Total No. of Questions : 12]

SEAT No. :

P2345

[Total No. of Pages :4

[4758] - 83
T.E. (Computer Engineering)
THEORY OF COMPUTATION
(2008 Pattern) (310245)

Time : 3 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Assume suitable data if necessary.***

SECTION - I

Q1) a) Construct NFA and DFA for accepting all possible strings of zeroes and ones not containing 011 as a substring. **[6]**

b) Define the following terms with example. **[4]**

i) Symbol

ii) Alphabet

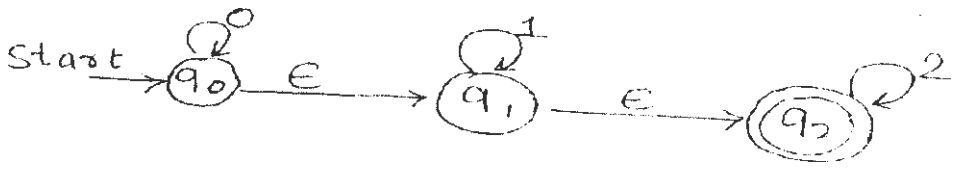
iii) NFA

c) For w= {a,b}*, design a Mealy machine that gives an output of 1 if the input string w ends in aba, otherwise output 0. **[6]**

OR

Q2) a) Design Mealy and Moore machine for the following processes. For input from (0,1)*, if input string ends in 110, output x, if input string ends in 101, output y otherwise output z. **[10]**

b) Consider the following NFA with ∈ -transitions. Convert this NFA to DFA. **[6]**



P.T.O.

Q3) a) Explain the closure properties and decision properties of regular languages. **[6]**

b) Let L $=\{0^n \mid n \text{ is prime}\}$ show that L is not regular. **[6]**

c) Design the finite automata and then equivalent regular expression using Arden's theorem that accepts the set of all strings over the alphabet {a,b} with an equal number of a's and b's. such that each prefix has atmost one more a than b's and atmost one more b than a's. **[6]**

OR

Q4) a) Prove: **[6]**

i) $\Phi^* = \varepsilon$ (Φ is null)

ii) $(r^*s^*) = (r+s)^*$

b) For each of the following draw DFA, **[8]**

i) $(11 + 00)^*$

ii) $(111 + 100)^*. 0$

c) Explain the application of regular expressions in unix with any one example. **[4]**

Q5) a) Find a CFG for each of the following languages: **[10]**

i) The set of odd length strings in {a, b}* with middle symbol a

ii) The set of even length strings in {a,b}* with the two middle symbols equal.

iii) The set of odd length strings in {a,b}* whose first, middle and last symbols are all same.

b) Prove that L $=\{a^ib^ic^i \mid i > 1\}$ is not a CFL. **[6]**

OR

Q6) a) Convert the following grammar to Griebach Normal form. **[6]**

$S \rightarrow ABA \mid AB \mid BA \mid AA \mid A \mid B$

$A \rightarrow aA \mid a$

$B \rightarrow bB \mid b$

b) Define Normal Forms in grammars with the help of suitable examples. **[4]**

c) For the right linear grammar given below, obtain an equivalent left linear grammar. **[6]**

$S \rightarrow 10A \mid 01$

$A \rightarrow 00A \mid 1$

SECTION - II

Q7) a) Design push down automata (PDA) for accepting the set of all strings over {a, b} with an equal number of a's and b's. The string should be accepted both by **[10]**

i) Final state

ii) Empty stack

b) Construct push down automata (PDA) for accepting $L = \{a^n b^m a^n | m,n >= 1\}$. **[6]**

OR

Q8) a) Prove "Let L be a language accepted by deterministic PDA, then the complement of L, can also be accepted by a DPDA". **[4]**

b) Show that if L is accepted by a PDA in which no symbols are removed from the stack, then L is regular. Justify with appropriate example. **[6]**

c) Give a PDA and FA, which of these machines is capable of accepting a palindrome string? Justify your answer for both machines. **[6]**

Q9) a) Show that the language $L = \{a^n b^n c^n \mid n >= 0\}$ is Turing - decidable. **[6]**

b) Construct POST machine for the language $(a^n b^n \mid n >= 0\}$. **[6]**

c) Design a Turing machine for accepting the strings with an equal number of 0's and 1's. **[6]**

OR

Q10)a) Explain following Turing Machine. **[6]**

i) Single infinite length TM

ii) Multi-tape TM

b) Write a short note on universal TM. **[6]**

c) Design Post Machine that accepts the strings of 'a' and 'b' having odd length and the element at the center is 'a'. **[6]**

Q11)a) Show that the set of languages L over {0,1}, so that neither L and L' is recursively enumerable, is uncountable. **[6]**

b) What is un-decidability? How do you prove that a problem is un-decidable? Prove that the blank tape halting problem is un-decidable. **[6]**

c) Prove that the set of real numbers R is not countable. **[4]**

OR

Q12)a) Write a short note on Post Correspondence Problem. **[4]**

b) Show that if L_1 and L_2 are recursive languages and if L is defined as: **[6]**

$L = \{w \mid w \text{ is in } L_1 \text{ and not in } L_2 \text{ or } w \text{ is in } L_2 \text{ and not in } L_1\}$, then prove or disprove that L is recursive.

c) Show the following problem is un-decidable. "Given a TM T, there exist some string on which T halts". **[6]**

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