



'সমানো মন্ত্র: সমিতি: সমানী'

UNIVERSITY OF NORTH BENGAL
B.Sc. Honours 5th Semester Examination, 2022

CC12-COMPUTER SCIENCE (52)

THEORY OF COMPUTATION

Time Allotted: 2 Hours

Full Marks: 60

The figures in the margin indicate full marks.

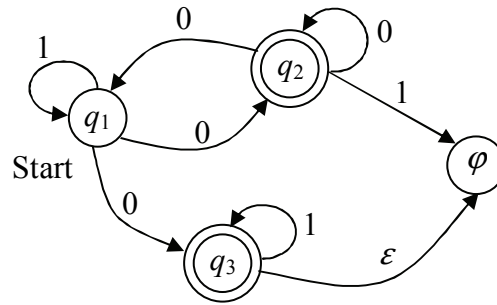
1. Answer any **four** questions: 3×4 =12
 - (a) What do you mean by derivation of a string? Explain with an example.
 - (b) When a grammar is called ambiguous? Explain with a suitable example.
 - (c) Explain left recursion with example. Eliminate the left recursion from the example.
 - (d) Write the algorithm to minimize the number of states in a DFA.
 - (e) Define alphabet, string and Kleene Star with example.
 - (f) What is Greibach Normal Form? Explain with an example.

2. Answer any **four** questions: 6×4 =24
 - (a) Convert the following regular expression into its equivalent NFA:
$$(a + b)^* ab(a + b)^* (aa)^* b$$
 - (b) Convert the following CFG to CNF:
$$S \rightarrow bA \mid aB$$
$$A \rightarrow bAA \mid aS \mid a$$
$$B \rightarrow aBB \mid bS \mid a$$
 - (c) What do you mean by regular expression? Write some properties of regular grammars.
 - (d) Obtain the CGF for PDA M with the transitions:
$$\delta(q_0, a, Z) = (q_0, AZ)$$
$$\delta(q_0, b, A) = (q_0, AA)$$
$$\delta(q_0, a, A) = (q_1, \epsilon)$$
 - (e) Write the regular expression for the following languages:
 - (i) Representing for strings of a 's and b 's having odd length.
 - (ii) To accept strings of a 's and b 's such that third symbol from the right is a and fourth symbol from the right is b .
 - (f) Write a short note on Turing machine.

3. Answer any *two* questions:

12×2 =24

(a) Convert the following NFA given below into its equivalent DFA.



(b) Define grammar. For the grammar $G = \{S \rightarrow AaS \mid a, A \rightarrow SbA \mid SS \mid bA\}$, find the leftmost and rightmost derivation for the string aabbaaa.

(c) Using pumping lemma for regular languages prove that $L = \{a^n b^n : n \geq 1\}$ is not regular.

(d) Write short notes on any *two*:

- (i) Transition graphs
- (ii) Recursively enumerable language
- (iii) Chomsky Hierarchy.

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