1. Regular Languages
   (a) [5] What are the two techniques to prove a language is regular?
   (b) [10] Use these two techniques to prove the language of all strings with an even number of 0's and an odd number of 1's is regular

2. [15] Pumping lemma (PDA)
   (a) Show that L = $\{a^n b^m \mid n > m, m \geq 0\}$ is not regular
   (b) Show that L = $\{a^n b^m \mid n \leq m, n \geq 0\}$ is not regular
   (c) Prove or disprove the following statement: If L1 and L2 are nonregular languages, then L1 $\cup$ L2 is also nonregular

3. Consider the decimal integer system. The first digit cannot be a 0 unless its value is zero.
   (a) [5] Write down the regular expression that generates the language L of all decimal integer numbers.
   (b) [10] Use Thompson's construction to find its NFA that accepts L(G)
   Note: Must follow the Thompson's construction algorithm to build NFA
   (c) [10] Convert the NFA to a DFA
   Note: must use the subset construction algorithm
   (d) [5] Minimize the DFA

4. [15] Is it possible to find a DFA that accepts the same language as the PDA M?
   $M = (\{q0, q1\}, \{a, b\}, \{z\}, \delta, q0, z, \{q1\})$
   with
   $\delta(q0, a, z) = \{(q1, z)\}$
   $\delta(q0, b, z) = \{(q0, z)\}$
   $\delta(q1, a, z) = \{(q1, z)\}$
   $\delta(q1, b, z) = \{(q0, z)\}$

5. [10] Eliminate left recursion from the grammar
   E → E sub E
   E → E sup E
   E → E sub E sup E
   E → id

6. Consider the following grammar G
   exp → *atom* | *list*
   atom → **num** | **id**
   list → (*exp-list*)
   exp-list → *exp-list exp* | *exp*
   (a) [5] Remove the left recursion
   (b) [5] Write down the FIRST and FOLLOW sets for all nonterminals of G'
   (c) [5] Show the predictive parsing table of G'
   (d) [5] Show the process of parsing the string "(a (b (2)) (c))" by the predictive parser