

Exercise 1

1. Describes the languages denoted by the following regular expressions:
 - a. $a(a|b)^*a$.
 - b. $((\epsilon|a)b^*)^*$.
 - c. $(a|b)^*a(a|b)(a|b)$.
 - d. $a^*ba^*ba^*ba^*$.
 - e. $(aa|bb)^*((ab|ba)(aa|bb)^*(ab|ba)(aa|bb)^*)^*$.
2. Write regular definitions for the following languages:
 - a. All strings of lowercase letters that contain the five vowels in order.
 - b. All strings of lowercase letters in which the letters are in ascending lexicographic order.
 - c. Comments, consisting of a string surrounded by `/*` and `*/`, without an intervening `*/`, unless it is inside double-quotes (`"`)
 - d. All strings of digits with no repeated digits. Hint: Try this problem first with a few digits, such as `{0, 1, 2}`.
 - e. All strings of a's and b's that do not contain the substring `abb`.
 - f. All strings of a's and b's that do not contain the subsequence `abb`.
3. Write character classes for the following sets of characters:
 - a. The first ten letters (up to "j") in either upper or lower case.
 - b. The lowercase consonants.
 - c. The "digits" in a hexadecimal number (choose either upper or lower case for the "digits" above 9).
 - d. The characters that can appear at the end of a legitimate English sentence (e.g., exclamation point)
4. Design finite automata (deterministic or nondeterministic) for this language
 - a. All strings of digits with no repeated digits. Hint: Try this problem first with a few digits, such as `{0, 1, 2}`.
5. Convert the following regular expressions to deterministic finite automata:
 - a. $(a|b)^*$
 - b. $(a^*|b^*)^*$
 - c. $((\epsilon|a)|b^*)^*$
 - d. $(a|b)^*abb(a|b)^*$