Homework 3 (due Monday March 8)

(1) Express the following arguments / statements as sentences of predicate logic:
   (a) Every irreflexive and transitive binary relation is asymmetric.
   (b) There is someone who is going to pay for all the breakages. Therefore, each of the
       breakages is going to be paid for by someone.
   (c) All the female chimpanzees can solve every problem. There exists at least one problem.
       Any chimpanzee who can solve a problem will get a banana. Chica is a female
       chimpanzee. Therefore, Chica will get a banana.
   (d) Sultan and Chica can solve exactly the same problems. If Sultan can solve any of the
       problems, then he will get a banana. Sultan will not get a banana. Therefore, Chica
       cannot solve any of the problems.
   (e) Everyone loves somebody and no one loves everybody, or somebody loves everybody
       and someone loves nobody.
   (f) Some people are witty only if they are drunk.

(2) For the following well-formed formula give their meaning in English under the proposed
    interpretation and state whether they are true or false. The interpretation \( I \) is defined as follows:
    The domain of discourse is the set of non-negative integers, \( P_I \) is \( = \), \( f_I \) is \( + \), \( g_I \) is \( \times \), \( a_I \) is 0 and \( b_I \) is 1.

   (i) \( \forall x \exists y (P(x, f(y, y)) \lor P(x, f(f(y, y), b))) \)
   (ii) \( \forall x \forall y (P(g(x, y), a) \rightarrow (P(x, a) \lor P(y, a))) \)
   (iii) \( \exists y (P(f(y, y), b)) \)

(3) Represent the following statements in predicate logic:
   (i) If a brick is on another brick, it is not on the table.
   (ii) Every brick is on the table or on another brick.
   (iii) No brick is on a brick which is also on a brick.

(4) Go through the web pages:
   http://people.hofstra.edu/stefan_waner/realworld/logic/logic1.html
   http://people.hofstra.edu/stefan_waner/realworld/logic/logic2.html
   ……
   http://people.hofstra.edu/stefan_waner/realworld/logic/logic7.html

Read the material and take the self assessment exercises.