

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

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) $\delta (m, 1) = n$
- (b) $\delta (0, n) = m$
- (c) $\delta (m,0) = \epsilon$
- (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 $(Q, \Sigma, T, \delta, q_0, b, F)$ the blank symbol b is (CO5) 1
- (a) in $\Sigma - T$
- (b) in $T - \Sigma$
- (c) $T \cap \Sigma$
- (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 $\Sigma = \{0, 1\}$ 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 $\{ a^n b^{2n+1} / n \geq 1 \}$. (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 $L = \{ a^n b^n \mid n \geq 0 \}$ 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
- $S \rightarrow AB$
 $A \rightarrow aAb / ab / B$
 $B \rightarrow abB / \epsilon$
- 6-b. State the pumping lemma for context free languages. Show that the language, 10
 $L = \{0^n 1^n 2^n \mid n \geq 0\}$ 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