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50 (FLA)

[16–HRAGDA–M3]

MCA/MScIT 3rd Semester Exam., 2016

FORMAL LANGUAGE AND AUTOMATA

[MCA (S3) 11]

Full Marks : 80

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Answer any *five* from the following : 2×5=10

(a) What is the meaning of the moves of pushdown automata $\partial(q, a, x) = \{p, \varepsilon\}$?

(b) Give the regular expression for the language L on $\Sigma = \{a, b, c\}$, where L consists of all strings containing exactly one a.

(c) When is grammar said to be ambiguous?

(d) What is Kleen's closure? Give examples.

(e) When is a function said to be computable? Define recursively enumerable language.

(f) Define automaton. Give an example of a finite automaton.

2. Answer any *three* from the following : 4×3=12

(a) Consider the grammar

$$G = \{\{S\}, \{a, b\}, S, P\}$$

where the productions are given by

$$S \rightarrow aSbb$$

$$S \rightarrow abb|\varepsilon$$

What is the language generated by this grammar?

(b) Consider the grammar G whose productions are $S \rightarrow AB$, $A \rightarrow aaA|\varepsilon$ and $B \rightarrow Bb|\varepsilon$. Find the leftmost derivation and the rightmost derivation for the string *aab*. Also find the language generated by the grammar.

(c) What is the meaning of the transition function $\delta(q, \varepsilon) = q$ in case of DFA? Give two basic differences between DFA and NFA in terms of transition function.

(d) Briefly discuss the applications of pumping lemma.

3. Answer any *three* from the following : 6×3=18

(a) Briefly discuss the applications of Church's and Turing's theses. What are the uses of primitive recursive functions?

(b) Write short notes on any *two* of the following : 3×2=6

(i) Seven tuples of pushdown automata

(ii) Type-2 grammar

(iii) Regular expression and regular language

(c) Describe in English language the set represented by the following regular expressions : 2×3=6

(i) $a*b+b*a$

(ii) $a(a+b)*ab$

(iii) $a*b*$

(d) Define Turing machine and briefly discuss various states of a Turing machine.

4. Answer any *four* from the following : 10×4=40

(a) Write short notes on the following : 5×2=10

(i) Chomsky hierarchy

(ii) Closure properties of context-free grammar