CSI 409: DFAs
Some sample problems

1. Construct deterministic finite automata (DFAs) recognizing the following languages over the alphabet \{a, b\}:

   (a) \{w \mid aa \text{ is a substring of } w, \text{ but } ab \text{ is not}\}

   (For instance, baa is in this language, but aab is not.)

   (b) \{a^i b^j \mid i \geq 0, j \geq 0, i + j \text{ is an even number}\}

   (0 is an even number, so \(\epsilon\) is in this language.)

   (c) The set of all strings that begin with \(a\) but do not contain aab as a substring.

   (d) \(\{ab\}^* \cup \{a\}\)

   (e) \(\{b\} \circ \{aa\}^*\)

2. Disprove the following: for all languages \(A, B\)

   \[A \subset B \rightarrow A^* \not\subset B^*\]

   (In other words, exhibit languages \(A\) and \(B\) such that \(A\) is a proper subset of \(B\), but \(A^*\) is not a proper subset of \(B^*\).)

3. Disprove the following: \(A \circ (B \cap C) = (A \circ B) \cap (A \circ C)\) for all languages \(A, B, C\).

   (Exhibit languages \(A, B, C\) such that \(A \circ (B \cap C) \neq (A \circ B) \cap (A \circ C)\).)