

Answer all questions in the exam book. You may keep the exam questions after you are done.

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

$$(0 | 1)^* 01 (0 | 1)^*$$

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