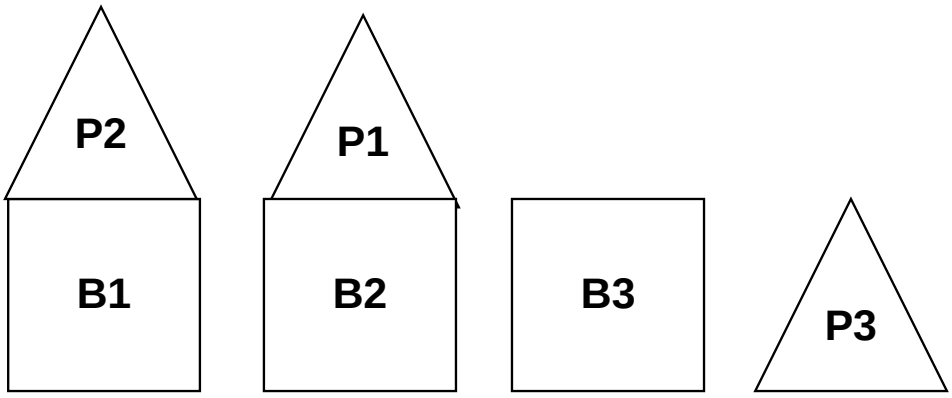
TDBB08 Logic with Applications Spring 1998b

Exercises for the group exercise session on May 8, 1998

1. Assume that the blocks world is augmented to include three cubes and three pyramids. Give a complete interpretation which characterizes the state shown below.



Use the example on page 14 of the notes on first-order logic as a guide. Give in particular:

(i) The domain of the interpretation.
(ii) The values under the interpretation of the constant symbols B1, B2, B3, P1, P2, and P3.
(iii) The values under the interpretation of the relation symbols Is_cube, Is_pyramid, On, and On_table.

2. Assuming that the set of variables is $\{x_0, x_1, x_2, \ldots\}$, give three distinct valuations for the interpretation which is your answer to question 1. Include two valuations which differ only on the value for x_0.

3. For the sentence below, do the following;
   (a) Draw the parse tree.
   (b) Identify all instances of bound, shadowed, and free variables.
   (c) Rename variables to obtain an equivalent formula in which no shadowing occcurs, and in which no variable is associated with more than one quantifier.

$$(\forall x)((\forall z)(P(x,y) \wedge (\forall x)(\forall y)R(x,y)) \rightarrow (P(x,y) \vee (\forall y)Q(x,y,z)))$$

4. Work through Exercises 9.2 and 9.3 on page193 of the textbook. Make sure in particular that you understand why the implications work in one direction but not the other.