Optional Project. Due Dec 18, the day OF the final. 90 points

I will only look at this after the final is graded and final grades are ABOUT to be entered. If you get a failing grade in this course (D+ or lower) then I will look at your project and, if its good enough, will bump you to a C-. Throughout this document "prove" means "give a construction and discuss why it works." What you hand in must be TYPED or VERY GOOD HANDWRITING. Write your name at the top NEATLY!!!!

NOTE- this is TWO pages long.

1. (15 points) Let L, L_1 and L_2 be regular. Prove or Disprove or state that it is unknown to science.

   (a) $L_1 L_2$ is regular.

   (b) L^* is regular.

   (c) $L^R = \{w \mid w^R \in L\}$ is regular. (RECALL that w^R is the string w written backwards. So $(aaab)^R = baaa$.)

2. (15 points) Let L, L_1 and L_2 be context free languages (CFL's). Prove or Disprove or state that it is unknown to science.

   (a) $L_1 L_2$ is CFL.

   (b) L^* is a CFL.

   (c) $L^R = \{w \mid w^R \in L\}$ is CFL.

3. (15 points) Let L, L_1 and L_2 be in P. Prove or Disprove or state that it is unknown to science.

   (a) $L_1 L_2$ is in P

   (b) L^* is in P.

   (c) $L^R = \{w \mid w^R \in L\}$ is CFL.

4. (15 points) Let L, L_1 and L_2 be in NP. Prove or Disprove or state that it is unknown to science.

   (a) $L_1 L_2$ is in NP

   (b) L^* is in NP.

   (c) L^R is in NP.

5. (15 points) Let L, L_1 and L_2 be decidable. Prove or Disprove or state that it is unknown to science.

   (a) $L_1 L_2$ is in decidable.

   (b) L^* is decidable.

   (c) L^R is is decidable.

6. (15 points) Let L, L_1 and L_2 be c.e. Prove or Disprove or state that it is unknown to science.

   (a) $L_1 L_2$ is c.e.

   (b) L^* is is c.e..

   (c) L^R is c.e.