

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) $\forall x \exists y (P(x, f(y, y)) \vee P(x, f(f(y, y), b)))$
- (ii) $\forall x \forall y (P(g(x, y), a) \rightarrow (P(x, a) \vee P(y, a)))$
- (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

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http://people.hofstra.edu/stefan_waner/realworld/logic/logic7.html

Read the material and take the self assessment exercises.