

## 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:

- $\forall x((\exists y \text{Loves}(x, y)) \longrightarrow \text{Happy}(x))$
- $\forall x, \forall y(\text{Loves}(x, y) \longrightarrow \text{Happy}(x))$

#### 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.