Printed Page:- Subject Code:- ACSE0404

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - THEORY EXAMINATION (2021 - 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. A Language for which no DFA exist is a________ (CO1) 1

(a) Regular Language
(b) Non-Regular Language
(c) May be Regular
(d) Cannot be said

1-b. Which of the following option (Statement) is correct? (CO1) 1

(a) NFA is slower to process and its representation uses more memory than DFA
(b) DFA is faster to process and its representation uses less memory than NFA
(c) NFA is slower to process and its representation uses less memory than DFA
(d) DFA is slower to process and its representation uses less memory than NFA

1 Every regular grammar is _____________ (CO2) 1

(a) context free grammar
(b) non context free grammar
(c) english grammar
(d) none of the mentioned

1 (a+b)* is equivalent to __________ (CO2) 1

(a) b*a*
(b) (a*b*)*
(c) a*b*
(d) none of the mentioned

1-e. Context free languages are __________ (CO3) 1

(a) Closed under union
(b) Closed under complementation
(c) Closed under intersection
(d) Not closed under union

1-f. Give a production grammar that accepts the specified language L = {a^i b^{2i} | i >= 1} (CO3) 1

(a) {S->aSbb, S->abb}
(b) {S->aSb, S->b}
(c) {S->aA, S->b, A->b}
(d) None of these

1 Which Automata takes stack as storage? (CO4) 1

(a) Finite Automa
(b) Push Down Automata
(c) Turing Machine
(d) Regular Expression

1	A language accepted by Deterministic Push down automata is closed under which of the following? (CO4) (a) Complement (b) Union (c) All of the mentioned (d) None of the mentioned	1
1	If Turing machine accepts all the words of the language L and rejects or loops for other words, which are not in L, then L is said to be ___ (CO5) (a) recursively enumerable (b) recursive (c) context free language (cfl) (d) none of them	1
1	Which of the following problems is undecidable? (CO5) (a) Finiteness problem for FSAs (b) Membership problem for CFGs (c) Equivalence problem for FSAs (d) Ambiguity problem for CFGs	1

2. Attempt all parts:-

2.a.	How will you find the Reverse of a regular language? Explain. (CO1)	2
2.b.	Define alphabet, language and strings. (CO2)	2
2.c.	Eliminate the Unit productions from the following Grammar: S->XY ǀ a , X->Y , Y->Z ǀ b , Z-> c (CO3)	2
2.d.	List any two languages that can be implemented by both DFA and PDA. (CO4)	2
2.e.	State halting problem of Turing Machine. (CO5)	2

SECTION B 30

3. Answer any five of the following:-

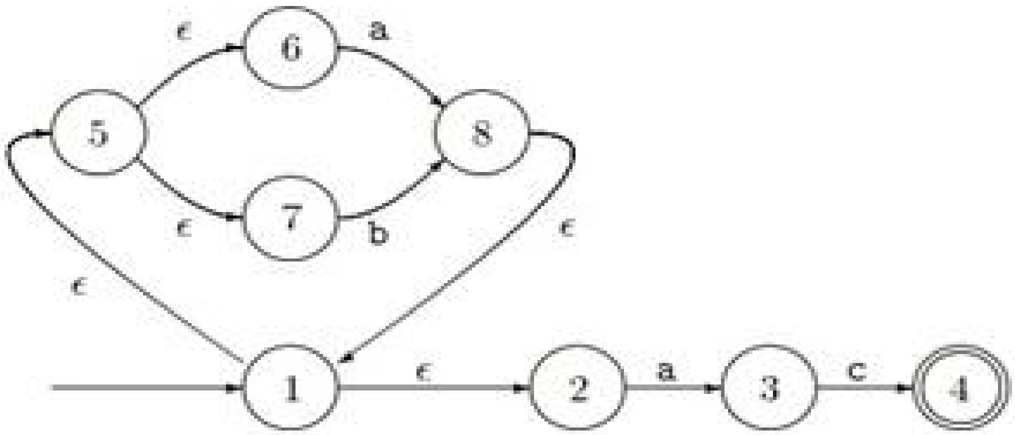
3	Construct a finite automaton (deterministic or nondeterministic) that recognizes the language over the alphabet {a, b, c} of all strings not containing the substring ba (CO1)	6
3	Construct a Mealy Machine that accepts all the strings ending in 01 and 11 over an alphabet $\Sigma = \{0, 1\}$. Convert the same to a Moore Machine. (CO1) Construct a Mealy Machine that accept string ending in 01 and 11. Convert the same to a Moore Machine.	6
3-c.	Explain Left Linear Grammar and Right Linear Grammar with the help of suitable examples. (CO2)	6
3-d.	Describe and prove any 3 closure properties of regular languages (with example). (CO2)	6
3.e.	Show that the Grammar with rule E -> E - E ǀ E + E ǀ E * E ǀ E ^ E ǀ a is ambiguous. Also rewrite an Unambiguous Grammar for the same. (CO3)	6
3.f.	Construct a DPDA which accepts the following language, (CO4) L = $\{wcw^R \mid w \in \{a, b\}^*, \Sigma = \{a, b, c\}\}$	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 Draw an NFA that accepts a language L over an input alphabet $\sum = \{a, b\}$ such that L is the set of all strings where 3^{rd} symbol from the right end is 'b'. Also convert the same to DFA. (CO1) 10

4 Convert the following NFA-ε into NFA without ε . (CO1) 10



5. Answer any one of the following:-

5 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 Write regular expression for the following Languages over $\sum = \{x, y\}$ that contains: (CO2) 10

(i) Strings where number of x's are even
(ii) Strings with length at least 5.
(iii) Strings where 4^{th} symbol from the end is y.
(iv) Strings where there are no two consecutive x's.
(v) Strings with length at most two.

6. Answer any <u>one</u> of the following:-

6-a. Write the steps to convert CFG to GNF. (CO3) 10

6-b. State the pumping lemma for context free languages. Show that the language, $L = \{0^n 1^n 2^n \mid n >= 0\}$ is not a context free language. (CO3) 10

7. Answer any <u>one</u> of the following:-

7 Compare Deterministic and Non deterministic PDA. Is it true that non deterministic PDA is more powerful than deterministic PDA? Justify your answer. (CO4) 10

7 Compare FM and PDA. Construct a PDA accepting all palindromes over {a, b}. (CO4) 10

8. Answer any <u>one</u> of the following:-

8-a. Show that the union of two recursively enumerable languages is also a recursively enumerable language and union of two recursive languages is recursive. (CO5) 10

8-b. Define turing machine and describe its capabilities. 10
Construct a TM for the language: $L = \{a^n b^n c^n \mid n >= 0\}$ (CO5)