

T-106.4200 Introduction to Compiling

Exam Oct. 25, 2010

Examiner: Jorma Tarhio

No written material is allowed in this exam. Submit at least one answer sheet, even if an empty one! Write on *each* answer sheet you submit the code of the course, the date, your name, and your student ID number.

1. Answer shortly to the following questions:

- (a) What is a lookahead symbol?
- (b) What is an LR(0) item?
- (c) To which direction do attribute values go in an S-attributed grammar?
- (d) Why top-down parsing methods cannot handle left-recursive grammars?
- (e) What is the difference between dynamic binding and static binding?

(10 p)

2. Construct an NFA for $((a|b) c)^*$ using Thompson's method.

(8 p)

3. (a) Consider a small language using only the letters z, o, and the slash character '/'. A comment in this language starts with /o and ends after the very next o/. Comments do not nest. Give a regular expression that describes exactly every possible complete comment.

(b) Give a context-free grammar (without regular expressions) which describes the same language as the regular expression $((a|b) c)^*$. (8+5 p)

4. Consider the following grammar:

$$A \rightarrow BeBc \mid DcDe$$
$$B \rightarrow bB \mid \varepsilon$$
$$D \rightarrow dD \mid \varepsilon$$

(a) Compute the FIRST and FOLLOW sets of the nonterminals.

(b) Construct the LL(1) parsing table.

(c) Is the grammar LL(1)? Why?

(5+7+2 p)

P.T.O.

5. Write an attribute grammar that computes the number of executed statements for a program conforming to the grammar below. Use the fact that the number of times a loop executes can be computed from the two constants that specify the range of the loop variable. You may assume that the lower bound of the range is less than or equal to the upper bound.

Program \rightarrow Stm-list

Stm-list \rightarrow Stm ';' Stm-list

Stm-list \rightarrow Stm

Stm \rightarrow 'for' Var '=' Const 'to' Const '{' Stm-list '}'

Stm \rightarrow Ass-stm

(10 p)