(c) Write notes on decidable and undecidable. 4

10. (a) Let L(R) be language represented by regular expression R. Let L(G) be language generated by context free grammar G. 2x2=4

Let L(D) be a language generated by deterministic conetxt free grammer. Which of the following is True / False. Explain with example.

(i) Given a regular expression R and a string w, is $\omega \subseteq L(R)$ is decidable.

(ii) Given a context free grammar G is L(G)= finite or infinite.

(b) Write short notes on : 5+5=10

(i) Church's turing Teris

(ii) Universal Turing Machine.

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PG Even Semester Examination, September, 2023

COMPUTER SCIENCE

(8th / 2nd Semester)

Course No.: MCS-551

(Theory of Computation)

Full Marks: 70

Pass Marks: 28

Time: 3 hours

The figures in the margin indicate full marks for the questions.

Answer any five questions, taking one from each unit.

UNIT-I

1. (a) Write regular expression to recognise the set of strings over {a,b}, for the language containing the set of all strings 'w', that

(i) Start and ends with different symbol

(ii) Contain a substring 'aab'

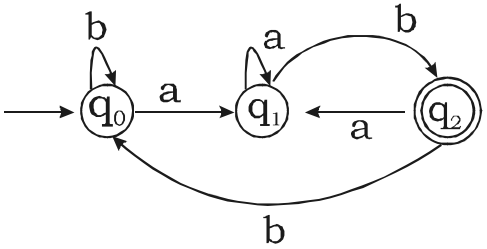
(iii) Length of w is equal to 3

(iv) Length of w is at least 3.

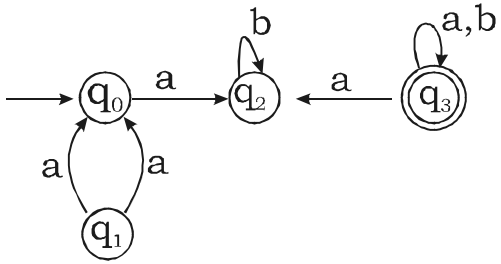
(v) Length of w is atmost 3. 5x2=10

(b) If the final states and non-final states in the given DFA are interchanged then write

the language over the alphabet {a,b} will be accepted by the new DFA? 2



(c) Write the equivalent regular expression of the following Finite Automata (FA). 2

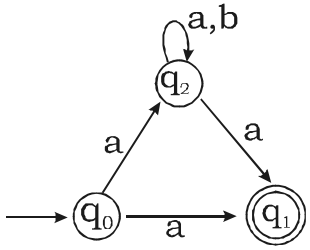


2. (a) Construct a DFA, over Σ={a,b} which accepts a language of all strings not starting with 'a' or not ending with 'b'. 4

(b) Construct a DFA, that accepts the set of all strings 'ω' over Σ= {a,b} where 4

(i) $|\omega| \bmod 2=0$ (ii) $|\omega| \bmod 2=1$

(c) Convert the given NFA to DFA. 6



$T \rightarrow aT/bU/\in$

$U \rightarrow aT /\in$

UNIT-IV

7. (a) Design a Turing Machine that will accept the language. 8

$L= \{a^n b^n c^n / n>1\}$

(b) Convert the given CFG (Context free grammar) to CNF (Greibach Normal form) 6

$S \rightarrow CA|BB$

$B \rightarrow b|SB$

$C \rightarrow b$

$A \rightarrow a$

8. (a) Design a Turing Machine that will accept the language. 8

$L= \{\omega c \omega / \omega \in \{a,b\}^*\}$

(b) Convert the given CFG (context free gramma) to CNF (Chemsky Normal Form) 6

$S \rightarrow bA|AB$

$A \rightarrow bAA|aS|a$

$B \rightarrow aBB|bS|b$

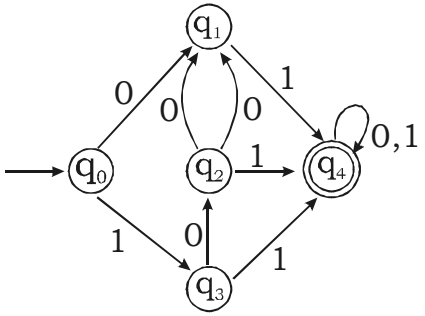
UNIT-V

9. (a) Explain Halting problem of Turing Machine. 5

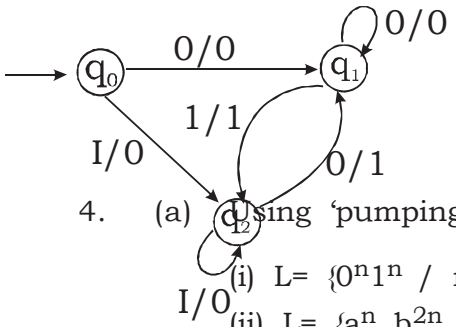
(b) Explain P and NP complete problems with example. 5

UNIT-II

3. (a) Minimize the given DFA. 7



(b) Convert Mealy to Moore machine. 7



4. (a) Using 'pumping Lemma' prove that - 2x4=8

(i) L= $\{0^n 1^n / n>1\}$ is not regular

(ii) L= $\{a^n b^{2n} / n>0\}$ is not regular

(b) Identify the following language is regular or not? Explain. 2x3=6

(i) L= $\{a^n b^m / n, m>0\}$

(ii) L= $\{a^n b^n / n>0\}$

(iii) L= $\{a^n b^m / n+m= \text{even}\}$

UNIT-III

5. (a) If G is a grammar with productions 3

$S \rightarrow SaS|aSb|bSa|SS|E$

where S is the start variable, then design the parse trees and write the production ruels used (derivation) for any three strings that are generated by G?

(b) Identify the languages generated by the following grammar. 3

$S \rightarrow bS|aA|b$

$A \rightarrow bA|aB$

$B \rightarrow bB|aS|a$

(c) Design a NDPDA (nondeterministic Pushdown Automata) that will accept the language. 8

$L = \{\omega\omega^R / \omega \in \{a,b\}^*\}$

6. (a) Design a DPDA (Deterministic Pushdown Automata) that will accept the language. 8

$L= \{\omega c\omega^R / \omega \in \{a,b\}^*\}$

(b) Convert the given CFL to CFG 2x2=4

(i) L= $\{a^{2n}b^n / n>1\}$

(ii) L= $\{a^m b^n / m>n, n>0\}$

(c) Consider the CFG (Context free grammar) given below. Give the leftmost derivation for the string 'bbaa' using the grammar. 2

$S \rightarrow bS|aT|\in$