

Name _____

CSci 311: Models of Computation
CSci 500: Fundamental Concepts of Computing
Fall 2024 Homework #1
Due Date: September 19, 2024

Directions: Complete each of the questions and submit them to Blackboard by the due date.

1. Assuming $\Sigma = \{a, b\}$, answer the questions incorporating the three different components below:

- Describe the language in English as clearly as possible.
- Give the DFA definition for a DFA that accepts sentences in the language (Transitions can be written as a state transition table or as a list of transition functions).
- JFlap transition graph of the DFA. You must submit a JFlap file for each question. Assign a distinct name to each solution to make it easily distinguishable from others, particularly in relation to the question it addresses.

(a) Using the definition of $occ_{w1}(w)$ to mean the number of times the substring w_1 appears in string w ,

$$L_1 = \{w \in \Sigma^* : occ_{aba}(w) \bmod 2 = 0\}$$

Accepted Strings: $\lambda, a, b, ba, ababa, bbbabaaaaabaaababa, abaaba, babababab, aabaabaabaaba, ababbaba$

Rejected Strings: $abbaabababa, abababa, ababbaabbaa, bbabbababba, aabbababbaababbabababa, ababababba, bababbbababa, ababaaba, ababbaabaaabbaba, aba$

(b) $L_2 = \{w : n_a(w) \bmod 2 = 0; n_b(w) \bmod 3 = 0\}$

Accepted Strings: $\lambda, ababb, babab, aaabbbabbb, bbaab, abbabbabba, abbba, bbbbbb, aaaaa, bbbbbbbaaaa$

Rejected Strings: $ab, a, b, bababa, bbbbaaa, baba, baaba, babaaaabb, aaaaabbb, aba$

(c) $L_3 = \{a^n b^m : (n + m) \bmod 2 = 0\}$

Accepted Strings: $\lambda, ab, ba, aba, baa, aaabbbb, aabbbb, aabb, aabbbb, babababa, aaabbb, bbbbbb, aaaaaa, aaaaab, abbb$

Rejected Strings: $a, b, aab, abb, aaaab, aaabb, abbbb, aaaabbb, aaaaabbbb, aabbbbb$

(d) $L_4 = \{a(ba)^n a : n \geq 2\}$

Accepted Strings: $ababaa, abababaa, ababababaa, abababababaa, ababababababaa, abababababababaa, ababababababababaa, abababababababababaa$

Rejected Strings: $abaa, ababa, abababaaa, aa, abbababaa, bababa, aabababaa, aba, ababaababaa, bababababaa$

2. Assuming $\Sigma = \{a, b\}$, answer the questions incorporating the two different components below:

- Give FA definition for a FA that accepts sentences in the language (Transitions can be written as a state transition table or as a list of transition functions). (If possible describe the language in English.)
- JFlap transition graph of the FA. You must submit a JFlap file for each question. Assign a distinct name to each solution to make it easily distinguishable from others, particularly in relation to the question it addresses.

(a) $L_5 = \{a^n b^m : n \geq 2, m \geq 3\} \cup \{a^n b^m : n \geq 3, m \leq 2\}$

Accepted Strings: $ababba, babbab, bb, aa, aba, bab, baabab, abababa, abaa, bbbbab$

Rejected Strings: $\lambda, abb, bbaaba, a, b, ab, ba, baa, bbaba, ababab$

(b) Give a finite acceptor for $L_6 \cup L_7$ where $L_6 = \{a, ab, abb\}$ and $L_7 = \{b, ba, baa\}$