B.E. / B.Tech. / M.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2024

Fifth Semester

Computer Science and Engineering

(Common to M.Tech. - Computer Science and Engineering)

20CSPC502 - THEORY OF COMPUTATION

Regulations - 2020

Duration: 3 Hours   Max. Marks: 100

PART - A (10 × 2 = 20 Marks)
Answer ALL Questions

|		Marks	K–Level	CO
1.	Illustrate a DFA for the language over {0, 1}* such that it contains "000" as a substring.	2	K2	CO1
2.	Define Finite Automata (FA) and Transition Diagram with an example.	2	K1	CO1
3.	Illustrate a regular expression for the language accepting the strings which are starting with 1 and ending with 0, over the set = {0,1}.	2	K2	CO2
4.	Identify a finite automaton for the regular expression 0*1*.	2	K2	CO2
5.	Identify a CFG for the language L={0*1*}.	2	K2	CO3
6.	Define the instantaneous Description of PDA.	2	K1	CO3
7.	Identify and eliminate the epsilon production for the following Grammar.	2	K2	CO4

$$S \rightarrow CD$$
$$C \rightarrow cCC / \varepsilon$$
$$D \rightarrow dDD / \varepsilon$$

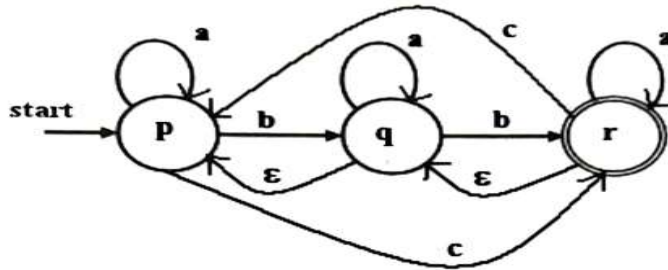|		Marks	K–Level	CO
8.	State the pumping lemma for CFL.	2	K1	CO4
9.	List out the features of universal turing machine.	2	K1	CO6
10.	Define NP hard and NP completeness problem.	2	K1	CO6

PART - B (5 × 13 = 65 Marks)
Answer ALL Questions

| 11. | a) | Convert the following NFA to its equivalent DFA. | 13 | K2 | CO1 |

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create
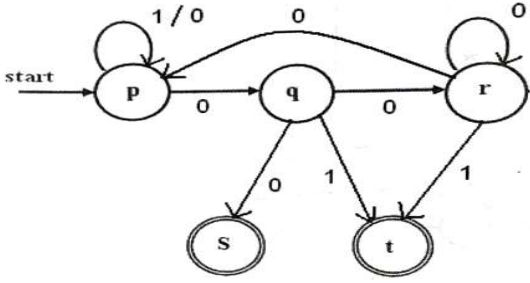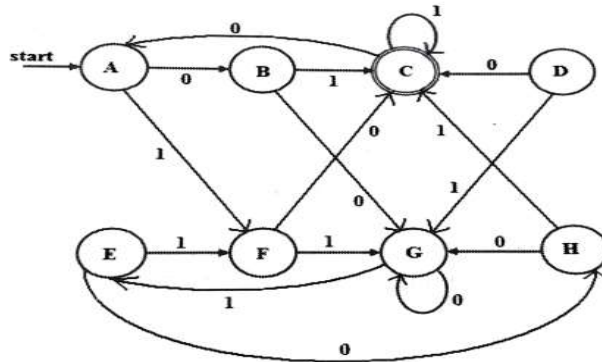
OR

b) Identify an NFA without Epsilon for the given NFA with Epsilon.   *13   K2   CO1*
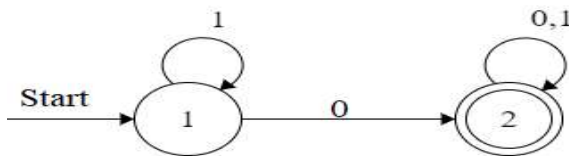

12. a) Construct minimized automata for the following automata to define   *13   K3   CO2*
the same language using Table Filling Algorithm.

OR

b) Determine a regular expression by converting the Finite Automata   *13   K3   CO2*
using the Formula Method.

13. a) Is the following grammar ambiguous? If ambiguous, construct an   *13   K3   CO3*
unambiguous Grammar. Given String: (a * a) + a – a.

$$E \rightarrow E+E \mid E*E \mid E-E \mid E/E \mid (E) \mid a$$

OR

b) Construct PDA to accept the language $L=\{a^{2n} b^{n+1} / n>=1\}$ by reading   *13   K3   CO3*
final state and convert PDA reaching final state into PDA by empty
stack.

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   **12862**

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14.   a)   Identify a Chomsky Normal Form (CNF) for the following grammar   *13   K2   CO4*
after eliminating Unit Productions.

$$E \rightarrow E + T \,/\, T$$
$$T \rightarrow T * F \,/\, F$$
$$F \rightarrow (E) \,/\, I$$
$$I \rightarrow Ia \,/\, Ib \,/\, I0 \,/\, I1 \,/\, a \,/\, b$$
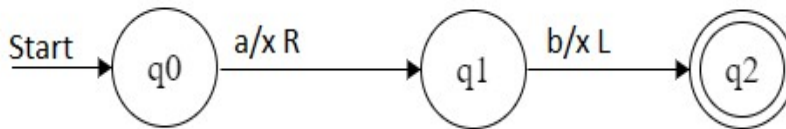
OR

  b)   Show that the language $L = \{a^n \, b^n \, c^n \mid n >= 0\}$ is not a context free   *13   K2   CO4*
Language using Pumping Lemma.

15.   a)   Illustrate the undesirability of PCP with the following lists. Explain   *13   K2   CO6*
regarding the solution.

i	List A (Wi)	List B (Xi)		i	List A (Wi)	List B (Xi)
1	10	101		1	1	111
2	011	11		2	10111	10
3	101	011		3	10	0

OR

  b)   Explain and Convert the Given Turing machine to a PCP.   *13   K2   CO6*

PART - C (1 × 15 = 15 Marks)

16.   a)   Explain and describe a Turing Machine M to implement the function   *15   K2   CO5*
"multiplication" using the subroutine copy.

OR

  b)   Explain and Solve the Turing machine to accept the language.   *15   K2   CO5*
$L=\{0^n 1^n \mid n >= 1\}$.