Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering / Science
End Sem Examination May-2024
CA5EL49 Theory of Computation

Programme: MCA / BCA-MCA (Integrated) Branch/Specialisation: Computer Application

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. Pumping Lemma is used to prove that certain sets are- **1**

(a) Not regular (b) Regular

(c) CFG (d) None of these

ii. There are _____ tuples in finite state machine. **1**

(a) 4 (b) 5 (c) 6 (d) 7

iii. Every grammar in Chomsky normal form is- **1**

(a) Regular (b) Context sensitive

(c) Context free (d) All of these

iv. Which of the following statements are true? **1**

I. Every left-recursive grammar can be converted to a right-recursive grammar and vice-versa

II. All epsilon productions can be removed from any context-free grammar by suitable transformations

III. The language generated by a context-free grammar all of whose productions are of the form X --> w or X --> wY (where, w is a string of terminals and Y is a non-terminal), is always regular

IV. The derivation trees of strings generated by a context-free grammar in Chomsky Normal form are always binary trees

(a) I, II, III and IV (b) II, III and IV only

(c) I, III and IV only (d) I, II and IV only

v. The transition a push down automaton makes is additionally dependent upon the: **1**

(a) Stack (b) Input tape

(c) Terminals (d) None of these

P.T.O.

vi. A Push down automata use which data structure- **1**
(a) Stack (b) Queue (c) Link list (d) Hash set

vii. There are _____ tuples in Turing machine. **1**
(a) 9 (b) 6 (c) 8 (d) 7

viii. Which of the following is NOT a component of a Turing machine? **1**
(a) Q (b) Σ (c) V_N (d) Γ (toy)

ix. _____ is the class of decision problems that can be solved by non-deterministic polynomial algorithms. **1**
(a) NP (b) P (c) Hard (d) Complete

x. Problems that cannot be solved by any algorithm are called- **1**
(a) Tractable problems (b) Intractable problems
(c) Undecidable problems (d) Decidable problems

Q.2 i. Define star closure. **2**

ii. Write down all tuples of finite automata. **3**

iii. Design a deterministic finite automaton that satisfies the following: **5**
{w | w has abab as a substring}

OR iv. Convert Moory machine to Melay machine where transaction table is- **5**

	a	b	output
q_0	q_1	q_2	0
q_1	q_3	q_0	1
q_2	q_0	q_1	1
q_3	q_2	q_3	0

Q.3 i. Define grammar. **2**

ii. Explain all types of Chomsky hierarchy with example. **8**

OR iii. Convert CFG to Chomsky normal form, where S is start symbol- **8**
S->ASA| aB
A->B|S
B->b|ε

Q.4 i. Write down all tuples of push down automata. **3**

ii. Design a PDA where L={WCW^R : W is $(a,b)^*$} and C is separator. **7**

OR iii. Design a PDA with empty stack. where L={$a^n b^{2n}$ where n>=1}. **7**

Q.5 i. Explain all the tuples of Turing machine. **4**

ii. Design a Turing machine for L={$a^n b^n$ where n>=1}. **6**

OR iii. Design a Turing machine for parenthesis checker. **6**

Q.6 Attempt any two:

i. Explain in detail P and NP problems. **5**

ii. Elaborate recursive set and recursive enumerable set. **5**

iii. Explain the concept of post correspondence problem with help of one example. **5**

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Marking Scheme

CA5EL49 (T) Theory of Computation

Q.1	i)	A)	**1**
	ii)	B)	**1**
	iii)	C)	**1**
	iv)	C)	**1**
	v)	A)	**1**
	vi)	A)	**1**
	vii)	D)	**1**
	viii)	D)	**1**
	ix)	A)	**1**
	x)	C)	**1**

Q.2	i.	Definition is of 2 marks	**2**
	ii.	Tuples corrected will be of 3 Marks	**3**
	iii.	The Whole machine should be correct without any failure	**5**
OR	iv.	The whole conversion process, if it is correct then it will be given 8 Marks otherwise marks Will be deducted according to the Step.	**5**

Q.3	i.	Definition if of 2 Marks	**2**
	ii.	Each Chomsky hierarchy is of 2 Marks	**8**
OR	iii.	null production is of 2 Marks remove Useless symbol is of 2 Marks Represent the final Ans if of 4 Marks	**8**

Q.4	i.	Tuples corrected will be of 3 Marks	**3**
	ii.	Push and Pop Step is of 3 Marks each and 1 Marks for the Final step	**7**
OR	iii.	Push and Pop Step is of 3 Marks each and 1 Marks for the Final step	**7**

Q.5	i.	All Tuples corrected will be of 4 Marks	**4**
	ii.	If All transection step are corrected then 6 Marks will be given otherwise 4 marks will be given	**6**
OR	iii.	If All transection step are corrected then 6 Marks will be given otherwise 4 marks will be given	**6**

Q.6			
	i.	P and NP both are 2.5 Marks each	**5**
	ii.	Recursive set and Recursive Enumerable set both are 2.5 Marks each	**5**
OR	iii.	PCP is of 2.5 Marks and Example is of 2.5 Marks	**5**

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