Hall Ticket Number:

Code No. : 31525 S

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (IT) III Year I-Semester Supplementary Examinations, May/June-2018

Theory of Automata

Time: **3** hours Max. Marks: **70**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

1. Write the basic differences between a DFA and an NFA?
2. Define regular expression and give two examples.
3. State the pumping lemma for regular languages.
4. What is a parse tree? Give one example.
5. Construct a PDA equivalent to the following grammar.
   S → aAA
   A→ aS | bS | a
6. List the closure properties of context free languages.
7. Describe Multi Stack Turing Machine?
8. Write the formal definition of Turing Machine
9. Define Modified Post's Correspondence Problem (MPCP).
10. What is an NP Complete Problem?

Part-B (5 × 10 = 50 Marks)

11. a) Construct an Є- NFA for the regular expression (00 + 11) 0* [4]

    b) Convert the following Є - NFA to NFA (without ε transitions) [6]

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

12. a) Minimization the following DFA. [6]

δ	0	1
→A	B	E
B	C	F
C	D	H
*D	E	H
E	F	I
F	G	B
G	H	B
H	I	C
*I	A	E

    b) Check whether the following grammar is ambiguous or not. [4]
    S -> aB / bA
    A -> aS / bAA / a
    B -> bS / aBB / b

Contd... 2

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13. a) Design a PDA that accepts **{wcw^r| win (0+1)* }** [5]

    b) State pumping Lemma for Context-Free Languages and prove that the following Language is not Context free Language. [5]

    {$0^n 1^n 2^n$ | n>=1}

14. a) Design a Turing Machine to compute the proper subtraction function which is defined as below [7]

    m – n = m-n if m > = n
    = 0 if m < n

    b) Explain the halting problem of Turing machines. [3]

15. a) What is PCP and test whether the following PCP instance has a solution or not. [5]
    A = (ab, a, bc, c) B = (bc, ab, ca, a).

    b) Define universal language and write the binary code corresponding to the turing machine M whose moves are given as: [5]

    $\delta(q_1,1)=(q_3,0,R)$
    $\delta(q_3,0)=(q_1,1,R)$
    $\delta(q_3,1)=(q_2,0,R)$
    $\delta(q_3,B)=(q_3,1,L)$

16. a) Convert the following DFA to a regular expression using Arden's Theorem. [5]

δ	a	b
--> *P	S	P
Q	P	S
R	R	Q
S	Q	R

    b) Show that **{$0^i 1^j$ | gcd (i, j) = 1}** is not regular. [5]

17. Answer any ***two*** of the following:

    a) Obtain a CFG that generates the language accepted by following PDA [5]
    M = ($\{q_0, q_1\}$, {a,b} , {A,Z} , δ , q_0 , Z , $\{ q_1\}$)
    with the transitions $\delta(q_0 , a , Z) = (q_0 , A Z)$
    $\delta(q0 , b , A) = (q0 , AA)$
    $\delta(q_0 , a , A) = (q_1 , \epsilon)$

    b) Discuss about various modifications of Turing Machines. [5]

    c) Explain the SAT problem. [5]