Computer Science 320: Midterm Examination

March 13, 2007

You have 1.5 hours to answer the following six questions. This midterm is closed book/closed notes. For partial credit, show all work. Put your name on every page. Write out and sign the Honor Code pledge before turning in the test.

"I pledge my honor that I have not violated the Honor Code during this examination."

Problem 1: (12%)
Build a *Deterministic Finite Automaton* (DFA) that recognizes the following regular expression:

$$(a\,|\,b)* \quad | \quad (a\,|\,c)*$$

Problem 2: (11%)

Derive a context free grammar for the regular expression in Problem 1.

Problem 3: (11%)

Write a single inference rule for the type checking of ML's if-then-else expression.

Problem 4: (11%)

Prove that the following grammar is ambiguous:

$$S \to S + S \qquad\qquad\qquad S \to S \text{ - } S$$
$$S \to \text{a}$$

Problem 5: (11%)

Is the following grammar in LR(0)? Prove your answer in an organized manner.

$$S' \to S \; \$$$
$$S \to \text{a } E \text{ a} \qquad\qquad\qquad S \to \text{b } E \text{ b}$$
$$S \to \text{a } F \text{ b} \qquad\qquad\qquad S \to \text{b } F \text{ a}$$
$$E \to \epsilon \qquad\qquad\qquad\qquad F \to \epsilon$$

Problem 6: (11%)

Is the Problem 5 grammar in LR(1)? Prove your answer in an organized manner.

Problem 7: (11%)

Is the Problem 5 grammar in SLR(1)? Prove your answer in an organized manner.

Problem 8: (11%)

Is the Problem 5 grammar in LALR(1)? Prove your answer in an organized manner.

Problem 9: (11%)

Is the Problem 5 grammar in LL(1)? Prove your answer in an organized manner.