CS 330 : Discrete Computational Structures

Spring Semester, 2019

ASSIGNMENT #4

Due Date: Wednesday, February 20

Suggested Reading: Rosen Sections 2.1 - 2.3; Lehman et al. Chapter 4.1, 4.3, 4.4

These are the problems that you need to hand in for grading. Always explain your answers and show your reasoning.

1. **[6 Pts]** Prove that if $A \subseteq B$ and $C \subseteq D$, then $A \times C \subseteq B \times D$.
2. **[6 Pts]** Use Venn diagrams to show that $(B - A) \cup (C - A) = (B \cup C) - A$.
3. **[6 Pts]** Use an iff argument to prove that $(B - A) \cup (C - A) = (B \cup C) - A$. Use logical equivalences in your proof.
4. **[8 Pts]** Disprove the statements below.
   (a) If $A - C = B - C$ then $A = B$.
   (b) If $A \cap C = B \cap C$ then $A = B$.
5. **[8 Pts]** Prove that if $A - C = B - C$ and $A \cap C = B \cap C$ then $A = B$.
6. **[8 Pts]** Prove that $\overline{A \cup B} = \overline{A} \cap \overline{B}$. To prove $S = T$, where S and T are sets, prove that each set is a subset of the other. To prove $S \subseteq T$, prove that if any element x is in S then it is in T. You *may not* use logical equivalences in your proof. Use general proof techniques like 'proof by contradiction' and 'proof by cases'.
7. **[4 Pts]** Prove that $f(n) = 5n + 12$ is one-to-one, where the domain and co-domain of f is $\mathcal{Z}^+$. Show that f is not onto.
8. **[4 Pts]** Prove that $f(m, n) = 3mn$ is onto, where the domain of f is $\mathcal{R} \times \mathcal{R}$ and the co-domain of f is $\mathcal{R}$. Show that f is not one-to-one.

For more practice, you are encouraged to work on the problems given in Rosen Sections 2.1 - 2.3 and Lehman et al. Chapter 4.1, 4.3, 4.4.