CS323 Written Assignment 1

1 Requirements

You are expected to complete all required homework exercises. For submission, please put all your answers in a single PDF file and submit it via the assignment channel on BlackBoard. The name of the file should follow the format **"studentID_HW#"** (e.g., 30003554_HW1). **The submission deadline is 10:00 PM, September 28, 2025.** Late submissions are allowed within three days after the deadline (grace period). If you submit your assignment during the grace period, your score will be 60% of the score you could get if the submission was made in time. Assignments submitted after the grace period will not be graded.

2 Exercises (100 points)

Exercise 1: Given the alphabet $\Sigma = \{a, b\}$ and the following two languages:

- L_1 : { all strings with exactly two a's }
- L_2 : { all strings with exactly two b's }

Enumerate the first six shortest strings (by length) in the language $L = L_1 \cap L_2$. Please order the strings of the same length lexicographically (e.g., $a < b < aa < ab < ba < bb$). [15 points]

Exercise 2: For the string $\omega = abbab$, determine the following:

- prefixes of ω [5 points]
- proper suffixes of ω [5 points]
- subsequences of ω of length 3 [5 points]

Note: If there are strings of the same content, you may avoid listing duplicate strings.

Exercise 3: Identify all prefixes of the string "$abcd$" that belong to the language represented by the regular expression $R = (a|b|c|d)^*$. [10 points]

Exercise 4: Write a regular expression for each of the following languages over the alphabet $\Sigma = \{0, 1\}$:

- All strings that do not end with 01. [10 points]
- All strings that contain an even number of 0's. [10 points]

- All strings that contain an odd number of 1's. [10 points]
- All strings where every occurrence of the substring 000 is followed by a 1. [10 points]

For each regular expression, please provide a detailed explanation of why it is correct.

Exercise 5: Write a regular definition for a valid email address. Here, we assume that email addresses can only contain English letters and the following two symbols: '@' and '.'. [10 points]

Exercise 6: Given an alphabet $\Sigma = \{0, 1\}$, are the following two regular languages equivalent? Besides saying yes or no, please also justify your answer. [10 points]

1. $L_1 = L((01)^*0)$
2. $L_2 = L(0(10)^*)$