Math 2534  Homework 3  Fall 2015
Put all work on another sheet of paper. Show all work.  No Ink. Staple papers.

Problem 1: Put the following sentences in symbolic logic using a quantifier. Define the domain and the single variable predicate for each statement

   a) Most students read a book.
   b) Every child likes dinosaurs.
   c) Not all CS majors minor in math.

Problem 2: Convert the logic statement into natural conversational English

   a) Domain D: all professors
      Predicate O(x) = x holds office hours.
      \( \forall x, x \in D \rightarrow O(x) \)
   b) Domain B: all VT students
      Predicate H(x) = x does homework.
      \( \exists x \mid x \in B \land \sim H(x) \)

Problem 3: Put into symbolic logic with multiple quantifiers and define the domains and the multi-variable predicate for each statement.

   a) There are some books that all students must read.
   b) Any student likes some sport.

Problem 4:
Given the following domains and predicate, put each of the following into conversational English.

Domain D: all marching bands (x = an arbitrary band)
Domain B: all half-time shows (y = an arbitrary half time show)
Predicate: \( P(x,y) = x \text{ preforms in } y \).

\( \exists x \mid D \forall y \in B, P(x,y) \)
\( \forall y \in B, \exists x \in D \mid P(x,y) \)
\( \exists y \mid B \forall x \in D, P(x,y) \)
\( \forall x \in D, \exists y \in B \mid P(x,y) \)
Problem 5: A discrete math class contains 2 CS majors who are a freshman, 15 engineering majors who are sophomores, 50 CS majors who are sophomores, 5 engineering majors who are juniors, and 10 CS majors who are juniors, and no senior engineering majors or CS majors. There are no double majors. Determine the truth sets for each of the statements below. (ie. The set of elements that will make the statement true—there also a possibility that the truth set is an empty set)

1) There is a student in the class who is not a junior.
2) There is a student in the class who is neither a CS major nor a sophomore.
3) There is a student in the class who is freshman and not a CS major.
4) There is a student in the class who is a sophomore and an engineering major.
5) There is a student in the class who is engineering major and a senior.

Problem 6: Prove directly or give a counter example for the following theorems.

Theorem 1: If $a$ and $b$ are odd integers and $c$ is an even integer, then $(a + c)^2 + b^2$ is even.