Total No. of printed pages = 3

CSE 181503

Roll No. of candidate ⬜⬜⬜⬜⬜⬜⬜⬜⬜

04/01/2023

2022

B.Tech. 5th Semester End-Term Examination

CSE

FORMAL LANGUAGE AND AUTOMATA THEORY

(New Regulation and New Syllabus)

Full Marks – 70   Time – Three hours

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

Answer Question No. 1 and any *four* from the rest.

1. Answer the following : $(10 \times 1 = 10)$

    (i)   A push down automaton employs ——————— data structure.

    (ii) Production rule aAb->agb belongs to ——————— grammer.

    (iii) In a n-track turing machine, ——————— head/heads read and write on all tracks simultaneously.

    (iv) The regular languages are not closed under ———————.

    (v)   The tuples for NDFA is ———————.

    (vi) Grammar is checked by which component of compiler?

          (a) Scanner   (b) Parser

          (c) Semantic Analyzer   (d) None of the mentioned

    (vii) Which of the following can be used to simulate any turing machine?

          (a) Finite State Automaton   (b) Universal Turing Machine

          (c) Counter machines   (d) All of the mentioned

    (viii) Which of the following strings do not belong the given regular expression?
          $(a)^*(a+cba)$

          (a) aa   (b) aaa

   (c) acba   (d) acbacba

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(ix) Which of the following statement is false?

    (a) Context free language is the subset of context sensitive language

    (b) Regular language is the subset of context sensitive language

    (c) Recursively enumerable language is the super set of regular language

    (d) Context sensitive language is a subset of context free language

(x) The minimum number of productions required to produce a language consisting of palindrome strings over $\sum = \{a, b\}$ is
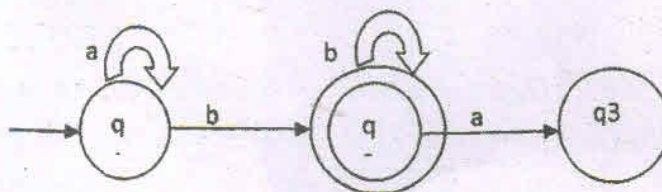
    (a) 3   (b) 7

    (c) 5   (d) 6

2. (a) Define finite automata. Differentiate between DFA and NFA.

    (b) Design a DFA to accepts all strings of a's and b's ending with abb over $\sum = \{a, b\}$.

    (c) Convert the following NFA with ε to DFA. $(5 + 5 + 5 = 15)$
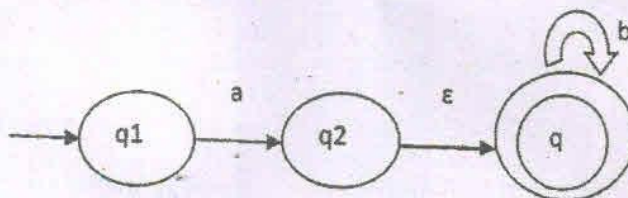
3. (a) Construct Regular expression for the language L which accepts all the strings containing with atleast two b's over $\sum = \{a, b\}$.

    (b) Construct regular expression for the following DFA.

    (c) Define context free grammar. Construct a context free grammar for the language consisting of atleast two a's over $\sum = \{a, b\}$. $(5 + 5 + 5 = 15)$

4. (a) Convert the following grammar to chomsky Normal form : (5)

S-> A11 | 11A

S-> B | 11

A->0

B->BB

(b) Explain Chomsky's hierarchy. Check whether the given grammar is ambiguous or not. (5+5)

S->iCtS

S-> iCtSeS

S->a

S->b

5. (a) Define Push Down Automata. Construct PDA for $a^n b^{2n}$.

(b) What Context sensitive language? Explain with example.

(c) Construct PDA from the following CFG :

S->AB

A->CD

B->b

C-> a

D->a

(5 + 5 + 5 = 15)

6. (a) Define Recursive language. What are decidable languages and undecidable languages?

(b) What are P class and NP class problems? Define Turing machine.

(c) Construct a Turning machine to check whether a string is palindrome or not, over the set $\sum = \{a, b\}$. (5 + 5 + 5 = 15)

7. (a) Prove using pumping lemma that the following language (L) is not regular $L = \{a^n b^n, n \geq 0\}$, $\sum = \{a, b\}$. (5)

(b) Is the grammar in question 7 (a) is context free? If not justify. If yes, design the corresponding CFG (Context Free Grammar). (5)

(c) Explain the computing power of universal turing. (5)