Roll Number: _____

Thapar Institute of Engineering and Technology, Patiala

Department of Computer Science and Engineering

B E- COE, CSE (VI Semester) MST	Course Code: UCS701 Course Name: Theory of Computation
April 5, 2022 11:00	
Time: 2 Hours, M. Marks: 35	Name Of Faculty: Sunita Garhwal, Chinmaya Panigrahy, Avadh Kishor, Gaurav Pareek, Shashank Sheshar, Nitigya Sambyal

Note: Attempt any five questions with proper justification. Assume missing data, if any, suitably. **All questions carry equal weightage.**

Q.1(a) Using Thompson's construction, convert the regular expression $r=(1+01)^*$ into non-deterministic finite automaton. (3)

Q1(b) Design a non-deterministic finite automaton for the language that will accept all string ending with **abb** over $\{a, b\}$. Convert the NFA into DFA using subset construction. You **are not supposed to** apply Thompson' s construction. (4)

Q2(a) Construct a Moore machine that will count the number of occurrences of 011 in a binary string. Convert it into equivalent Mealy machine. (4)

Q2(b) Write down regular grammar for the language over $\sum = \{0,1\}$ that consists of all strings of even length and every odd position contains 1. (3)

Q3 (a) Given language L=(ab+ba+c)*. Write down all strings of length 3 in L^* (2)

Q3(b) Prove that regular languages are closed under intersection. (3)

Q3(c) Write down regular grammar for $L=a(aa|bb)^*$ (2)

Q4(a) Consider the language $L = \{a^n b\, c^m \mid n, m \geq 0\}$. (3)
If language is regular then design regular expression and Deterministic finite automata for language L.
If language is non-regular then prove it using Pumping Lemma.

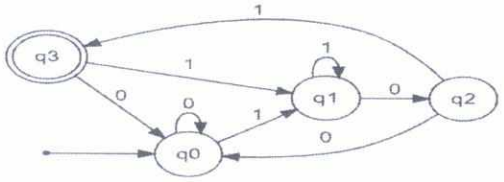
Q4(b) Construct the minimal deterministic finite automaton and write regular grammar for the language $L=(111+11111)^*$ (4)

Q5(a) Construct a deterministic finite automaton over $\sum = \{a, b\}$ that will accept all strings such that number of a's is divisible by two and number of b's is divisible by three. (4)

Q5(b) Minimize the following DFA (Consider A as initial and C as final state) (3)

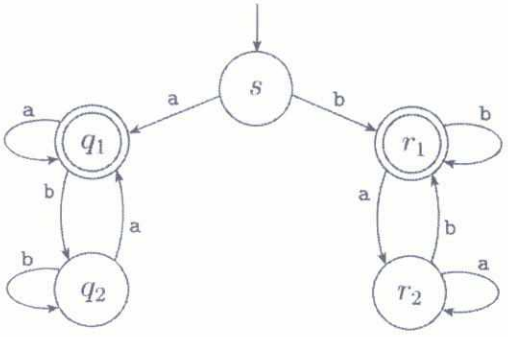
Present State	Next State	
	I/P = 0	I/P = 1
A	F	B
B	C	G
C	C	A
D	G	C
E	F	H
F	G	C
G	E	G
H	C	G

Q6(a) Write down regular expression corresponding to following finite automaton using Arden's Theorem. (4)



Q6(b) Using Pumping Lemma, prove that $L=\{(ab)^n a^k \mid n>k, k\geq 0\}$ is not a regular language. (3)

Q7 Consider the finite state machine M.



Q7(a) Write down regular expression corresponding to the finite state machine. (2)

Q7(b) Construct a finite state machine that will represent L' where L represent the language represented by the language and L' represents the complement of L. (2)

Q7(C) Write down regular expression for the language L'. (3)

**********End of Paper**********

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Thapar Institute of Engineering and Technology

Department of Computer Science and Engineering

B E- COE, CSE (VI Semester) MST — Course Code: UCS701

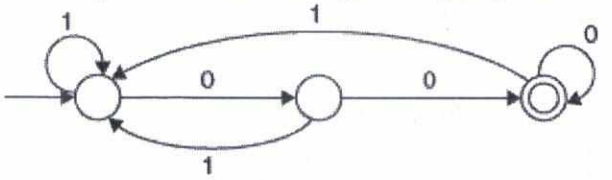
Course Name: Theory of Computation

April 5, 2022 10:45 — Time: 15 Mins Marks: 15

Note: Attempt all questions with proper justification. Assume missing data, if any, suitably. All questions carry equal weightage. **In case you think no option is correct write option (e).**

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15

Q.1 The given DFA accepts the set of all strings over {0, 1} that



a) Begin either with 0 or 1.
b) End with 0
c) End with 00
d) Contain the substring 00

Q2 The minimum state deterministic automaton accepting the language $L = \{w | w \in \{0,1\}^*$, the number of 0's and 1's in w are divisible by 3 and 5 respectively$\}$ has

a) 15 states
b) 11 states
c) 10 states
d) 9 states

Q3 Consider the regular expression (0 + 1)(0 + 1) . . . . . N times. The minimum state FA that recognizes the language represented by this regular expression contains

a) n states
b) (n + 1) states
c) (n + 2) states
d) None of the above

Q4 The regular expression corresponding to the language L where L={x∈{0,1}* | x ends with 1 and does not contain substring 00} is:

a) (1 + 01)* (10 + 01)
b) (1 + 01)* 01
c) (1 + 01)* (1 + 01)
d) (10 + 01)* 01

Q5 Which of the following are not regular?

I. Strings of even number of a's.
II. Strings of a's, whose length is a prime number.
III. Set of all palindromes made up of a's and b's.
IV. Strings of a's whose length is a perfect square.

a. I and III
b. II and III
c. II, III and IV

d. III and IV

Q6 If a regular language L is finite and accepts a string of length at most n, then how many maximum number of states does the DFA have which accepts L.

a) n/2
b) n-1
c) n+1
d) 2n+1

Q7 Which of the following defines the language of the regular expression $(0+1+\varepsilon)^4$ (select one option)?

a) All strings over {0,1} with length 4 or more
b) All strings over {0,1} with length 0 or more
c) A null string
d) All strings over {0,1} with length 4 or less

Q8 Consider the regular grammar $G = (\{S_1, S_2\}, \{0,1\}, \{S_1 \rightarrow 0S_1|0S_2, S_2 \rightarrow 1S_2|1\}, S_1)$. Which of the following regular expression denotes $L(G)$?

a) 0^*1^*
b) $0(01)^*1$
c) $(00^* + 11^*)$
d) 00^*11^*

Q9 For an input string of length n, the length of the outputs generated by Moore and Mealy machine are _____ and _____, respectively.

a) n, n b) n, n+1 c) n+1, n d) n+1, n+1

Q10 The minimized Mealy and Moore machine to find 1's complement of a binary string will have ____ and _____ number of states, respectively.

a) 1, 1 b) 1, 2 c) 2, 1 d) 2, 2

Q11 The Moore machine constructed from a Mealy machine with p states and q outputs will have at most _____ states.

a) pq (b) pq+1 (c) p(q+1) (d) (p+1)q

Q12 Given regular expression r=(ab)*. On applying Thompson's construction, the number of states and transitions obtained in NFA is

a) 5, 6 b) 5, 7 c) 4, 6 d) 4, 7 e) None

Q13 The regular set denoted by regular expression (a+b) + (a+b) is

a) {a,b} b) {a,b,ab,ba} c) {aa,ab,ba,bb} d) {a,b,bb,aa}

Q14 A regular expression (0+1)(0+1)…(0+1) k times represents all the strings over {0,1} of length

a) exactly k b) up to k c) below k d) above k

Q15 The set of all strings over {0,1} starting with 00 and ending with 11

a) 00(0+1)*11 b) 00(0+1)* c) (0+1)*11 d) none