CSE105 Section B Sample Questions

1. Give the state diagram of an NFA over the alphabet \{ a, b \} that accepts

\{ w | w has each a immediately followed by b \}

2. Give the state diagram of a DFA over the alphabet \{ 0, 1 \} that accepts

\{ w | w has \((3m + 1)\) 1's for some integer \(m \geq 0\)\}

3. Give the state diagram of an NFA over the alphabet \{ a, b \} that accepts

\{ w | w has either aa or bb as substring \}
4. Give the state diagram of a DFA over the alphabet \{ 0, 1 \} that accepts

\{ w \mid w \text{ has } 5m \text{ 1's for some integer } m \geq 0 \}

5. Reserved XML names begin with the string xml (where any letter may be lower or upper case), and contain any number of letters, digits, hyphens, underscores or colons. Write a regular expression for Reserved XML names.

Please use \Sigma to stand for the alphabet \{ A-Z, a-z \} of upper and lower-case letters, \Delta for the alphabet of digits \{ 0-9 \}, - for hyphen, _ for underscore, and : for colon.

6. Construct a state diagram of an NFA accepting the set described by the following regular expression over the alphabet \{ 0, 1 \}, indicating the start and final state(s) of the NFA:

\(((00)^*11) \mid 111\)
7. Construct the state diagram of a DFA that accepts the language over \( \{a, b\} \) such that any string in \( L \) has an even number of \( a \)'s and an odd number of \( b \)'s. Indicate the start and final state(s) of the DFA.

8. Write a regular expression over the alphabet \( \{a-z, \%, /\} \) that describes *simple comments*. A *simple comment* is any string which starts with /\%, ends with %/, and has only lower-case letters (a through z) in between.

9. Construct an NFA that recognizes the language described by the regular expression

\[(a \circ b)^* \cup (a \circ a^*)\]

where \( \circ \) is the concatenation operator.
10. Write a regular expression over the alphabet $\Sigma$ of lower-case letters $\{ a-z \}$ to describe the language that consists of all strings containing exactly one occurrence of each vowel, such that the vowels appear in alphabetical order $a \ e \ i \ o \ u$. (For example the string $xyaxyewhyiwhyou$ is in the language, but $eioubxyz$ and $aeiouxyz$ are not.)

Please use $\Sigma$ to stand for the alphabet $\{ a-z \}$ of lower-case letters. You can then use $\Sigma - \{ x \}$ to stand for the alphabet of lower-case letters minus letter $x$, and $\Sigma - \{ x, y \}$ to stand for the alphabet of lower-case letters minus $x$ and $y$, and so forth.

11. Construct an NFA that recognizes the language described by the regular expression

$$(c^* \circ d) \cup (c \circ c^*)$$

where $\circ$ is the concatenation operator.