Total No. of Printed Pages:04

SUBJECT CODE NO: H-196
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E. (CSE/IT)
Theory of Computation
(REVISED)

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

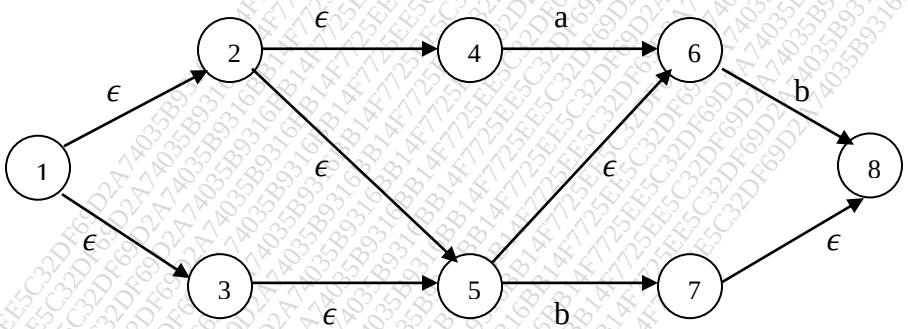
Please check whether you have got the right question paper.

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) Compute $\epsilon -$ closure of every state in the following $\epsilon -$ NFA.



b) Differentiate between Mealy and Moore Machine.

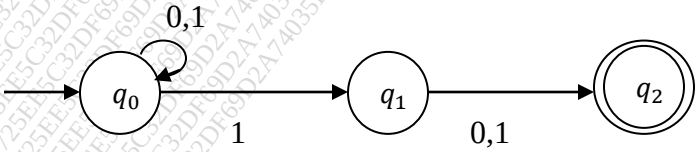
c) Construct finite automata for the regular expression $11(0+1)0^*$

d) State any two algebraic laws for regular expressions with suitable example.

e) Why are context – free grammars used in parsers? Justify your answer.

f) Find regular expression for set of all strings over {a, b} beginning & ending with ab.

g) Determine whether the string 01010 is accepted by following NFA or not.



h) Let $G = \{S \rightarrow aA,\ A \rightarrow abb|abB,\ B \rightarrow aa|ab\}$. Derive the string "aabab" from G.

Q.2 a) Find out minimal DFA for the following DFA $A = (\{q_1, q_2, q_3, q_4, q_5\}, \{0,1\}, \delta, q_1\{q_3, q_5\})$ where δ is – 08

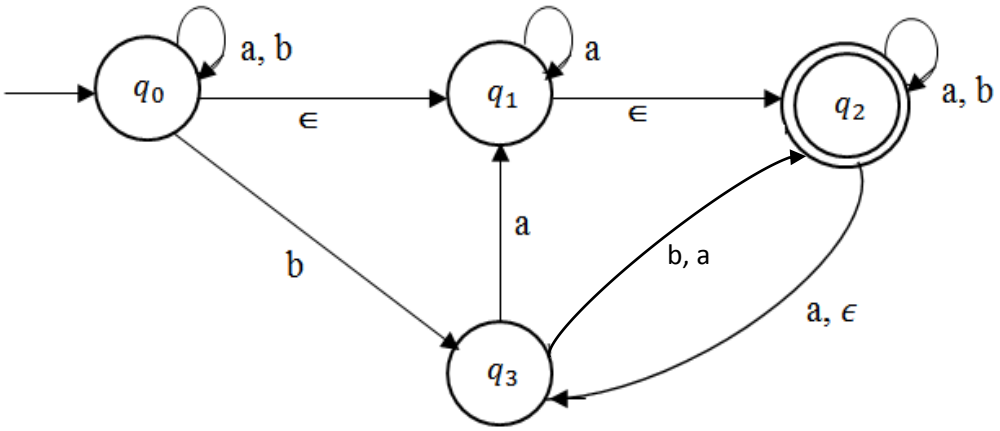
States / Σ	0	1
$\rightarrow q_1$	q_2	q_3
q_2	q_3	q_5
$* q_3$	q_4	q_3
q_4	q_3	q_5
$* q_5$	q_2	q_5

b) Define ambiguous grammar. show that the grammar $S \rightarrow a \mid abSb \mid aAb, A \rightarrow bS \mid aAAb$ is ambiguous. 07

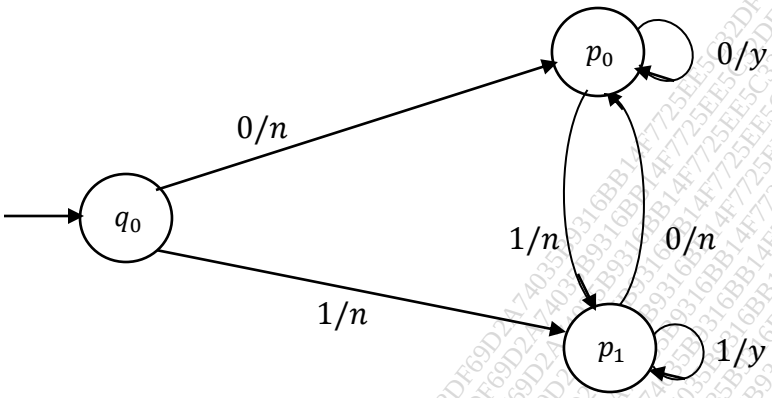
Q.3 a) Construct DFA equivalent to given NFA:- $A = (\{a, b, c, d\}, \{0,1\}, \delta, a, \{d\})$, where δ is given by:- 08

State / Σ	0	1
$\rightarrow a$	a, b	a
b	c	c
c	d	-
$* d$	d	d

b) Eliminate $\epsilon -$ transitions from the following $\epsilon - NFA$ and generate corresponding automata without $\epsilon -$ transitions. 07



Q.4 a) Consider the Mealy machine described by the transition diagram given below. Construct a Moore machine equivalent to it. 08



b) Show that $L = \{a^p / p\ is\ prime\}$ is not regular language. 07

Q.5 a) Construct DFA to accept the language: 08
L={w/w $is\ of\ even\ length\ and\ begins\ with$ 01}
Check whether 011101 is accepted by DFA or not.

b) Let G be the grammar: 07
$S \rightarrow 0B/1A\ , A \rightarrow 0/0S/1AA, B \rightarrow 1/1S/0BB.$
For the string 00110101, find
i) Leftmost derivation
ii) Rightmost derivation
iii) Parse tree

SECTION B

Q.6 Attempt <u>any five</u> questions from the following. 10

a) Eliminate null productions from the following grammar:
$S \rightarrow aS/AB\ , A \rightarrow \Lambda\ , B \rightarrow \Lambda\ , D \rightarrow b$

b) Define Greibach Normal form with suitable example.

c) Explain multitape turing machine with example.

d) Draw transition diagram for the following PDA:
$A = (\{q_0, q_1\}, \{a, b\}, \{a, z_0\}, 8, q_0, z_0, \phi)$
Where δ is defined by –
$\delta(q_0, a, z_0) = \{(q_0, az_0)\}$
$\delta(q_0, a, a) = \{(q_0, aa)\}$
$\delta(q_0, b, a) = \{(q_1, a)\} = \delta(q_1, b, a)$
$\delta(q_1, a, a) = \{(q_1, \Lambda)\}$
$\delta(q_1, \Lambda, z_0) = \{(q_1, \Lambda)\}$

e) Define turing machine formally.

f) Illustrate working of PDA with neat diagram.

g) State the application of pumping lemma for context – free languages.

h) Differentiate between deterministic and non-deterministic PDA.

Q.7 a) Design a turing machine to recognize all strings consisting of odd number of 1's. Test whether this TM accepts 11111 or not. 08

b) Construct a PDA equivalent to the following CFG: 07

$S \rightarrow a|\ as \mid ssb \mid sbs.$
test whether aaabba is in N(A).

Q.8 a) Construct a reduced grammar equivalent to the grammar: 07
$S \rightarrow aAa\ , A \rightarrow Sb|bCC|DaA, C \rightarrow abb|DD, E \rightarrow aC, D \rightarrow aDA$

b) Construct a CFG equivalent to the following PDA: 08
$M = (\{q_0, q_1\}, \{0,1\}, \{x, z_0\}, \delta, q_0, z_0, \phi)$
Where , δ is given by :-
$\delta(q_0, 0, z_0) = \{(q_0, Xz_0)\}$
$\delta(q_0, 0, X) = \{(q_0, XX)\}$
$\delta(q_0, 1, X) = \{(q_1, X)\}$
$\delta(q_1, \Lambda, X) = \{(q_1, \Lambda)\}$
$\delta(q_0, \Lambda, z_0) = \{(q_1, \Lambda)\}$

Q.9 a) Construct a PDA accepting language $L = \{a^n b^{2n} | n \geq 1\}$ by null store. 07

b) Reduce the following grammar to Chomsky normal form: 08

$S \rightarrow 1A|0B\ , A \rightarrow 1AA|0S|0, B \rightarrow 0BB|1S|1.$

Q.10 Write short notes on : 15
a) Turing Machine and Halting Problem.
b) Linear Bounded Automata.
c) Recursively Enumerable languages.