

CSCI 340 — Homework 1

Dr. Schwartz

Written homework should be submitted to Desire2Learn (D2L), as either a plain-text file or a PDF file. Homework will be graded for *completion* – whether or not it looks like you have tried to answer all of the questions to the best of your ability – rather than *correctness*. The purpose of homework is to give you practice with the concepts (and types of problems) that you can expect to see on the exams.

1. Consider the language S^* , where $S = \{aa\ b\}$. How many words does this language have of length 0? of length 1? of length 2? of length 3? of length 4? of length 5? of length 6? What can be said in general?
2. One student suggested the following algorithm to test a string of a 's and b 's to see if it is a word in S^* , where $S = \{aa\ ba\ aba\ abaab\}$:
 - cross off the longest set of characters from the front of the string that is a word in S .
 - repeat step 1 until it is no longer possible.

If what remains is the string λ , the original string was a word in S^* . If what remains is not λ (this means some letters are left, but we cannot find a word in S at the beginning), the original string was not a word in S^* .

Find a string that disproves this algorithm.

3. Prove that for all sets S ,
 - (a) $(S^+)^* = (S^*)^*$
 - (b) $(S^+)^+ = S^+$
4. Give a recursive definition for the language PALINDROME. Make sure it works for even and odd length strings. $\Sigma = \{a\ b\}$
5. Consider the language PALINDROME over the alphabet $\{a\ b\}$. Prove that if x is in PALINDROME, then so is x^n for any n .
6. Give recursive definitions for the following languages. $\Sigma = \{a\ b\}$
 - (a) the language EVENSTRING of all words of even length
 - (b) the language ODDSTRING of all words of odd length
 - (c) the language AA of all words containing substring aa
 - (d) the language NOTAA of all words **not** containing substring aa