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10CS56

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Formal Languages and Automata Theory

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting at least TWO questions from each part.

PART - A

- 1 a. Differentiate between DFA and NFA. Construct DFA to accept the following language.
 $L = \{\omega : |\omega| \bmod 3 \geq |\omega| \text{ and } 2\}$ where $\Sigma = \{a, b\}$. (10 Marks)
- b. Write a procedure to convert NFA to equivalent DFA, convert the following NFA into equivalent DFA.

$\rightarrow q_0$	$\{q_0\}$	$\{q_0, q_1\}$
q_1	$\{q_2\}$	$\{q_2\}$
q_2	$\{q_3\}$	$\{q_3\}$
$*q_3$	ϕ	ϕ

(10 Marks)

- 2 a. Define Regular expression. Write regular expression to accept the following languages
 $L = \{a^n b^m : n \geq 1, m \geq 1, nm \geq 3\}$ (08 Marks)
- b. Show that every language defined by a regular expression is also defined by a finite automata. (06 Marks)
- c. Discuss any three applications for Regular expressions. (06 Marks)
- 3 a. State pumping lemma for regular languages. Show that the following language is not regular. $L = \{0^n : n \text{ is prime number}\}$ (06 Marks)
- b. If L and M are regular languages, show that $L \cap M$ is also regular. (06 Marks)
- c. Minimize the following DFA using Table filling method. (08 Marks)

	0	1
$\rightarrow A$	B	A
B	A	C
C	D	B
*D	D	A
E	D	F
F	G	E
G	F	G
H	G	D

- 4 a. Define Context Free Grammar. Construct CFG for the following language.
 $L = \{0^i 0^j 0^k \mid j > i + k\}$ (08 Marks)
- b. Write leftmost, derivation and construct parse tree for the string 'aabbba' using the grammar
 $S \rightarrow AB \mid \epsilon$
 $A \rightarrow aB$
 $B \rightarrow Sb$ (06 Marks)
- c. Define ambiguous grammar. Show that the following language is ambiguous.
 $S \rightarrow SS / (S) / ($ (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

PART – B

- 5 a. Define push Down Automata. Construct NPDA for accepting the following language.
 $L = \{\omega\omega^R : \omega \in \{a, b\}^*\}$
 Show all ID's to process the string 'baab' (14 Marks)
- b. Convert the grammar to equivalent PDA.
 $S \rightarrow 0AA$
 $A \rightarrow 0S \mid 1S \mid 0$ (06 Marks)
- 6 a. Convert the grammar into GNF.
 $S \rightarrow AA \mid 0$
 $A \rightarrow SS \mid 1$ (08 Marks)
- b. Eliminate all ϵ production from the grammar
 $S \rightarrow ABC$
 $A \rightarrow BC \mid a$
 $B \rightarrow bAC \mid \epsilon$
 $C \rightarrow cAB \mid \epsilon$ (06 Marks)
- c. If L is a CEL and R is a regular language then show that $L \cap R$ is a CEL. (06 Marks)
- 7 a. Define Turing machine. Design Turing machine that accept the following language
 $L = \{a^n b^n c^n : n \geq 1\}$ (10 Marks)
- b. Write a note on :
 i) Multiple Turing Machine
 ii) Nondeterministic Turing Machine. (10 Marks)
- 8 a. Define Recursively Enumerable language. Prove that Diagonalization is not recursively enumerable. (08 Marks)
- b. Write a note on :
 i) Recursive language
 ii) Post's correspondence problem. (12 Marks)
