

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

I. [64] Consider the following grammar G:

1. $S \rightarrow X \perp$
2. $X \rightarrow YX$
3. $X \rightarrow \epsilon$
4. $Y \rightarrow 1Y$
5. $Y \rightarrow 2$

(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.

- 1) LL(0)
- 2) LL(1)
- 3) LR(0)
- 4) LR(1)
- 5) SLR(1)
- 6) LALR(1)
- 7) General precedence

(b) Show that the LANGUAGE generated by grammar G is a regular language.

II. [18] Answer each of the following:

a) [3] Assuming the usual grammar for expressions, give the Polish Postfix for the expression: $((4+2*3+7)+8*5)$

b) [3] If the grammar for an expression is given by the grammar:

$$E \rightarrow E + T \mid E - T \mid E * T \mid E / T \mid T$$

$$T \rightarrow \text{digit} \mid (E)$$

Give the parse tree for the expression in (a).

c) [3] Using the grammar in (b), give the Postfix for the expression in (a).

d) [3] Give a set of quads that would be the output for the Postfix in (c).

e) [6] What is the minimal value of k for which a Polish postfix grammar is LR(k) (i.e., a grammar that generates Polish postfix strings)? Explain why.

III. [15] For the regular expression

$$(0 \mid 1)^* 101 (0 \mid 1)^*$$

(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. [3] Why do you want only synthesized attributes in YACC (or Bison or CUP)? What would happen if you defined YACC with inherited attributes?