

1. The assignment can be handwritten or typed. It MUST be legible.
2. You must do this assignment individually.
3. Submit this assignment only if you have read and understood the policy on academic honesty on the course web page. If you have questions or concerns, please contact the instructor.
4. Use the dropbox near the main office to submit your assignments, or hand them in at the beginning of class (please note the times and day above). No late submissions will be accepted.

Question 1

Suppose L is a regular language. Consider the language L' consisting of all subwords of L . A subword of a word w is a word obtained by deleting zero or more characters from the beginning and deleting zero or more characters from the end of w . Is L' regular? Prove your answer.

Question 2

Given a language L , define $L_1 = \{vw | v \in L, w \notin L\}$. Prove that if L is regular, so is L_1 . Prove also that the converse is not true.

Question 3

Prove that the languages $\{a^m b^n | n \geq m \geq 0\}$ and $\{a^m b^n | 0 \leq n \leq m\}$ are not regular. Infer from these results that the union of two non-regular languages may be regular.

Question 4

Consider the CFG $S \rightarrow \epsilon | aSb | SS$. Prove that the words generated by this language satisfy the following conditions:

1. The number of a 's and b 's are equal, and
2. In each prefix, the number of a 's is no less than the number of b 's.

Question 5

Is the language $\{ww^R w | w \in \{a, b\}^*\}$ context-free? Prove your answer.