Problem assignment 6  
*Due: October 8, 2020*

First-order Logic

Problem 1. Translation to FOL

Express the following sentences in the first-order logic. Assume that the universe of discourse are people.

a. Some students took both History and Biology class in Spring 2020.

b. At least one student failed History.

c. At least one student failed both History and Biology.

d. All students who took History also took Biology.

e. Every person who buys an insurance policy is smart.

f. No person buys an expensive insurance policy.

g. There is a woman who likes all men who are not vegetarians.

h. There is a barber who shaves all men in town who do not shave themselves.

i. No person likes a professor unless the professor is smart.

Problem 2

Argue that the following two sentences in first order logic are equivalent:

- $\forall x((\exists y Loves(x, y)) \rightarrow Happy(x))$
- $\forall x, \forall y(Loves(x, y) \rightarrow Happy(x))$

Problem 3. Translation and Inference

Consider the following paragraph:
Tony, Mike and John belong to the Alpine Club. Every member of the Alpine Club is either
a skier or a mountain climber or both. No mountain climber likes rain, and all skiers like snow. Mike dislikes whatever Tony likes and likes whatever Tony dislikes. Tony likes rain and snow.

**Part a.** Represent the above information in FOL.

**Part b.** Consider a statement: There exists a member of the Alpine Club who is a mountain climber but not a skier. Use resolution refutation to show whether the knowledge extracted from the paragraph entails the statement. Your solution should give a proof in terms of a sequence of clauses derived by applying the resolution rule to existing sentences and corresponding variable substitutions.