Homework 8

Due midnight, Thursday, 4/4/2013

Please submit your homework solutions online at `http://www.dci.pomona.edu/tools-bin/cs081upload.php`. If you have more than one file to be turned in, please put it in a folder and zip it up before turning it in.

1. (10 points) **Program Proofs**

   Problem 4.4.1a from H & R page 303. Note that it is related to problem 5 on the last homework.

2. (5 points) **LTL**

   Problem 3.2.3 from H & R page 246. You need only show the equivalence for the first formula. Notice that we don't have proof rules, so you must show the equivalence using our definition of semantics. I.e., two formulas are equivalent iff the formulas are true exactly the same models and paths.

3. (10) **Semantics of LTL**

   Problem 3.3.1ab from H & R page 247.

4. (20) **Model checking**

   We can express four desirable properties of concurrent systems in CTL as follows:

   Safety $\phi_1 = AG\neg(c_1 \wedge c_2)$.

   Liveness $\phi_2 = AG(t_1 \rightarrow AF\, c_1)$

   Non-blocking $\phi_3 = AG(n_1 \rightarrow EX\, t_1)$

   No strict sequencing $\phi_4 = EF(c_1 \wedge E[c_1\ U(\neg c_1 \wedge E[\neg c_2\ U\ c_1])])$

   Apply the labeling algorithm to check each of ϕ_1, ϕ_2 and ϕ_4 in the mutual exclusion model in Figure 3.7 (page 188) of H & R. (Note that we did ϕ_3 in class!)