



'সমানো মন্ত্র: সমিতি: সমানী'

UNIVERSITY OF NORTH BENGAL
B.Sc. Honours 5th Semester Examination, 2023

CC12-COMPUTER SCIENCE (52)
THEORY OF COMPUTATION

Time Allotted: 2 Hours

Full Marks: 60

The figures in the margin indicate full marks.

GROUP-A

Answer any *four* questions

3×4 = 12

1. State Pumping Lemma for Regular language.
2. Define DFA.
3. What are Regular Expressions? Explain different notations for Regular Expressions.
4. What is a Parse tree? Give one example.
5. What does the regular expression $0^*1^*2^*$ represent?
6. Eliminate the unit production from the following production rule.

$$\begin{aligned} S &\rightarrow AB \\ A &\rightarrow a \\ B &\rightarrow c \mid b \\ C &\rightarrow D \\ D &\rightarrow E \end{aligned}$$

GROUP-B

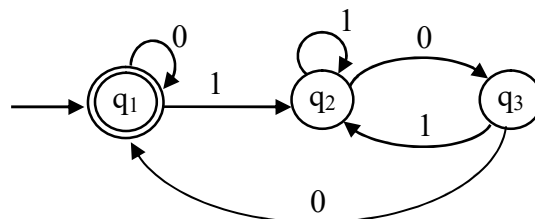
Answer any *four* questions

6×4 = 24

7. Show that the following grammar is ambiguous

$$\begin{aligned} E &\rightarrow E + E \\ E &\rightarrow E - E \\ E &\rightarrow E * E \\ E &\rightarrow E / E \\ E &\rightarrow [E] \\ E &\rightarrow id \end{aligned}$$

8. Convert the DFA to a Regular Expression.



9. Explain Chomsky Hierarchy.
10. Convert the following grammar into CNF
- $$S \rightarrow aAD$$
- $$A \rightarrow aB \mid bAB$$
- $$B \rightarrow b$$
- $$D \rightarrow d$$
11. Explain Thompson's Construction to convert a regular expression to NFA.
12. When is a grammar called left recursive? How to remove left recursion from a grammar? Explain with example.

GROUP-C

Answer any two questions

12×2 = 24

13. Explain the model of turing machine with mathematical representation. Explain the types of turing machines.
14. Construct a NFA with ϵ for $(a + b)^* b(a + b)$. Convert it into its equivalent DFA and minimize the number of states if possible.
15. Let G be a grammar

$$E \rightarrow E + T \mid T$$

$$T \rightarrow T * F \mid F$$

$$F \rightarrow (E) \mid a$$

Construct (a) left most derivation

(b) Right most derivation

(c) Parse tree

for the following string:

$$\omega : (a + a * a) * (a + a)$$

16. Write short notes on any **two** of the following:
- (a) PDA (Push Down Automata)
 - (b) Equivalence of two FA
 - (c) Kleen Closure
 - (d) Halting problem of turing machine.

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