

$$(P \vee Q) \Rightarrow (P \wedge Q)$$

Leonard quickly constructed a truth table.

(a) Mimic what Leonard did: Construct a truth table for Sheldon's claim. (Fill in, at least, the input combinations and the three indicated columns)

P	Q	column 1 ($P \vee Q$)	column 2 \Rightarrow	column 3 ($P \wedge Q$)

(b) Which column is the output column?

(c) Did Leonard agree with Sheldon?

Score

6. (10 pts) My third grade teacher, Mrs. Bevis, tried to convince us that we would never need to more than 5 digits for arithmetic: 00000 to 99999. So she taught us 10's complement arithmetic. To speak with normal people she taught us how to say 10's complement numbers in normal speak.

(a) What is the normal value of $(31415)_{10c}$?

(b) Write -31415 in 10's complement notation?

Score

7. (10 pts) Write the digits $\mathbb{D} = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$ in binary notation.

Score

8. (10 pts) Nothing is important. Everything is important. The symbol \emptyset denotes the set with nothing in it. For this question, let \mathbb{N} be the *universal* set, the set containing every important thing.

Let \mathbb{X} be a subset of \mathbb{N} . Which of the following are **True** and which are **False**. Explain your answers.

(a) $\emptyset \in \{\emptyset\}$

(b) $\emptyset \subseteq \mathbb{X}$

(c) $\emptyset \in \mathbb{N}$

(d) $\mathbb{X} \in \mathbb{N}$

(e) $\mathbb{N} \subseteq \{\mathbb{N}\}$

Total Points: 100

Wednesday, February 4, 2015