CPSC 351 — Tutorial Exercise #7
Additional Practice Problems

About These Problems

These problems will not be discussed during the tutorial, and solutions for these problems will not be made available. They can be used as "practice" problems that can help you practice skills considered in the lecture presentation for Lecture #7, or in Tutorial Exercise #7.

Practice Problems

1. Each of the following is a regular expression over the alphabet $\Sigma = \{\mathtt{a}, \mathtt{b}, \mathtt{c}, \mathtt{d}\}$. Give a brief description of the ***language*** of these regular expressions in simple English (or using set-theoretic notation, if this is easier for you to do).

   (a) $(((\mathtt{a})^\star \circ (\mathtt{b})^\star) \cup ((\mathtt{c})^\star \circ (\mathtt{d})^\star))$

   (b) $(((\mathtt{a} \circ \mathtt{b})^\star \cup ((\mathtt{c} \circ \mathtt{d}))^\star)$

   (c) $(((\mathtt{a} \circ \mathtt{b}) \cup (\mathtt{c} \circ \mathtt{d})))^\star$

   (d) $(((\Sigma)^\star \circ (((\mathtt{a} \circ \mathtt{b}) \circ \mathtt{c}) \circ \mathtt{d})) \circ (\Sigma)^\star)$

2. Give regular expressions over the alphabet $\Sigma = \{\mathtt{a}, \mathtt{b}, \mathtt{c}, \mathtt{d}\}$ for each of the following sets, and explain ***briefly*** why your answer is correct.

   (a) The set of strings in $\Sigma^\star$ with length *at most* three.

   (b) The set of strings in $\Sigma^\star$ that end with either "$\mathtt{c}$" or "$\mathtt{d}$".

   (c) The set of strings $\omega \in \Sigma^\star$ such that $\mathtt{aa}$ is a substring of ω.

   (d) The set of strings $\omega \in \Sigma^\star$ such that $\mathtt{aa}$ is *not* a substring of ω.

   Note: Part (d) is more challenging than the previous parts of this question (and it is certainly OK if you do not know how to solve this problem).