CPSC 313 — Quiz #1
September 27, 2018

Name: ____________________________________________

Tutorial Section (circle one):

T01 (Mon 12:00)   T02 (Mon 17:00)   T03 (Wed 12:00)   T04 (Wed 17:00)

Please **DO NOT** write your ID number on this page.

No Aids Allowed.

Answer all questions on the quiz sheet.

Total marks: 25
1. Answer true or false to each of the questions below. No explanations are necessary; just state your answer.

(a) [1 mark] Every regular language is accepted by some DFA.

(b) [1 mark] There exist languages that are accepted by some NFA, but by no DFA.

(c) [1 mark] The language $L = \{0\}^*$ consisting of the strings $\varepsilon, 0, 00, 000, 0000 \ldots$ is regular.

(d) [1 mark] Every finite language is regular.

(e) [1 mark] The language $L = \{w \in \{0, 1\}^* \mid w \text{ has even length}\}$ is regular.
2. Consider the DFA $M$, defined over the alphabet $\Sigma = \{0, 1\}$, with the following transition diagram.

(a) [3 marks] Give a formal description of $M$.

(b) [2 marks] Write down the sequence of states that $M$ assumes on input string $w = 11010$. Does $M$ accept $w$?

(c) [2 marks] Write down the sequence of states that $M$ assumes on input string $w = 0110010$. Does $M$ accept $w$?

(d) [3 marks] Give a set-theoretic description of the language of $M$. You only need to state your result, no proof is necessary.
3. (a) [5 marks] Give a state diagram of an NFA that accepts the language

\[ L = \{ w \mid w \text{ contains the substring 00 or the substring 010} \} \]

defined over the alphabet \( \Sigma = \{0, 1\} \), and using at most 4 states.

(b) [5 marks] In this question, you will provide a partial proof of correctness of your NFA of part (a). Prove that

\[ L \subseteq L(M) , \]

where \( M \) is your NFA of part (a). Continue your proof on the next page if necessary. (You need not prove \( L(M) \subseteq L \).)
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