

Total No. of Questions: 6

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Enrollment No.....



Faculty of Engineering
End Sem (Odd) Examination Dec-2018
CA5CO13 Theory of Computation
Programme: MCA 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.

- Q.1 i. Regular expressions are closed under 1
(a) Union (b) Intersection
(c) Kleen star (d) All of these
- ii. A language is regular if and only if 1
(a) Accepted by DFA (b) Accepted by PDA
(c) Accepted by LBA (d) Accepted by Turing machine
- iii. The entity which generate Language is termed as: 1
(a) Automata (b) Tokens (c) Grammar (d) Data
- iv. Every grammar in Chomsky Normal Form is: 1
(a) Regular (b) Ambiguous
(c) Context free (d) All of these
- v. Which of the following languages over $\{a,b,c\}$ is accepted by a 1
deterministic PDA?
(a) $\{wbw^R \mid w \in \{a,c\}^*\}$
(b) $\{ww^R \mid w \in \{a,b\}^*\}$
(c) $\{a^n b^n c^n \mid n \geq 1\}$
(d) $\{w \mid w \text{ is a palindrome over } \{a,b,c\}\}$
- vi. The instantaneous PDA has the following elements 1
(a) State (b) Unconsumed input
(c) Stack content (d) All of these
- vii. A turing machine that is able to simulate other turing machines: 1
(a) Nested Turing machines (b) Universal Turing machine
(c) Counter machine (d) None of these

P.T.O.

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- viii. A language L is said to be Turing decidable if: **1**
 (a) Recursive (b) TM recognizes L
 (c) TM accepts L (d) None of these
- ix. A language L is said to be _____ if there is a turing machine **1**
 M such that L(M)=L and M halts at every point.
 (a) Turing acceptable (b) Decidable
 (c) Undecidable (d) None of these
- x. According to the rice's theorem, If P is a non-trivial property, Lp **1**
 is:
 (a) Infinite (b) Decidable
 (c) Undecidable (d) None of these

- Q.2 i. Define Automata with a small example. **2**
- ii. Differentiate between NFA and DFA. **3**
- iii. Given NFA is **5**

Q / Σ	a	b
→ q0	{q0,q1}	{q2}
q1	{q0}	{q1}
*q2	ϕ	{q0,q1}

Where *q2 is final state. Convert it into DFA.

- OR iv. Construct the minimum state automata for the following Transition **5**
 Table.

Q / Σ	a	b
→ q0	q1	q0
q1	q0	q2
q2	q3	q1
*q3	q3	q0
q4	q3	q5
q5	q6	q4
q6	q5	q6
q7	q6	q3

Where *q3 is a final State.

- Q.3 i. Formulise the idea of grammar with its components in a **2**
 grammatical description of a language.
- ii. Design a context free grammar for the following: **8**
 (a) $L_1 = \{a^n b^n c^i \mid i, n \geq 1\}$ (b) $L_2 = \{a^n b^m \mid n \geq m\}$
- OR iii. Change the following grammar into CNF. **8**
 $S \rightarrow abSb / a / aAb$
 $A \rightarrow bS / aAAb$
- Q.4 i. Give the formal definition of Pushdown Automata, explaining all **3**
 its elements shortly.
- ii. Construct a PDA for the Language $\{L = a^m b^m c^n \mid m, n \geq 1\}$. **7**
- OR iii. Convert the following CFG into PDA: **7**
 $S \rightarrow aS \mid aA$
 $A \rightarrow bA \mid b$.
- Q.5 i. Explain Turing Machine as physical computing device with its **4**
 tuple notations and moves.
- ii. Design a Turing Machine that recognises the set of all string of 0's **6**
 and 1's containing at least one 1.
- OR iii. Define the following: **6**
 (a) Multiple Tapes Turing Machine
 (b) Multiple Heads Turing Machine
- Q.6 Attempt any two: **5**
 i. What are decidable and undecidable languages? **5**
 ii. Define P, NP-Complete, NP, and NP-Hard. **5**
 iii. Define halting problem of TM and PCP. **5**

Marking Scheme
CA5CO13 Theory of Computation

Q.1	i.	Regular expressions are closed under (d) All of these		1
	ii.	A language is regular if and only if (a) Accepted by DFA		1
	iii.	The entity which generate Language is termed as: (c) Grammar		1
	iv.	Every grammar in Chomsky Normal Form is: (c) Context free		1
	v.	Which of the following languages over {a,b,c} is accepted by a deterministic PDA? (b) $\{ww^R \mid w \in \{a,b\}^*\}$		1
	vi.	The instantaneous PDA has the following elements (d) All of these		1
	vii.	A turing machine that is able to simulate other turing machines: (b) Universal Turing machine		1
	viii.	A language L is said to be Turing decidable if: (a) Recursive (b) TM recognizes L		1
	ix.	A language L is said to be _____ if there is a turing machine M such that $L(M)=L$ and M halts at every point. (b) Decidable		1
	x.	According to the rice's theorem, If P is a non-trivial property, L_p is: (c) Undecidable		1
Q.2	i.	Automata.		2
	ii.	Differentiate between NFA and DFA. At least two differences 1.5 marks each	(1.5 marks * 2)	3
	iii.	Method DFA Construction on the basis of method	2.5 marks	5
OR	iv.	Method Minimization	2.5 marks	5
Q.3	i.	Definition Components	1 mark 1 mark	2

	ii.	Design a context free grammar for the following: (a) $L_1 = \{a^n b^n c^i \mid i, n \geq 1\}$ (b) $L_2 = \{a^n b^m \mid n \geq m\}$	4 marks 4 marks	8
OR	iii.	Change the following grammar into CNF. Formula Formation Grammer	2 marks 3 marks 3 marks	8
Q.4	i.	Definition Components	2 marks 1 mark	3
	ii.	Logic Solution	3 marks 4 marks	7
OR	iii.	Logic Solution	3 marks 4 marks	7
Q.5	i.	Definition Components	2 marks 2 marks	4
	ii.	Logic Solution	3 marks 3 marks	6
OR	iii.	Define the following: (a) Multiple Tapes Turing Machine (b) Multiple Heads Turing Machine	3 marks 3 marks	6
Q.6		Attempt any two:		
	i.	Decidable Undecidable languages	2.5 marks 2.5 marks	5
	ii.	P, NP-Complete NP, and NP-Hard	2.5 marks 2.5 marks	5
	iii.	Halting problem of TM Halting problem of PCP.	2.5 marks 2.5 marks	5
