I. [56] Consider the following grammar G:
   1. $S \rightarrow X \perp$
   2. $X \rightarrow A \ 1 \ B$
   3. $X \rightarrow 2$
   4. $A \rightarrow 2$
   5. $B \rightarrow A$

   For each of the following grammar classes, if G is of that class, give the appropriate parsing table. If it is not of that class, fully explain why it isn’t.
   (a) LL(0)
   (b) LL(1)
   (c) LR(0)
   (d) LR(1)
   (e) SLR(1)
   (f) LALR(1)
   (g) Operator precedence

II. [11] What is k and EXPLAIN WHY for each of the following:
   (a) What is the minimal value of k for which a Polish postfix grammar is LR(k)?
   (b) What is the minimal value of k for which a Polish prefix grammar is LR(k)?
   (c) What is the minimal value of k for which a grammar for miniscript is LR(k)?

III. [15] For the regular expression
      \[(0 \ | \ 1)^* \ 0 \ 1 \ (0 \ | \ 1)^*\]
   (a) Give the minimal state DFA that recognizes the same set?
   (b) Give the regular grammar that recognizes the same set?
   (c) Give the syntax diagrams for the regular grammar in (b) above.

IV. [18] Answer each of the following:
   (a) If S is a regular set, show that $S'$ is regular. ($S'$ means S-reversed. That is, $abc \in S$ if and only if $cba \in S'$)
   (b) Consider $S'$ (from part (a) above). Is $(S \cap S')$ regular, context free, or context sensitive? (Choose the smallest class.) Prove your answer.
   (c) Why is the following not LR(k) for any k? \( \{x^a y^b z^c \mid a=b \text{ or } b=c, \ a>0, \ b>0, \ c>0\} \)