

IIT Rajasthan
B.Tech. V Sem. 2011
CS340-Assignment # 1 (Topics: Preliminaries, Regex)

Max. Marks=15 Date: 08-8-2011.

1. If it is given that $x > 4$, then show that $2^x \geq x^2$.
2. Prove that $(uv)^R = v^R u^R$, where u, v are strings on some alphabets, and R stands for reversal of string.
3. Which of the following functions are computable?
 - a. $S = \{x|x \notin x\}$
 - b. $f : x \rightarrow$ if $odd(x)$ then print x else $x := x + 1$.
 - c. $f : x \rightarrow succ(x)$.
4. If $f : A \rightarrow B, g : b \rightarrow C$, then prove the following:
 - a. If f and g are both *injection*, then $g \circ f$ is also *injection*.
 - b. If f and g are both *bijection*, then $g \circ f$ is also *bijection*.
5. Can there be an algorithm that can find out whether a given **C** program halts on input x ? Justify your answer for Yes/No.
6. Given the languages $L_1 = \{\varepsilon, 0, 1\}$ and $L_2 = \{\varepsilon, 01, 11\}$, find out $L_1 \cup L_2, L_1 \cap L_2, L_1 \circ L_2, L_1^*, \bar{L}_1$.
7. List any number of problems which are unsolvable, with brief description for each.
8. For $a \in \Sigma$, and three languages A, L, M on Σ , and $n > 1$, show that:
 - a. $\{a\} \circ L = \{a\} \circ M \Rightarrow L = M$.
 - b. $A \circ L = A \circ M \not\Rightarrow L = M$
 - c. $L^* = M^* \not\Rightarrow L = M$.
 - d. $L^n = m^n \Rightarrow L = M$.
9. Which of the following languages are equal?
 $(L \cup M)^*, (L \circ M)^* \circ L, (L^* \cup M^*)^*, (L^* \circ M^*)^*$.
10. What is regular expression for $\Sigma = \{0, 1\}$, where each string in the language contains at least one 1.

11. Prove that all the finite languages are regular.
12. What are the regular expressions for following, for $\Sigma = \{a, b\}$.
 - a. All strings have no more than two a .
 - b. All strings have even counts of a or b .
 - c. All strings are beginning and ending with a and have at least one b .
 - d. Length of all the strings are divisible by 4.
13. Find the regular expressions corresponding to the following regular sets:
 - a. $\{ab, ac, ad\}$
 - b. $\{ad, ae, af, bd, be, bf, cd, ce, cf, \dots\}$
14. If r_1, r_2, r_3 are the regular expressions, then the language corresponding to $r_1(r_2 + r_3)$ is same as that of $r_1r_2 + r_1r_3$.
15. What are the regular expressions corresponding to the following?
 - a. Decimal integer with or without sign.
 - b. Decimal float type number
 - c. C language variable representation.

*Note: (1). Submission deadline **Aug. 18, 2011** as hardcopy or soft-copy (by mail till 11:55PM), with subject TOC-Rollno. The hardcopy may be submitted in class. (2) If any two or more students have been found with verbatim answers, the marks will be awarded to one, and will be equally distributed among them.*