COT 4210 Quiz #1 Part A

2/4/2021

Note: This quiz (both parts A and B) will count for 9% of the course grade instead of 10%. The quiz 0 grade counted for 1% of the course grade, and together with this quiz, totals 10%.

1) (9 pts) Design a DFA over the alphabet $\Sigma = \{a, b\}$ that accepts all strings that either start with ab or end with ab. Please clearly mark the start state, all accept states, and all transitions with clearly labeled arrows. (Examples of strings in the language are abbbbbbabba, bbaaab and abab. Examples of strings not in the language are a, b, and aabba.)

2) (9 pts) Design an NFA over the alphabet $\Sigma = \{0, 1, 2\}$ that accepts all strings that contain the subsequence 2, 0, 1, 2. Note: a subsequence is a subset of items in a sequence which appears in the same order within the larger sequence. For example, the sequence 0, 0, 0, 1, **2**, 1, **0**, 2, **1**, 0, **2**, 1, contains the subsequence 2, 0, 1, 2 (highlighted). Please clearly mark the start state, all accept states, and all transitions with clearly labeled arrows. (An example of a string not in the language is **2**22221111111**0**0000022222**1**111100001. The bold characters identify the "best choice" for the subsequence, but there is no 2 following the bolded 1, which is why the string isn't in the language.)

3) (6 pts) Give a regular expression for the language of all strings over the alphabet {a, b} that does NOT contain two consecutive a's. (Examples of strings that belong to this language are abbb, ababa, and bbbb. Examples of strings not in the language are: bbbbaa, abaa, and abbbabaabb.)

COT 4210 Quiz #1 Part B

2/4/2021

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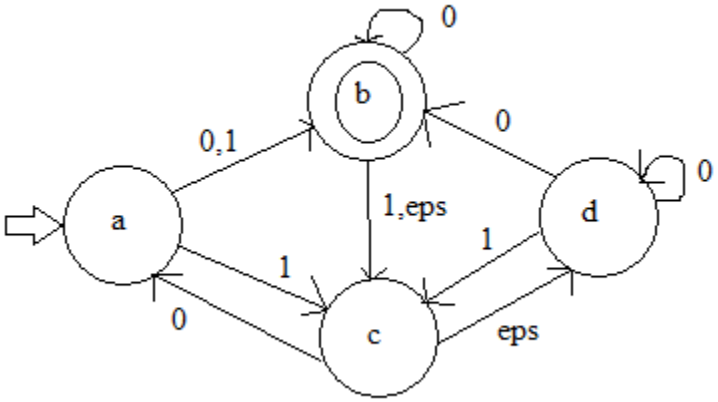
4) (10 pts) Below is an NFA with states Q = {a, b, c, d}, the alphabet Σ = {0, 1}, and the start state q_0 = a. Convert this NFA to an equivalent DFA using the algorithm shown in class. Only include reachable states in your DFA. Label the states in your DFA with each letter from the subset of states it represents. For example, if one could be in state a, c or d in the NFA, please label the corresponding state in the DFA acd. Draw your DFA using the previously stated guidelines.



5) (10 pts) Let L = { w | w contains twice as many a's as b's} be a language over the alphabet {a, b}. Using the pumping lemma, prove that L is NOT regular.

6) (1 pt) From what country did the coffee called "Café Cubano", originate?