OPTIONAL HW TO HELP YOU STUDY
I WILL BE GOING OVER THIS ON NOV 4.

1. For every language below say if its
   (1) Finite OR (2) Regular but not finite OR (3) CFL but not regular
   OR (4) P but not CFL.
   Explain your answer (NOTE- this is all for own good and not being
   collected so if you guess you are in a stupid state.)
   (a) \{w \mid n_a(w) = n_b(w) = n_c(w) = n_d(w)\}.
      \(n_\sigma(w)\) is how many times \(\sigma\) appears in \(w\).
   (b) \{a^n b^n c^n \mid n \in \mathbb{N}\}.
   (c) \{a^n b^m c^n \mid n, m \in \mathbb{N}\}.
   (d) \{a^{2n} b^{3n} \mid n \in \mathbb{N}\}.
   (e) \{a^n b^n c^{2n} \mid n \in \mathbb{N}\}.
   (f) \{a^n \mid n \in \mathbb{N}\}.
   (g) \{a^{2n+5} \mid n \in \mathbb{N}\}.
   (h) \{a^n \mid n \text{ is an even prime}\}.

2. For each of the following say if its true or false. If true then prove it, if
   false then give a counterexample
   (a) If \(L_1\) and \(L_2\) are Reg then \(L_1L_2\) is Reg.
   (b) If \(L_1\) and \(L_2\) are CFL’s then \(L_1L_2\) is a CFL.
   (c) If \(L_1\) and \(L_2\) are in P then \(L_1L_2\) is in P.
   (d) If \(L\) is Reg then \(L^*\) is Reg.
   (e) If \(L\) is CFL then \(L^*\) is CFL.
   (f) If \(L\) is in P then \(L^*\) is in P.

3. Let \(L \in DTIME(T(n))\).
   (a) Give an algorithm for \(L^*\).
   (b) Fill in the following sentence: My Algorithm shows that \(L^*\) is in
       \(DTIME(XXX(n))\).

4. Show that there exists a decidable language that is NOT in \(DTIME(2^n)\).