Discrete Structures Homework 5

Include your name, the homework number, and your complete work, including any steps used to obtain the answer. Submit a hard copy - written out legibly or printed - before class. *18 pts*

Section 2.1

4. For each of these pairs of sets, determine whether the first is a subset of the second, the second is a subset of the first, or neither is a subset of the other. *(2 pt)*

a) the set of people who speak English, the set of people who speak English with an Australian accent
b) the set of fruits, the set of citrus fruits
c) the set of students studying discrete mathematics, the set of students studying data structures

14. Use a Venn diagram to illustrate the relationship $A \subseteq B$ and $B \subseteq C$. *(2 pt)*

32. Let $A = \{a,b,c\}$, $B = \{x,y\}$, and $C = \{0,1\}$. Find *(2 pt)*

a) $A \times B \times C$ b) $C \times B \times A$
c) $C \times A \times B$ d) $B \times B \times B$

42. Translate each of these quantifications into English and determine its truth value. *(2 pt)*

a) $\exists x \in \mathbf{R}\ (x^3 = -1)$ b) $\exists x \in \mathbf{Z}\ (x + 1 > x)$
c) $\forall x \in \mathbf{Z}\ (x - 1 \in \mathbf{Z})$ d) $\forall x \in \mathbf{Z}\ (x^2 \in \mathbf{Z})$

Section 2.2

2. Suppose that A is the set of sophomores at your school and B is the set of students in discrete mathematics at your school. Express each of these sets in terms of A and B. *(2 pt)*

a) the set of sophomores taking discrete mathematics in your school
b) the set of sophomores at your school who are not taking discrete mathematics
c) the set of students at your school who either are sophomores or are taking discrete mathematics
d) the set of students at your school who either are not sophomores or are not taking discrete mathematics

4. Let $A = \{a,b,c,d,e\}$ and $B = \{a,b,c,d,e,f,g,h\}$. Find *(2 pt)*

a) $A \cup B$ b) $A \cap B$
c) $A - B$ d) $B - A$

12. Prove the first absorption law from Table 1 by showing that if A and B are sets, then $A \cup (A \cap B) = A$. *(2 pt)*

24. Let A, B, and C be sets. Show that $(A - B) - C = (A - C) - (B - C)$. *(2 pt)*

52. Suppose that the universal set is $U = \{1,2,3,4,5,6,7,8,9,10\}$. Express each of these sets with bit strings where the *ith* bit in the string is 1 if i is in the set and 0 otherwise. *(2 pt)*

a) $\{3,4,5\}$
b) $\{1, 3, 6, 10\}$
c) $\{2,3,4,7,8,9\}$