CS357 Lab 1

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[**IMPORTANT**] For every lab, make sure you get graded before leaving the lab. You must also **submit** your solutions on moodle.

1 Exercise A.

We use implication to express the standard "if...then..." argument. For example, to express the sentence "If John says well then he will win" in logic, we can let $P =$"John plays well" and $W =$"John will win" and write $P \rightarrow W$.

Express the following sentences in logic:

- If the demand has remained constant and prices have been increased, then turnover must have decreased.
- The sum of two numbers is even if and only if either both numbers are even or both numbers are odd.
- If y is an integer then z is not real, provided that x is a rational number.

2 Exercise B.

The syntax for the quantifiers can be seen as follows:

- $\forall x : U.P(x)$ to mean "for all x of type U, $P(x)$ holds."
- $\exists x : U.P(x)$ to mean "there exists an x of type U for which $P(x)$ holds."

Express the following sentences in logic, defining predicates and introducing quantified variables as appropriate.

- Every cat washes itself.
- If all dogs are mortal, Fido is mortal.
- Not every scorpion is lethal.
- Every scorpion is non-lethal.
- At least one satellite orbits Mars.
- There is a planet larger than Neptune but cooler than it.
- Every village has at least one church.

You might like to use the following predicates:

- Unary predicates: is-a-cat, is-a-dog, is-mortal, is-a-scorpion, is-lethal, is-a-satellite, is-a-planet, is-a-village, is-a-church.
- Binary predicates: washes, likes, orbits, larger-than, cooler-than, has-a.