Reg. No.															

Question Paper Code	13540

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Fifth Semester

Computer Science and Engineering

(Common to Computer Science and Engineering (IoT))

20CSPC502 - THEORY OF COMPUTATION

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Which is used to construct an automaton? (a) States (b) Transitions (c) Both (d) None of the above	1	K1	CO1
2.	Which of the following is used to denote alphabets? (a) W (b) ∑ (c) |W| (d) ~	1	K1	CO1
3.	Which types of languages are accepted by regular expressions? (a) Regular language (b) Consistent language (c) Kleen language (d) Series language	1	K1	CO2
4.	Write the appropriate precedence order of operations over a Regular Language? (a) Kleene, Union, Concatenate (b) Kleene, Star, Union (c) Kleene, Concatenate, Union (d) Star, Union, Dot	1	K1	CO2
5.	Which CFG generates the language L={$a^n b^n$| n ≥ 0 } ? (a) S→aSb|ab (b) S→aSb| ϵ (c) S→aS|Sb|ab (d) S→aSbb| ϵ	1	K1	CO3
6.	What type of Pushdown Automaton allows only one transition in each configuration? (a) Deterministic (b) Non Deterministic (c) Finite (d) Non Finite	1	K1	CO3
7.	Which of the following statements is true about Chomsky Normal Form (CNF) in context-free grammars? (a) Every production has at least one terminal symbol on the right-hand side. (b) Every production has at most two variables on the right-hand side or a single terminal. (c) The grammar must be in Greibach Normal Form. (d) The grammar cannot generate infinite strings.	1	K1	CO4
8.	What is the purpose of converting a context-free grammar into the Chomsky Normal Form? (a) To reduce ambiguity in the grammar. (b) To make parsing algorithms more efficient. (c) To generate regular languages. (d) To eliminate all terminal symbols from the grammar.	1	K1	CO4
9.	Which of the functions can a turing machine not perform? (a) Copying a string (b) Deleting a symbol (c) Accepting a pal (d) Inserting a symbol	1	K1	CO5
10.	To which of the following class does a CNF-satisfiability problem belong? (a) NP class (b) P class (c) NP Complete (d) NP hard	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

		Marks	K – Level	CO
11.	Define Finite Automata (FA) and Transition Diagram with an example.	2	K1	CO1
12.	Describe and prove the statement If X > =4 , then $2^X >= x^2$	2	K2	CO1
13.	List the steps in Pumping Lemma.	2	K1	CO2
14.	Name the four closure properties of RE.	2	K1	CO2

15. Define ambiguous grammar? *2 K1 CO3*

16. List the moves of PDA. *2 K1 CO3*

17. Illustrate the Grammar G by eliminating the epsilon production. *2 K2 CO4*

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

18. Describe useless and useful symbols with example. *2 K1 CO4*

19. Show the difference between Finite automata and Turing machine. *2 K1 CO5*

20. Differentiate TM and PDA. *2 K2 CO5*

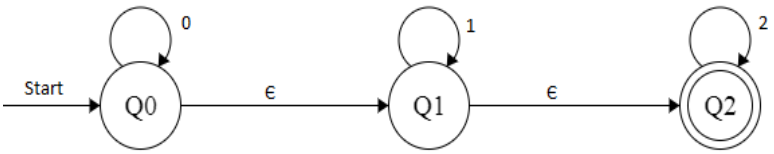
21. State the halting problem of TMs. *2 K1 CO6*

22. When we say a problem is decidable? Give an example of undecidable problem? *2 K1 CO6*

PART - C (6 × 11 = 66 Marks)

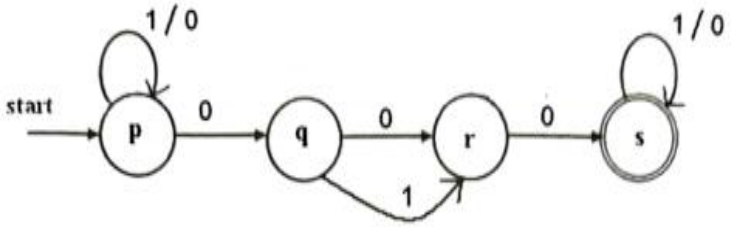
Answer ALL Questions

23. a) Illustrate an NFA without ε-transitions for the given NFA. *11 K2 CO1*

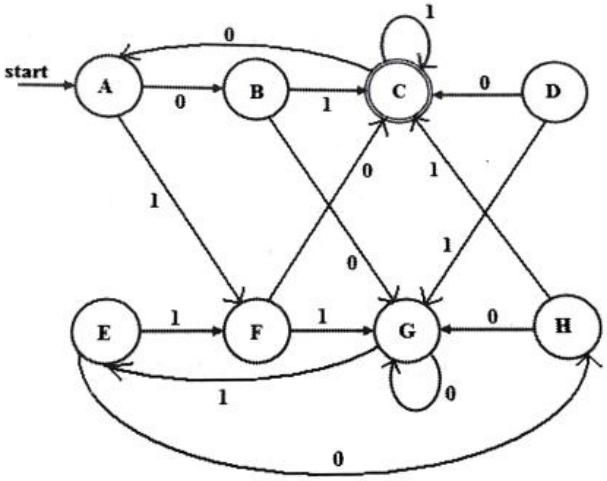


OR

b) Convert the following NFA to a DFA using the subset construction algorithm. *11 K2 CO1*

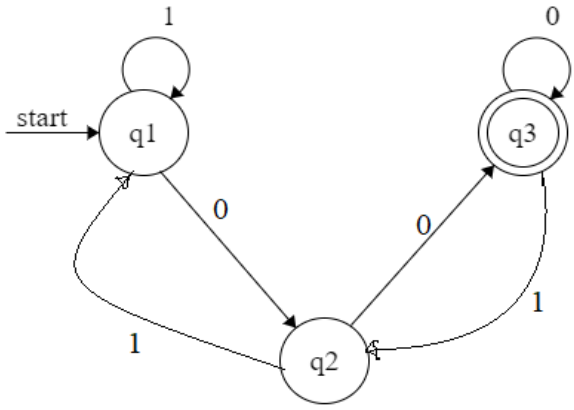


24. a) Construct minimized automata for the following automata to define the same language using Table Filling Algorithm. *11 K3 CO2*



OR

b) Construct for the given Finite Automata to regular expression using the State elimination Method. *11 K3 CO2*



25. a) Convert the grammar *11 K2 CO3*
S→0S1/A
A→1A0/S/ ε
into PDA that accepts the same language by empty stack. Check whether 0101 belongs to N(M).

OR

b) Convert the given PDA to a Context Free Grammar (CFG) *11 K2 CO3*
M=({q_0, q_1},{0,1},{X,Z_0},δ,q_0,Z_0,Φ)
and where δis given by
δ(q_0,0,z0)={(q0,XZ_0)},
δ(q_0,0,X)={(q0,XX)},
δ(q_0,1,X)={(q1,ε)},
δ(q_1,1,X)={(q1,ε)},
δ(q_1,ε,X)={(q1,ε)},
δ(q_1,ε,Z_0)={(q1, ε)}.

26. a) Identify a Chomsky normal form for the following grammar after eliminating Unit Productions. *11 K3 CO4*
E → E + T / T
T → T * F / F
F → (E) / I
I → Ia / Ib / I0 / I1 / a / b

OR

b) Construct a Turing machine for the language L={0^n1^n}n>=1}. *11 K3 CO4*

27. a) Define Subroutine. Construct the TM for Multiplication of two numbers using copy subroutine. *11 K2 CO5*

OR

b) Explain checking off symbols with suitable example. *11 K2 CO5*

28. a) Identify the code of the Turing machine M = ({q1,q2,q3},{0,1},{0,1,B} , δ , q1 , B, {q2}). The Transition functions of the Turing machine are as follows *11 K3 CO6*
δ (q1,1) = (q3, 0 , R)
δ (q2,0)=(q1,1,R)
δ (q3,1) = (q2,0,R)
δ (q3, B) = (q3,1,L)

OR

b) Construct the given Turing machine to MPCP. *11 K3 CO6*
M=({q1,q2,q3},{0,1},{0,1,B},q1,B,{q3}) with input string w=01

q_i	$\delta(qi,0)$	$\delta(qi,1)$	$\delta(qi,B)$
q_1	$(q_2,1,R)$	$(q_2,0,L)$	$(q_2,1,L)$
q_2	$(q_3,0,L)$	$(q_1,0,R)$	$(q_2,0,R)$
q_3	—	—	—