Q. Code: 552684

B.E./B.TECH. Degree Examination, December 2020

Fifth Semester

CS18503-THEORY OF COMPUTATION

(Regulation 2018)

Time: Three hours Maximum : 80 Marks

Answer **ALL** questions

PART A - (8 X 2 = 16 marks)

1. Identify the incorrect tuple from the given definition:

   Def: ({q0, q1, q2}, {0,1}, δ, q3, {q3})

   A) The definition does not satisfy 5 Tuple definition of NFA

   B) There is no transition definition

   C) Initial and Final states do not belong to the Graph

   D) Initial and final states can't be sam

2. If language L={0,1}*, then the reversed language L^R =

   A){0,1}*

   B){}

   C){0}*

   D){1}*

3. State true or false:

   Statement: R->R|T T->ε is an ambiguous grammar

   A) True

   B) False

4. If there exists a language L, for which there exists a TM, T, that accepts every word in L and either rejects or loops for every word that is not in L, is called

   A) recursive

   B) recursively enumerable

   C) NP-HARD

   D) none of these

5. Write the CFG for the regular expression 0*1(0+1)*.

6. When is PDA said to be deterministic? Illustrate.

7. Remove Ɛ - productions from the given CFG**.** S--> PQP, P--> 0P |**ε**, Q--> 1Q|**ε**.

8. Differentiate tractable and intractable problems.

PART B - (4 X16 = 64 marks)

09. (a) (i) Prove for every n>=1 by mathematical induction **(8)**

$$\sum^{n} i^3 = \{n(n+1)/2\}^2 .$$

(ii) Construct a NFA to accept the set of all binary strings starting with 0 and containing 1100 or 1010 as substrings. **(8)**

(OR)

(b) Obtain the DFA equivalent to the following ϵ-NFA and give all the strings of length three or less accepted by the automaton. **(16)**

δ	ϵ	**a**	**b**	**c**
→p	{q,r}	ϕ	{q}	{r}
q	ϕ	{p}	{r}	{p,q}
***r**	ϕ	ϕ	Φ	ϕ

10. (a) (i) Prove that the language $\{(01)^n 0^k \mid n > k; k >= 0\}$ is not regular. **(8)**

(ii) Prove the following: If L and M are regular languages, then so is L∩M. **(4)**

(iii) Suppose h is the homomorphism from the alphabet {0,1,2} to the alphabet {a,b} defined by h(0)=a; h(1)=ab; h(2)=ba; Find h(0120) and h(01*2) **(4)**

(OR)

(b) (i) Find the regular expression from the given DFA **(10)**

D= ({q1, q2, q3}, {0, 1}, δ, q1, {q1}) where δ is given by the transition table using State elimination method.

δ	0	1
->*q_1	q_1	q_2
q_2	q_3	q_2
q_3	q_1	q_2

(ii) Construct an NFA equivalent to the following regular expression: **(6)**

00(01)*0+1(01+10)*01*

11. (a) Design a PDA to accept the language L= $\{WCW^R \mid W \in \{0, 1\}\}$ and Construct the CFG for the designed PDA. **(16)**

(OR)

(b) (i) Construct a PDA equivalent to the CFG **(8)**

S-> aBB

B-> aS |bS| a

(ii) Find the language generated by the following CFG. **(8)**

S-> A1B

A-> 0A|**ε**

B-> 0B|1B|**ε**

Also find the LMD and RMD for the strings 00101 and 1001.

12. (a) (i) Convert the grammar into CNF: **(8)**

S-> AB|aB

A-> aab|**ε**

B-> bbA|C

D->abA

(ii) Design a Turing Machine for the language L that contains the set of strings with an equal number of 0's and 1's. **(8)**

(OR)

(b) (i) Prove that L_d is not RE. **(8)**

(ii) Outline the concept of P and NP problems with suitable examples. **(8)**