**B.TECH/IT/4TH SEM/INFO 2201/2018**

**SWITCHING THEORY & AUTOMATA**

**(INFO 2201)**

**Time Allotted : 3 hrs Full Marks : 70**

***Figures out of the right margin indicate full marks.***

***Candidates are required to answer Group A and***

***any 5 (five) from Group B to E, taking at least one from each group.***

***Candidates are required to give answer in their own words as far as practicable.***

**Group – A**

**(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Which string can be generated by A → abA/ bcB, B → cd / ccbB?

(a) aabccd (b) adabcca

(c) abbccd (d) abababd.

(ii) Definition of a language L with alphabet {a} is given as following. L= { ank | k > 0, and n is a positive integer constant} What is the minimum number of states needed in a DFA to recognize L?

(a) k + 1 (b) n + 1 (c) 2n + 1 (d) 2k+.

(iii) Which is the language generated by the grammar S→aSb,S→A, A→aA?

(a) am bm (b) Φ (c) an bm (d) am bn

(iv) Which of the following is true?

(a) Merger graph is directed graph

(b) Compatible graph is directed graph

(c) Both (a) and (b)

(d) None of these.

(v) A regular expression representing the language {ϵ, a, b} is

(a) a + b (b) ab (c) ϵ + a + b (d) ϵab.

(vi) Context Free Language are not closed under

(a) union (b) star

(c) complement (d) both (a) and (b).

(vii) Which of the following is true?

(a) (01)\*0 = 0(10)\*

(b) (0+1)\*0(0+1)\*1(0+1) = (0+1)\*01(0+1)\*

(c) (0+1)\*01(0+1)\*+1\*0\* = (0+1)\*

(d) All of the mentioned.

(viii) Difference between Turing machine and Two-way FA is in

(a) input tape (b) read write head

(c) finite control (d) all of these.

(ix) S → aABC | a

A → a| aD

B → aBA |

C → aC|a|aB

Select useless production

(a) B → aBA (b) A → aD

(c) C → aB (d) C → aC.

(x) A PDA can behave like Turing Machine when

(a) it has no stack (b) it has two or more stacks

(c) it has a stack of infinite size (d) all of these.

**Group – B**

2. (a) A long sequence of pulses enters a two I/P, two O/P synchronous sequential circuit, which is required to produce an O/P pulse z = 1 whenever the sequence 1101 occurs. Overlapping sequences are accepted; for example, if the input is 011011011………, the required O/P is 000010010……… .

(i) Draw a state diagram for a sequence (1101) detector.

(ii) Select an assignment and show the excitation and O/P tables.

(iii) Draw a Logic Diagram of a sequence (1101) detector.

(b) Write differences between Deterministic Finite Automata (DFA) and Non-deterministic Finite Automata (NFA).

**(3 + 2 + 5) + 2 = 12**

3. (a) Consider the following machine:

|  |  |  |
| --- | --- | --- |
| PS | NS, Z | |
| I1 | I2 |
| P | T, 0 | Q, 0 |
| Q | U, 0 | P, 0 |
| R | T, \_\_ | R, 0 |
| S | U, 1 | S, 0 |
| T | R, 1 | R, 0 |
| U | S, \_\_ | Q, 0 |

(i) Draw the merger table.

(ii) Draw the compatibility graph.

(iii) Find the minimal closed covering with justification.

(b) Prove that the following machine has a finite memory.

|  |  |  |
| --- | --- | --- |
| PS | NS, z | |
| X = 0 | X = 1 |
| A | B, 0 | D, 0 |
| B | C, 0 | C, 0 |
| C | D, 0 | A, 0 |
| D | D, 0 | A, 1 |

**(3 + 3 + 2) + 4 = 12**

**Group – C**

4. (a) Convert the following Non Deterministic Finite Automata (NDFA) to Deterministic Finite Automata (DFA). Where, q0 = initial state, q2, q3 = final states.

|  |  |  |
| --- | --- | --- |
| PS | Next State, O/P | |
| X = 0 | X = 1 |
| q0 | q0, q2 | q1 |
| q1 | q1 | q2 |
| q2 | q1, q2 | q0, q2, q3 |
| q3 | q3 | q2 |

(b) Write Regular Expression (RE) over ∑ = {0, 1}

(i) to generate all possible strings of length 4.

(ii) for set of all binary strings 0i1j2k where i, j, k are integers and i and j ≥ 1 and k ≥ 0.

**6 + (3 + 3) = 12**

5. (a) Define Left Recursive Grammar for Context Free Grammar (CFG). Remove Left Recursive for the following Grammar:

A → Ba|b

B → Bc|Ad|ϵ

(b) Generate Regular Expression (RE) from the following Finite Automata (FA) (where Sis the initial state and F is the final state):

**6 + 6 = 12**

**Group – D**

6. (a) Define Pumping Lemma for Context Free Grammar (CFG). Prove that the language L(G) = {ap| where p is prime} is not Regular Language.

(b) Define parse tree or derivation tree. Check, whether the following grammar is ambiguous or not with derivation tree?

E → T|E+T

T → F|T\*F

F → I|(E)

I → a|b|c

**(2 + 5) + (1 + 4) = 12**

7. (a) Define Chomskey’s Normal Form (CNF). Convert the following Context Free Grammar (CFG) to Chomskey’s Normal Form (CNF):

A → B|aA

B → cCC|aB|a | C

C → aC| λ

(b) Write Context Free Grammar (CFG) for even and odd Palindrome.

**(1 + 7) + (2 + 2) = 12**

**Group – E**

8. (a) Define nPDA. Explain with suitable example. Why does stack is needed to design PDA?

(b) Design a PDA, M to accept the language L = {a2nbn|n≥1}.

**(2 + 4) + 8 = 12**

9. (a) Design Turing Machine over ∑ = {0} to accept the language L = {0m| m is even}.

(b) Write short note on Multi-tape Turing Machine(TM).

**7 + 5 = 12**