CS 230 : Discrete Computational Structures

Spring Semester, 2019
ASSIGNMENT #2
Due Date: Monday, February 4

Suggested Reading: Rosen Sections 1.4 - 1.6; LLM Chapter 3

These are the problems that you need to turn in. For more practice, you are encouraged to work on other problems. Always explain your answers and show your reasoning.

1. **[4 Pts]** Translate the sentence "All bears can swim and catch fish." using three predicates. Then, state the negation of the statement with no negation to the left of the quantifier. Last, translate this back into English.

2. **[6 Pts]** Are $\forall x(P(x) \to Q(x))$ and $\forall x P(x) \to \forall x Q(x)$ logically equivalent? If yes, give a proof. If no, give a counterexample.

3. **[6 Pts]** For the following problems, let $S(x)$, $F(x)$ and $A(x, y)$ be the statements "x is a student", "x is a faculty member" and "x has asked y a question". Let the domain be all people at ISU. Translate the following sentences into logic.

   (a) There are at least two faculty members who have not asked questions to any students.

   (b) Everyone has asked a question to at least one student and at least one faculty member.

4. **[9 Pts]** LLM p.91: Problem 3.36 (a), (b), (c)

5. **[12 Pts]** LLM p.92: Problem 3.37 (a), (b), (d), (e)

6. **[13 Pts]** Define propositions or predicates and prove the following using the appropriate rules of inference:

   (a) **[4 Pts]** If there is ice or snow, then school will be closed and practice will be canceled. If school is closed, then exams will be postponed. Exams were not postponed. Therefore, it did not snow.

   (b) **[4 Pts]** Mary, a student in class, is from Minnesota. All Minnesotans know how to ice fish. Therefore, someone in class knows how to ice fish.

   (c) **[5 Pts]** All bears are good swimmers. If you can catch fish, you will not go hungry. If you can't catch fish, you are not a good swimmer. Therefore, no bears go hungry.

For more practice, you are encouraged to work on the problems given in Rosen, Sections 1.4 - 1.6 and in LLM Chapter 3.