CSC 330 Principles of Programming Language

Exam I

Name: _____

Total: 28 points (9 questions)

1. (2 points) Give the formal description of the machine below (treat <RESET> as a single symbol)



2. (3 points) NFA to DFA



- 3. (2 points) Let $S = \{+, -, \times, \div\}$. What is $\mathcal{P}(S)$? (Powerset)
- 4. (2 points) For each of the following languages, give two strings having six letters that are members and two strings that are not members. Assume the alphabet $\Sigma = \{a, b\}$. (If there is no answer, answer "NA")
 - (a) $a^* \cup (b^* a)$
 - (b) $\Sigma^* a \Sigma^* b \Sigma^*$
- 5. (3 points) Convert the two from the previous question: Q4(a) and (b), to NFA.

- 6. (4 points) Give DFAs recognizing the following languages. In all parts, the alphabet $\Sigma = \{0, 1\}$.
 - (a) $\{w \mid \text{starts with 0 and has odd length}\}$
 - (b) $\{w \mid \text{every odd position of } w \text{ is a 1} \}$

7. (5 points) Consider the language that the following grammar defines ($\Sigma = \{0, 1\}$):

$$A \to 0A1 \mid 1A0 \mid \varepsilon$$

- (a) Write two strings that are in this language and have six numbers.
- (b) Write twp string that is not in this language and has six numbers.
- (c) Give an informal description of pushdown automata for the language.Can your pushdown automata be deterministic?

8. (4 points) Give context-free grammars that generate the languages Q4(a) and (b).

9. (3 points) Using the given rules, draw the derivation tree for the statement.



if iszero succ pred 0 then succ succ pred 0 else pred succ succ 0