ICS 271
Fall 2015
Instructor : Kalev Kask
Homework Assignment 6
Due Thursday November 19

1. (20) Problem 8.24 in RN.

2. (15) Say whether or not the following pairs of expressions are unifiable, and show the most general unifier for each unifiable pair:
   (a) $P(x, B, B)$ and $P(A, y, z)$
   (b) $P(g(f(v)), g(u))$ and $P(x, x)$
   (c) $P(x, f(x))$ and $P(y, y)$
   (d) $P(y, y, B)$ and $P(z, x, z)$
   (e) $2 + 3 = x$ and $x = 3 + 3$

3. (20) We are given the following paragraph:

   Tony, Mike, and John belong to the Alpine Club. Every member of the Alpine Club is either a skier or a mountain climber or both. No mountain climber likes rain, and all skiers like snow. Mike dislikes whatever Tony likes and likes whatever Tony dislikes. Tony likes rain and snow.

   Represent this information by predicate-calculus sentences in such a way that you can represent the question “Who is a member of the Alpine Club who is a mountain climber but not a skier?” as a predicate-calculus expression. Use resolution refutation with answer extraction to answer it.

4. (10) Question 9.3 in RN

5. (10) Problem 9.6 from RN

6. (10) Problem 9.13(a) from RN

7. (15) Convert the following to CNF form:
   (a) $(\exists x)[P(x)] \lor (\exists x)[Q(x)] \rightarrow (\exists x)[P(x) \lor Q(x)]$
   (b) $(\forall x)[P(x)] \rightarrow (\exists x)[(\forall z)[Q(x, z)] \lor (\forall z)[R(x, y, z)]]$
   (c) $(\forall x)[P(x)] \rightarrow Q(x, y)] \rightarrow [(\exists y)[P(y)] \land (\exists z)[Q(y, z)]]$

8. (20) Sam, Clyde, and Oscar are elephants. We know the following facts about them:
   (a) Sam is pink.
   (b) Clyde is gray and likes Oscar.
   (c) Oscar is either pink or gray (but not both) and likes Sam.

   Use resolution refutation to prove that a gray elephant likes a pink elephant; that is, prove $(\exists x, y)[Gray(x) \land Pink(y) \land Likes(x, y)].$