Printed Page:- Subject Code:- AMICSE0404

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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech (Integrated)

SEM: IV - CARRY OVER THEORY EXAMINATION - SEPTEMBER 2022

Subject: Theory of Automata and Formal Languages

Time: 3 Hours Max. Marks: 100

General Instructions:

1. The question paper comprises three sections, A, B, and C. You are expected to answer them as directed.
2. Section A - Question No- 1 is 1 mark each & Question No- 2 carries 2 mark each.
3. Section B - Question No-3 is based on external choice carrying 6 marks each.
4. Section C - Questions No. 4-8 are within unit choice questions carrying 10 marks each.
5. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION A 20

1. Attempt all parts:-

1-a. For the following change of state in FA, which of the following codes is an incorrect option? (CO1) 1

(a) δ (m, 1) = n

(b) δ (0, n) = m

(c) δ (m,0) = ε

(d) s: accept = false; cin >> char;
if char = "0" goto n;

1-b. Regular expression for all strings starts with ab and ends with aba is ..... (CO1) 1

(a) aba*b*aba

(b) ab(ab)*aba

(c) ab(a+b)*aba

(d) All of the mentioned

1-c. Regular expressions are closed under ..... (CO2) 1

(a) Union

(b) Intersection

(c) Kleen star

(d) All of the mentioned

1-d. ---------- denotes all strings of 0's and 1's. (CO2) 1

(a) 0 1

(b) ( 0 + 1) *

(c) ( 0 + 1)

(d) 0 * 1

1-e. Which of the following does not belong to CFG ? (CO3) 1

(a) Terminal Symbol

(b) End Symbol

(c) Start symbol

(d) Non Terminal

1-f. Grammar is defined by number of _____tuples. (CO3) 1

(a) 4

(b) 5

(c) 3

(d) 2

1-g. The PDA has following contents: (CO4) 1

(a) Initial State

(b) Stack top alphabet

(c) transition function

(d) All of the mentioned

1-h. A given grammar is called ambiguous if ..... . (CO4) 1

(a) It has only one production rules.

(b) It has two non terminals on the left hand side

(c) A PDA can be constructed

(d) None of the above

1-i. Turing machine was invented by: (CO5) 1

(a) Alan Turing

(b) Turing man

(c) Turing taring

(d) None of these

1-j. In an standard turing machine(Q,∑,T,δ,q0,b,F) the blank symbol b is ..... (CO5) 1

(a) in ∑-T

(b) in T-∑

(c) T∩∑

(d) none of the above

2. Attempt all parts:-

2.a. Differentiate between NFA and DFA. (CO1) 2

2.b. Write regular expression for language over ∑ = {0, 1} where every string contains at least two 0's . (CO2) 2

2.c. Define CNF and GNF . (CO3) 2

2.d. Define 2 Stack PDA . (CO4) 2

2.e. Define Church thesis. (CO5) 2

SECTION B 30

3. Answer any five of the following:-

3-a. Draw a DFA to accept string of 0's and 1's ending with the string 011. (CO1) 6

3-b. Discuss the application of Finite Automata in String Matching. (CO1) 6

3-c. Draw NFA with ε transition for the R.E. (0+1)*011(0+1)* . (CO2) 6

3-d. Describe and prove any 3 closure properties of regular languages (with example). (CO2) 6

3.e. Discuss the procedure to eliminate Null Productions and Unit Productions with help of an example. (CO3) 6

3.f. Construct a PDA for { $a^n b^{2n+1}$ / n>=1}. (CO4) 6

3.g. Write short notes on : (1) Linear Bounded Automata (2) Universal Turing machine (CO5) 6

SECTION C 50

4. Answer any one of the following:-

4-a. Define Moore & Mealy Machines. Explain Various points of difference between Moore Machine and Mealy Machine. (CO1) 10

4-b. Explain Chomsky Classification of Grammars in detail. (CO1) 10

5. Answer any one of the following:-

5-a. State Pumping Lemma for Non-Regular languages. Prove that the language L= ($a^n b^n$ where n >= 0} is not regular. (CO2) 10

5-b. What is the relationship between Finite automata and regular expressions. Discuss its applications also. (CO2) 10

6. Answer any one of the following:-

6-a. What is meant by ambiguous grammar? Test whether the grammar is ambiguous or not. (CO3) 10

S →AB

A→ aAb / ab / B

B→ abB / ∈

6-b. State the pumping lemma for context free languages. Show that the language, 10

L = $\{0^n1^n2^n \mid n >= 0\}$ is not a context free language. (CO3)

7. Answer any one of the following:-

7-a. Define push down automata? Explain acceptance of PDA with empty stack. Define Instantaneous description (ID) in PDA. (CO4) 10

7-b. Differentiate between Deterministic PDA and Non Deterministic PDA. (CO4) 10

8. Answer any one of the following:-

8-a. Design a Turing machine to compute the following (CO5) 10

a) Division of Two integers

b) 2's complement of a given binary number

8-b. Show that the PCP with two lists x = (b, $bab^3$, ba) and y = ($b^3$, ba, a) has a solution. Give the solution sequence. (CO5) 10