Computer Science 456/656 Spring 2019 Practice for first Examination

Name:_____

No books, notes, scratch paper, or calculators. Use pen or pencil, any color. Use the rest of this page and the backs of the pages for scratch paper. If you need more scratch paper, it will be provided.

The entire examination is 150 points.

1. True or False. [5 points each]

   (a) _____ Every subset of a regular language is regular.

   (b) _____ Let L be the language over $\Sigma = \{a, b\}$ consisting of all strings of the form $a^m b^n$, where $m, n \geq 0$. Then L is a regular language.

   (c) _____ The complement of every regular language is regular.

   (d) _____ The Kleene closure of every context-free language is context-free.

   (e) _____ The intersection of any two regular languages is regular.

   (f) _____ The language consisting of all hexadecimal numerals for positive integers n such that $n \ \% \ 5 = 1$ is regular.

   (g) _____ The language consisting of all hexadecimal numerals for positive integers n such that $n^2 \ \% \ 5 = 1$ is regular.

   (h)

2. [5 points each blank] Fill in the blanks.

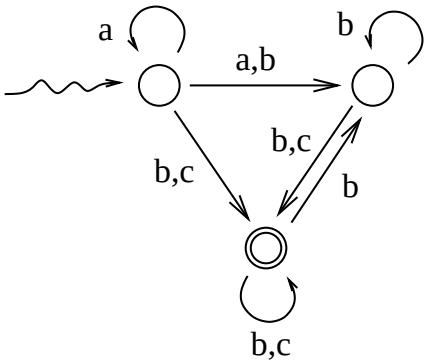
   (a) Name two classes of machines that accept the class of regular languages. _____

   and _____.

   (b) If a machine M is _____, there is at most one legal move M can make from any give configuration.

3. [25 points] Draw an NFA with five states which accepts the language described by the regular expression $(0+1)^*1(0+1)(0+1)(0+1)$

4. [25 points] Write a regular expression for the language accepted by the following NFA. If your answer is unnecessarily long by a wide margin, I might mark it wrong even if it's right.



Find a Regular Expression

5. [15 points] State the pumping lemma. The space below is enough. If you go over that space, either your writing is extremely large, or you're writing too much.

6. [30 points] Consider the NFA whose transition diagram is drawn below, where the input alphabet is $\{a, b, c\}$. Draw the transition diagram of an equivalent minimal DFA. Show your steps.

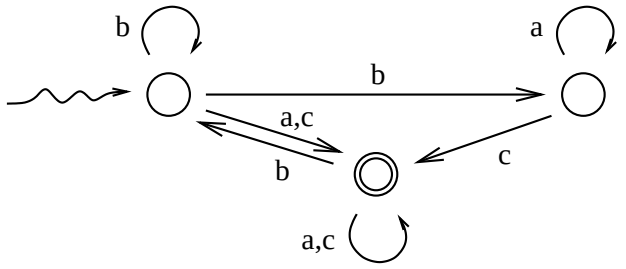


Figure 1: Find a minimal DFA equivalent to this NFA