Reg. No.

B.Tech. DEGREE EXAMINATION, MAY 2018
1st to 6th Semester

15CS301 – THEORY OF COMPUTATION
(For the candidates admitted during the academic year 2015 – 2016 onwards)

Note:
(i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.
(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: Three Hours

Max. Marks: 100

PART – A (20 × 1 = 20 Marks)
Answer **ALL** Questions

1. The basic limitation of FSM is
   (A) It can't remember arbitrary large amount of information
   (B) Sometimes fails to recognize regular grammar
   (C) Sometimes it recognizes non regular languages
   (D) It is accepting CFL

2. The regular expression over {0, 1} in which words ending in 01 is
   (A) 01
   (B) $01(0/1)^*$
   (C) $0(0/1)^*1$
   (D) $(0/1)^*01$

3. If NFA has n states then DFA will have
   (A) 2^n states
   (B) 2n states
   (C) n^2 states
   (D) n+2 states

4. Pumping lemma is based on
   (A) Pigeon hole principle
   (B) Mathematical induction
   (C) Set inclusion principle
   (D) Regular language

5. The transition of a PDA additionally depend upon
   (A) Input tape
   (B) Terminals
   (C) Non terminals
   (D) Stack

6. The language generated by the following CFG is $S \rightarrow aSa \mid bSb$ is
   (A) Even palindrome
   (B) Odd palindrome
   (C) a^*b^*
   (D) b^*a^*

7. An ambiguous grammar is one which has
   (A) One LMD
   (B) One RMD
   (C) One LMD and one RMD
   (D) More than one LMD or RMD

8. If the productions are of the from $A \rightarrow \alpha\alpha$ where $A \in V, a \in T, \alpha \in V^*$ is known as
   (A) Context free grammar
   (B) Chomsky normal form
   (C) Griebach normal form
   (D) Linear grammar

9. A deterministic PDA is a PDA in which
(A) No state of PDA has 2 outgoing transitions with same input
(B) More than one state can have two or more outgoing transitions
(C) Atleast one state has more than one transitions
(D) Two states can have same transition

10. If the PDA accepting step on accepting state and the stack is not empty then the string is
(A) Rejected (B) Accepted
(C) Goes into loop forever (D) May not go to infinite loop

11. PDA is powerful than
(A) TM (B) FSA
(C) Both (D) Moore machine

12. The symbol Z_0 in PDA definition is denoting
(A) Initial state (B) Stack content
(C) Variable (D) Initial stack alphabet

13. TM accepts which type of grammar in Chomsky hierarchy
(A) Type 0 (B) Type 1
(C) Type 2 (D) Type 3

14. Which of the following is the restricted model of TM
(A) TM with semi-infinite tape (B) Multi stack machine
(C) Offline TM (D) Both (A) and (B)

15. If T_1 and T_2 are two machines the composite can be represented by
(A) $T_1 T_2$ (B) $T_1 * T_2$
(C) $T_1 \cup T_2$ (D) $T_1 - T_2$

16. NDTM is one which has
(A) No transition (B) Multiple transitions for the same input
(C) One transition (D) Empty transition

17. If a language L is recursive then
(A) We can construct a TM (B) We can't construct a TM
(C) We can construct a TM that always halts (D) It never halts

18. PCP problem is
(A) Decidable (B) Semi decidable
(C) Undecidable (D) Partial solution can be got

19. A language L is decidable if L is
(A) Regular language (B) CFL
(C) CSL (D) Recursive language

20. The language $L = \{0^n 1^n 2^n : n \geq 0\}$ is accepted by
(A) PDA

PART – B (5 × 4 = 20 Marks)
Answer **ANY FIVE** Questions

21. Apply mathematical induction to prove $\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$

22. Prove that $\{(00)^n : n \geq 1\}$ is regular.

23. Construct a context free grammar which negates the language $L(G) = \{a^n b^{2n} c^n : n \geq 1\}$.

24. Construct PDA for the language $L(G) = \{a^n b^{2n} c^n : n \geq 1\}$.

25. Design a TM that will compute 4 n for given any integer n in binary form.

26. State 4 examples of undecidable problem.

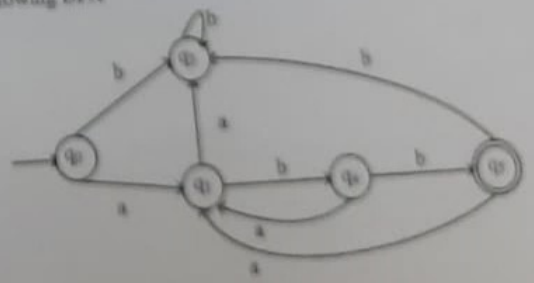
27. Define post correspondence problem. Explain with a suitable example.

PART – C (5 × 12 = 60 Marks)
Answer **ALL** Questions

28. a.i. Find DFA for the following

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

ii. Minimize the following DFA



(OR)

b.i. Construct DFA for $0^*1^*2^*$.

ii. Construct ϵ-NFA for

(1) $0(0+1)^*(01)^*$

(2) $01(0+1)^*01+(01)^*$ (8 Marks)

29. a.i. Prove that $S \rightarrow aS \mid aSbS \mid \epsilon$ is ambiguous. (4 Marks)

ii. Find LMD and RMD for the string *aab* and the corresponding parse tree.

(OR)

b. Convert the following to Chomsky normal form

$S \rightarrow ASB \mid \epsilon$

$A \rightarrow aAS \mid a$

$B \rightarrow SbS \mid A \mid bb$

30. a. Construct PDA for the language $L = \{ww^r : w \in \{a,b\}\}$ and illustrate with the string *abbbba*.

(OR)

b. Construct CFG for the following PDA $P = (\{p,q\},\{0,1\},\{x,z_0\},\delta,q,z_0)$ where δ is defined by

(i) $\delta(q,1,z_0) = \{(q,xz_0)\}$

(ii) $\delta(q,1,x) = \{(q,xx)\}$

(iii) $\delta(q,0,x) = \{(p,x)\}$

(iv) $\delta(q,\epsilon,x) = \{(q,\epsilon)\}$

(v) $\delta(p,1,x) = \{(p,\epsilon)\}$

(vi) $\delta(p,0,z_0) = \{(q,z_0)\}$

31. a.i. Construct a TM which accepts palindrome over $\Sigma = \{a,b\}$. (8 Marks)

ii. What is multitape TM? Explain with an example. (4 Marks)

(OR)

b.i. Construct a TM that will perform monks subtraction. (8 Marks)

ii. Prove that the union of two recursive languages is also recursive. (4 Marks)

32. a. Prove that M PCP is undecidable.

(OR)

b. Explain the following with suitable examples

(i) NP type problem

(ii) NP complete type problem

(iii) NP hard type problem

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