Total No. of Printed Pages:4

**SUBJECT CODE NO:- E-95**

**FACULTY OF ENGINEERING AND TECHNOLOGY**

**T.E.(CSE/IT) Examination Nov/Dec 2017**

**Theory of Computation**

**(REVISED)**

**[Time: Three Hours]** **[Max.Marks:80]**

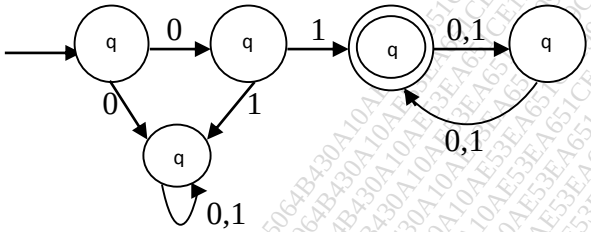
Please check whether you have got the right question paper.

N.B
i. Q. No. 1 and Q.No.6 are compulsory.
ii. Attempt any two questions from Q.No.2 to Q.No.5 and two questions from Q.No.7 to Q.No.10 of each section.
iii. Figures to the right indicate full marks.

**SECTION A**

Q.1 Attempt any five questions from the following : 10

a) Determine whether the following DFA accepts the string 011101 or not.




b) Define context-free grammar with suitable example.
c) Differentiate between NFA and DFA.
d) Find regular expression for set of all strings over {0, 1} ending with 11 and beginning with 100.
e) State Arden's Theorem. Where is it required?
f) Let G= ({S},{a,b,t,*},P,S) where P consists of : S⟶ S+S | S*S |a| b . Derive a + a*b.
g) Construct a finite automata for the regular expression 10(0+1)01.
h) Define Moore Machine with an example.

Q.2 a) Construct DFA equivalent to given NFA: 08

({p, q , r, s ,t},{0,1}, δ,p, {s })

Where δ is given by

| States/Σ | 0 | 1 |
|---|---|---|
| ⟶p | {p ,t} | {p, q} |
| q | Ø | {r} |
| r | {r} | {r} |
| *s | {s} | {s} |
| t | {s} | Ø |

b) Define ambiguity in CFG. Show that the following CFG is ambiguous: 07

S⟶ a B| a A , A⟶ a AB |a| b, B⟶ Abb |b.

Q.3 a) Describe the closure properties of regular languages. 07

b) Construct a Moore machine equivalent to following Mealy machine: 08

| Present State | Next state | | | |
|---|---|---|---|---|
| | a=0 | Output | a=1 | Output |
| → $q_1$ | $q_1$ | 1 | $q_2$ | 0 |
| $q_2$ | $q_4$ | 1 | $q_4$ | 1 |
| $q_3$ | $q_2$ | 1 | $q_3$ | 1 |
| $q_4$ | $q_3$ | 0 | $q_1$ | 1 |

Q.4 a) Show that L= $\{a^p \mid p \text{ is a prime}\}$ is not regular language. 07

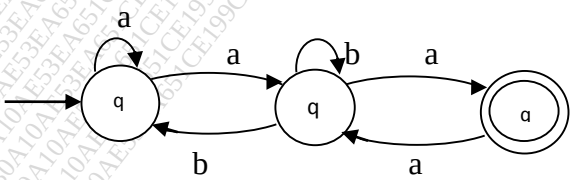
b) Let G=S→0B|1A, A→0|0S|1AA ,B→1|1S|0BB, for string 11001010, 08

Find: i) leftmost derivation,
ii) rightmost derivation,
iii) parse tree

Q.5 a) Draw finite automata for the following transition table & construct minimum state automata equivalent to it: 08

| States/Σ | 0 | 1 |
|---|---|---|
| →A | B | C |
| B | D | E |
| C | F | G |
| D | D | E |
| E | F | G |
| F | D | E |
| G | F | G |

b) Consider the following finite automata prove that the strings recognized are:- 07
(a + a(b + aa)*b)* a(b +aa)*a

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## SECTION B

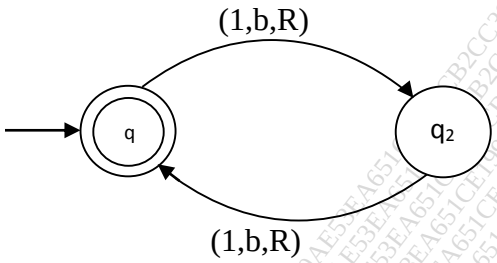
Q.6 Attempt any five question from the following: 10

a) Construct PDA for the following CFG:
s→ a |a S| bSS | SSb | SbS .

b) Define Chomsky Normal form with suitable example.

c) Differentiate between recursive & recursively enumerable languages.

d) Determine whether the string 1111 is accepted by the following Turing machine.




e) Discuss halting problem in Turing machine.

f) Define deterministic pushdown automata formally.

g) Explain decision problems involving context-free languages.

h) Let G be S→AB , A→a, B→C|b, C→D , D→E & E→a. Eliminate unit productions and get equivalent grammar.

Q.7 a) Find reduced grammar equivalent to G whose productions are: 07
S→AB|CA , B→BC|AB, A→a, C→aB|b.

b) Construct a grammar in Greibach normal form equivalent to the grammar. 08
S→AA|a , A→SS|b.

Q.8 a) Construct a PDA for the language L={$ww^R$ | w$\epsilon${a,b} * $w^R$ is reverse of w} 08

b) Explain various programming techniques for Turing machine with suitable example. 07

Q.9 a) Design a TM over {1, b} which can compute a concatenation function over $\Sigma=\{1\}$. 07

b) Construct a CFG 'G' which accepts N(A), where, $A=(\{q_0,q_1\},\{a,b\},\{z,z_0\},\delta, q_0,z_0,\emptyset)$ and $\delta$ is given by- 08

$\delta(q_0,b,z_0) =\{(q_0,zz_0)\}$
$\delta(q_0,\Lambda,z_0) =\{(q_0, \Lambda)\}$
$\delta(q_0,b,z) =\{(q_0,zz)\}$
$\delta(q_0,a,z) =\{(q_1,z)\}$
$\delta(q_1,b,z) =\{(q_1, \Lambda)\}$
$\delta(q_1,a,z_0) =\{(q_0,z_0)\}$

Q.10 a) Explain the model of linear bounded automata in detail. 07

b) Find a grammar in CNF equivalent to the following grammar: 08
$S\rightarrow aAbB$, $A\rightarrow a\ A \mid a$, $B\rightarrow bB|b$