SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Computer Science & Engineering
B. Tech. (CSE) Sem-III, Minor-1 Examination (Odd) 2018-19

Entry No: 17BCS045 | Total Number of Pages: [02]
Date: 01/09/2018 | Total Number of Questions: [05]

Course Title: Theory of Computation

Course Code: CSL 2041

Time Allowed: 1.5 Hours | Max Marks: [20]

Instructions / NOTE
i. Attempt All Questions.
ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
iii. Assume any missing data to suit the case / derivation / answer.

Section - A

Q1. (a) Let N be an NFA and w be a string. We say that N accepts w, if [1x4=4] CO1
A. All computation paths of N on w reach an accept state.
B. Exactly one computation path of N on w reaches an accept state.
C. No computation path of N on w reaches an accept state.
D. At least one computation path of N on w reaches an accept state.

(b) Let Q be the number of states in an NFA N. From any state in N, on reading an input symbol, N can go to
A. At most Q-1 states
B. At least Q-1 states
C. At most Q states
D. At least 2 states.

(c) Which of the following equivalences are true
A. $\emptyset^* = \epsilon$ B. $\epsilon^* = \emptyset$ C. $\emptyset + \epsilon = \epsilon$ D. $\emptyset.\epsilon = \epsilon$

(d) Which of the following strings can be generated by the regular expression $(1+01)^*0^*$
A. ϵ B.100101 C.001010 D.11101011000

Section - B

Q2. (a) Construct a Deterministic finite automaton to accept the set L [2x2=4] CO1
$L = \{ x \mid x$ is a binary string divisible whose decimal value is divisible by 4$\}$

(b) Construct a Deterministic finite automaton to accept the set L of all strings over $\{0,1\}$ ending with 010. over the alphabet $\Sigma = \{0,1\}$.

Q3. (a) Construct an NFA with three states and single final state that accept the language $\{ab, abc\}^*$ over the alphabet $\Sigma = \{a,b,c\}$ [2x2=4] CO1

(b) Consider the following modification of definition of an NFA with multiple initial states is defined by the quintuple
$M = (Q, \Sigma, \delta, Q_0, F)$

$Q_0 \subset Q$ is a set of possible initial states. The language accepted by such an n is defined as

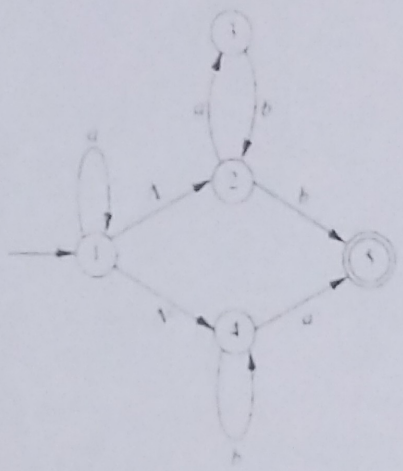
$L(M) = \{w: \delta^*(q_0, w) \text{ contains } q_f, \text{ for any } q_0 \in Q_0, q_f \in F\}$.

for every NFA with multiple initial states there exists an NFA with a l state that accepts the same language.

Q4. (a) Di... the algebraic properties of Regular expression [2x2=4] CO1

(b) Give the regular expression for the language L= {w | w has 1 at every odd position and |w| is odd} over the alphabet $\sum = \{0,1\}$

Q5. Convert following NFA to an equivalent DFA, first remove the lamda (λ) transition and then convert it to final DFA. [04] CO1



Course Outcomes

After Successful Completion of this Course, students shall be able to:

(1) Understand various computational models such as deterministic and non-deterministic finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.

(2) Understand more powerful class of language i.e. context-free languages by mastering the concepts of context- free grammars and more powerful machine push- down automata as compared to NFA's and DFA's.

(3) Solve analytical problems in related areas of theory in computer science. Able to design efficient Turing Machines to understand the concepts of recursive and recursively enumerable languages.

CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1	1(a)-1(d), 2(a)-2(b), 3(a)-3(b), 4(a)-4(b), 5	20	60

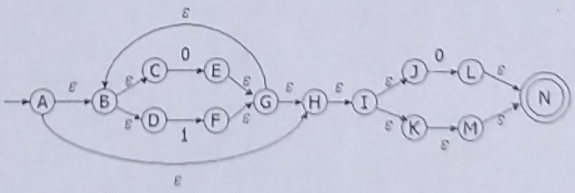
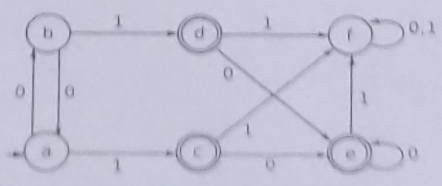
SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Computer Science & Engineering
B.Tech. (CS & E) Minor Examination (Odd Semester) 2018-19

Entry No: 17BCS0455 Total Number of Pages: [02]
Date: 14/10/2018 Total Number of Questions: [04]

Course Title: Theory of Computation
Course Code: CSL 2041

Time Allowed: 1.30 Hours Max Marks: [20]

NOTE
i. Attempt All Questions.
ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
iii. Assume an appropriate data / information, wherever necessary / missing.

	Section - A		
Q1.	(a) Prove or Disprove C/C++ language is regular or not.	[01]	CO1
	(b) Design DFA for scanf("%s", &str);	[01]	CO1
	(c) What is derivation tree, explain with example.	[01]	CO2, CO3
	(d) According to Chomsky hierarchy Regular grammar is: a) Type 0 grammar b) Type 1 grammar c) Type 2 grammar d) Type 3 grammar	[01]	CO2
Q2.	(a) Convert given ε-NFA into DFA. 	[02]	CO1
	(b)Prove that difference of two regular language is regular.	[02]	CO1, CO2
	Section - B		
Q3.	(a). Design a PDA for language L={ wcw^r |w∈{a,b}* }.	[02]	CO2
	(b) Write CFG for language L=$\{a^n b^m c^m d^n : n, m \geq 1\}$.	[02]	CO2
Q4.	(a) Minimize given DFA: 	[04]	CO1
	(b) Design a Pushdown automata for language L=$\{a^i b^j c^k : \|i-k\| = j\}$.	[04]	CO2

Course Outcomes

CO1: Comprehend various computational models such as deterministic and non-deterministic finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.

CO2: Understand more powerful class of language i.e. context-free languages by mastering the concepts of context- free grammars and more powerful machine push- down automata as compared to NFA's and DFA's.

CO3: Solve analytical problems in related areas of theory in computer science by designing efficient Turing Machines to understand the concepts of recursive and recursively enumerable languages.

CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1	1(a), 1(b), 2(a), 2(b),4(a)	10	54
CO2	1(c), 1(d), 2(b), 3(a), 3(b),4(b)	12	54

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA-182320

School of Computer Science & Engineering

B.Tech. (CS & E) Major Examination (Odd Semester) 2018-19

Entry No: 17BCS045

Total Number of Pages: [02]

Date: 27/11/2018

Total Number of Questions: [05]

Course Title: Theory of Computation

Course Code: CSL 2041

Time Allowed: 3.00 Hours

Max Marks: [50]

NOTE

i. Attempt All Questions.

ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.

iii. Assume an appropriate data / information, wherever necessary / missing.

Q1.	(a) Write the regular set denoted by regular expression $(a+b)(a+b)$.	[01]	CO1
	(b) How many different possible string of length exactly n over $\Sigma = (\Delta + \nabla)$.	[01]	CO1
	(c) What is Universal Turing Machine?	[01]	CO3
	(d) Define non-RE languages and give one example of non-RE language?	[01]	CO3
	(e) What is derivation tree? Write one example of ambiguous grammar?	[01]	CO2
Q2.	(a) If L_1 and L_2 are two RL then show that $L_1 \cup L_2$ is also RL.	[03]	CO1
	(b) Design a PDA for $L = \{a^i b^j c^k : j = i \text{ or } k+2\}$.	[03]	CO2
	(c) Given two finite automata M_1 and M_2, whether $L(M_1) = L(M_2)$ is decidable.	[03]	CO1
Q3.	(a) Prove that $L = \{a^p : p \text{ is prime no.}\}$ is non regular language.	[04]	CO2
	(b) Simplify given grammar $S \rightarrow ASA \mid aB$, $A \rightarrow B \mid S$, $B \rightarrow b \mid \varepsilon$ and convert it into CNF.	[04]	CO2
	(c) Write CFG for language $L = \{a^i b^j c^k \mid i, j, k \geq 0 \text{ and } i - j = k\}$.	[04]	CO2
Q4.	(a) If L_1 and L_2 are two recursive language then show that $L_1 \cap L_2$ and $L_1 \cup L_2$ are also recursive.	[05]	CO3
	OR		
	If L_1 and L_2 are two CFL then show that $L_1 \cap L_2$ need not be CFL.	[05]	CO2
	(b) Design a Turing Machine for $L = \{a^n b^n c^n : n > 0\}$.		
Q5.	(a) Prove that halting problem of Turing machine is undecidable.	[07]	CO3
	OR		
	Design a Turing Machine for $L = \{ww : w \in (a+b)^*\}$.		
	(b) Prove that language $L_U = \{< M >: M \text{ is a TM and } < M > \in L(M)\}$ is not	[07]	CO3

	recursive. OR Covert given grammar $S \to XY$, $X \to YS \mid 1, Y \to SX \mid 0$ into GNF.		

Course Outcomes

CO1: Comprehend various computational models such as deterministic and non-deterministic finite automata and develop ability to provide the equivalence between regular expressions, NFAs, and DFAs.

CO2: Understand more powerful class of language i.e. context-free languages by mastering the concepts of context- free grammars and more powerful machine push- down automata as compared to NFA's and DFA's.

CO3: Solve analytical problems in related areas of theory in computer science by designing efficient Turing Machines to understand the concepts of recursive and recursively enumerable languages.

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Comp. Sc. & Engg.

B. Tech. (Comp. Sc. & Engg) Minor Examination (Even) 2019-20

Entry No: 1 8 B C S 0 2 2 | **Total Number of Pages: [02]**

Date: 27th September, 2019 | **Total Number of Questions: [08]**

Course Title: Theory of Computation

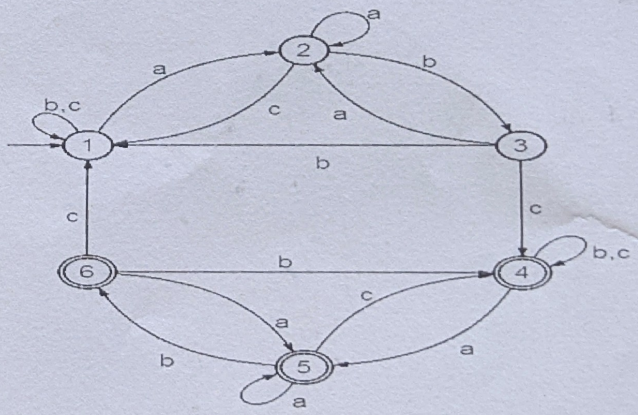
Course Code: CSL 2041

Time Allowed: 1hour 30 minutes | **Max Marks: [20]**

Instructions / NOTE

i. Attempt All Questions.
ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
iii. Assume an appropriate data / information, wherever necessary / missing.

Q1. Describe in English, the language accepted by the following FA. [03]

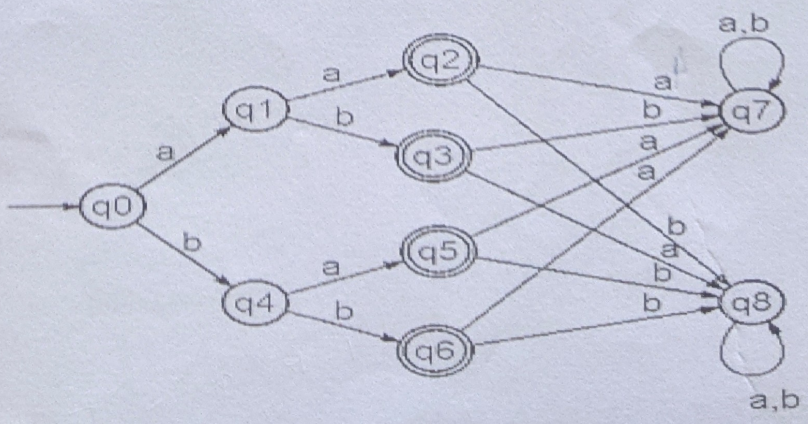


Q2. Find a string of minimum length in {0, 1}* not in the language corresponding to the given regular expression. [04]

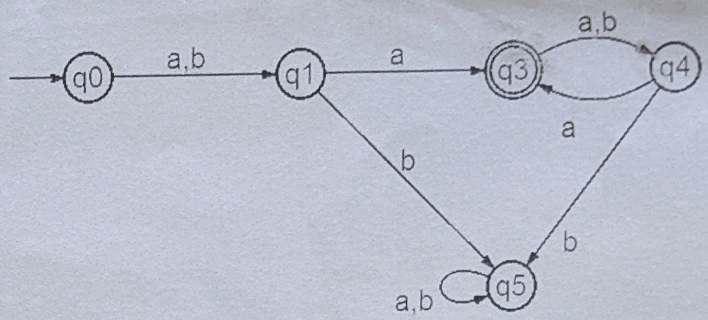
a) 1*(01)*0*
b) (0* + 1*)(0* + 1*)(0* + 1*)

Q3. Build the FA over the language {a, b}* that accepts only those words that have an even number of substring ab. [03]

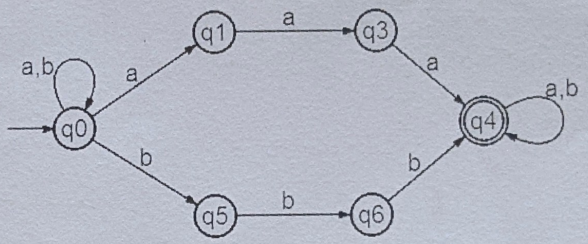
Q4. Minimize the given DFA [04]



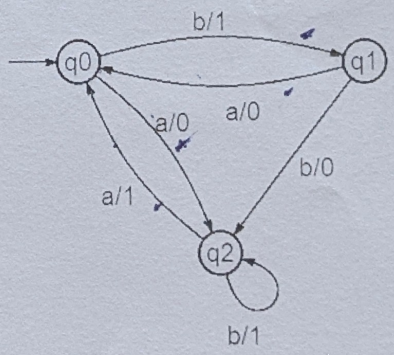
Q5. Find RE corresponding to the FA given below: [03]



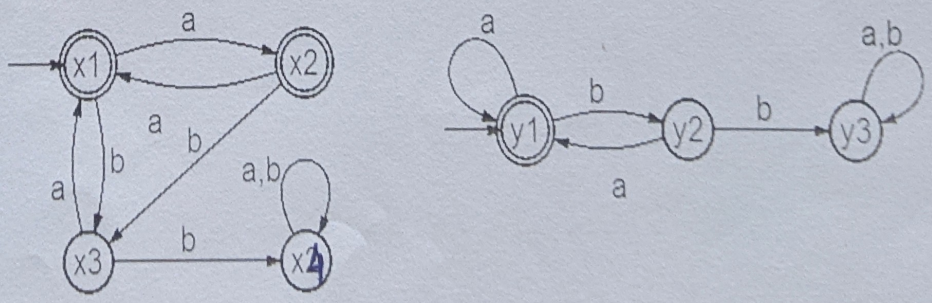
Q6. Convert the given NFA to corresponding DFA. [04]



Q7. Convert the given Mealy machine to Moore machine. [04]



Q8. Decide, whether the given pair of FA accept the same language or not. [05]



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SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Comp. Sc. & Engg.

B. Tech. (Comp. Sc. & Engg) Major Examination (Odd) 2019-20

Entry No: | | | | | | | | | | |

Total Number of Pages: [02]

Date: 4th December, 2019

Total Number of Questions: [06]

Course Title: Theory of Computation

Course Code: CSL 2041

Time Allowed: 3 hours **Max Marks: [50]**

Instructions / NOTE

i. Attempt All Questions.

ii. Support your answer with detailed stepwise solutions along with neat freehand sketches/diagrams, wherever appropriate.

iii. Assume an appropriate data / information, wherever necessary / missing.

SECTION - A

Q1. a) Define a DFA for the language $\{0^m1^n, m>=0, n>=1\}$. [02] CO1

b) Differentiate between Moore and Mealy Machines. [02] CO1

c) Write the statement for Pumping Lemma for Context Free Grammar along with its use. [02] CO3

d) Construct a CFG for the regular expression (011 + 1)*(01)*. [02] CO3

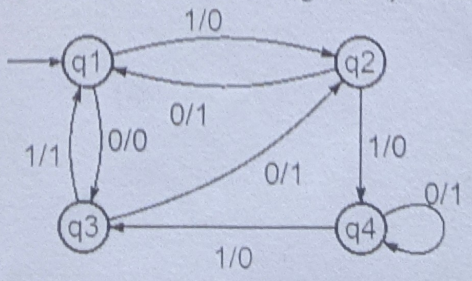
e) What do you mean by Turing Machine? Give its Definition. [02] CO4

SECTION - B

Q2. a) Construct a minimum state automaton equivalent to a DFA whose transition table is as given below: [04] CO1

State	a	b
-q0	q1	q2
q1	q4	q3
q2	q4	q3
+q3	q5	q6
+q4	q7	q6
q5	q3	q6
q6	q6	q6
q7	q4	q6

b) Convert the following Mealy machine to an equivalent Moore machine. [03]



Q3. a) Construct an FA for: ab + (aa + bb) (a + b)*b. [03] CO2

b) Draw the machine M1 accepting all the words beginning with a, and M2 accepting the words ending with a, where ∑ = { a, b}. Design a machine M3 accepting the strings with first & last symbol as a, using designed machines M1 & M2. [05]

Q4. a) Give a RE for the set of binary strings where every 0 is immediately followed by exactly k numbers of 1's and preceded by at least k number of 1's (k is a fixed integer). [02] CO2

b) Which of the following are Regular Languages: [03]

i) $a^n b^m c^k$ such that n,m,k>0

ii) WW^R such that Length(W) <= 100

iii) $a^n b^{n+m} c^m$ such that n,m >=1

Q5. a) Prove that the following grammar is ambiguous. [03] CO3

S→0Y/01 X→0XY/0 Y→XY1/1

b) Construct a PDA to accept the strings containing equal number of a's and b's in the language defined over (a, b)*. [03]

c) Define a PDA for L = $\{a^n b^m c^m d^n$, where m, n >= 1$\}$. [03]

d) Convert the given CFG to corresponding PDA. [03]

S→aAB/bBA A→bS/a B→aS/b

Q6. a) Design a Turing Machine to accept the language L= $a^n b^n c^n$, where n>=1. [04] CO4

b) Design a Turing Machine to perform the following operation [04]

f(x,y) = x – y, where x > y

Course Outcomes

CO1. Design the FSM and its variants for the given problem.

CO2. Able to convert RE to FA, differentiate between Regular and Non-regular languages, argue about diff. properties of Regular Languages.

CO3. Define and construct CFG along with corresponding machines, classify the languages into different Normal Forms.

CO4. Define and construct various type of TM, argue about decidability/undecidability of the problems.

CO	Questions Mapping	Total Marks	Total Number of Regular Students (to be appeared in Exam)
CO1	1.a, 1.b, 2	11	90
CO2	3, 4	13	90
CO3	1.c, 1.d, 5	16	90
CO4	1.e, 6	10	90