**COT 4210 (Discrete Structures II) Exam #1**

**September 22, 2011**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Note: Please justify your answer to each question. No answer, even if it is correct, will be given full credit without the proper justification.**

1) (10 pts) Create a DFA that accepts strings that don’t have more than two consecutive 0s or two consecutive 1s. Let the alphabet for this language be {0, 1}. Clearly label the start state, all accept states and all transitions. Briefly justify why the DFA you have created accepts this language, exactly.

2) (15 pts) Create a DFA equivalent to the NFA described below using the algorithm shown in class and discussed in the text.

Q = {1, 2, 3, 4}, q0 = 1, F = {3}, Σ = {0, 1}

|  |  |  |  |
| --- | --- | --- | --- |
| δ | a | b | ε |
| 1 | 1,2 | 3,4 | --- |
| 2 | 1,4 | --- | --- |
| 3 | 4 | --- | 2 |
| 4 | --- | 3,4 | --- |

3) (15 pts) Consider converting a DFA to a regular expression. In the process, a GNFA is created and the states of the GNFA are ripped out one by one. The picture below represents a GNFA with four states: s, 1, 2, and f, where s is the designated start state and f is the designated accept state. Using the algorithm shown in class for ripping out a state from a GNFA, show the result of ripping out state 1.

 

4) (15 pts) Prove that the following language over the alphabet {0, 1} is NOT regular via the Pumping Lemma:

 L = { w | w contains more 0s than 1s }

5) (20 pts) Convert the following grammar with the alphabet {0,1}, variables S, A, B, and the start symbol S into Chomsky Normal Form:

 S → A01B | A1A

 A → 1A0 | B

 B → ε | 11B

6) (15 pts) Define wdouble to be the same string as w, but with each letter copied twice, in order. For example, if w = 0110, then wdouble = 00111100. If w = 10110, then wdouble = 1100111100. Also, define wR to be the reverse string of w. Thus, if w = 1101, then wR = 1011. Create a PDA over the alphabet Σ ={0,1} that accepts the following language:

 L = { w(wdouble)R | w $\in $ Σ\* }

Clearly indicate the start state, accept states, extra characters in the tape alphabet, and mark the transitions as indicated in the textbook (char read, char pop → char push).

7) (9 pts) Prove or disprove: If L1 and L1 $∩$ L2 are both regular languages, then L2 is a regular language.

8) (1 pt) Who hosts the popular news show, Anderson Cooper 360°? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_