

Computer Science 320: Midterm Examination

March 14, 2013

Name _____

You have 1:20 to answer the following questions. This midterm is closed book/closed notes. For partial credit, show all work. Put your name on the bottom of every page. Write out and sign the Honor Code pledge on this page before turning in the test.

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

Problem 1: (55%)

For each of the following: If a *Deterministic Finite Automaton* (DFA) exists, show one. If a DFA cannot exist, explain why not. Transitions can be labeled with any number of symbols (understood as an alternation of symbols written as “a,b,c”), but cannot otherwise contain regular expressions.

A: A DFA that accepts all palindromic strings of three symbols in the alphabet a, b (palindrome = reads the same forward and backward).

B: A DFA that accepts all strings of a, b such that the number of a 's is divisible by 3.

C: A DFA that accepts strings accepted by this *Context Free Grammar* (CFG):

$$S' \rightarrow S\$$$

$$S \rightarrow b A c$$

$$S \rightarrow B c$$

$$A \rightarrow d$$

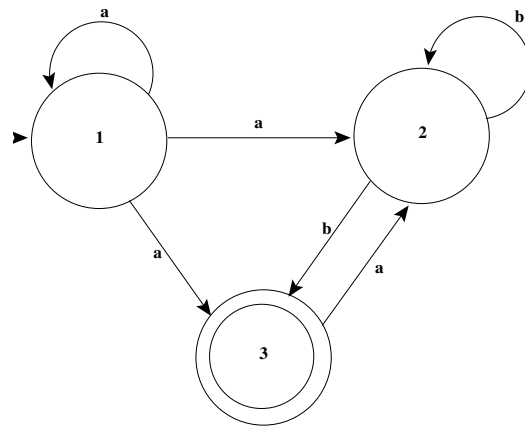
$$A \rightarrow A a B$$

$$B \rightarrow d$$

D: A DFA that implements this *Regular Expression* RE:

$(ab | c)^*ba$

E: A DFA that implements this *Non-deterministic Finite Automaton* NFA:



Problem 2: (20%)

Prove that the following grammar is in LR(1).

$$S \rightarrow E \$$$

$$E \rightarrow T + E$$

$$E \rightarrow T$$

$$T \rightarrow x$$

Problem 3: (16%)

Write “TRUE” or “FALSE”:

1. Every DFA can be algorithmically transformed into an equivalent NFA.

2. ML-YACC is a LALR parser generator. _____
3. There are languages that can be generated by a regular expression that cannot be generated by any context-free grammar. _____
4. Given a predictive parsing table for a grammar, if the table contains no duplicate entries then a predictive parser can be built for that grammar.

5. The only way to eliminate a shift-reduce conflict from a grammar is to rewrite the grammar. _____
6. LL(1) parsing has the same “parsing power” as LR(1). _____
7. If a program specifies two functions with the same name, the error should be reported by the compiler’s lexer. _____
8. The abstract syntax tree is the concrete parse tree with redundant punctuation tokens. _____

Problem 4: (9%)

You are defining the calling convention for a new machine. What would feature or property would you include in your stack frame design to support:

A: Functions with a variable number of arguments.

B: Nested functions.

C: Dynamic allocation of stack space.