

2024
(Session : 2022-25)

Time : 3 hours

Full Marks : 60

Pass Marks : 24

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer from both the Groups as directed.

Group – A
(Compulsory)

1. Choose the correct answer of the following :
 $1 \times 10 = 10$

(a) Which of the following operations represents the set of elements common to two sets A and B ?

- (i) Union (ii) Difference
(iii) Complement (iv) Intersection

(b) Which of the following statement about a bijective function is true ?

- (i) It is both injective and surjective

- (ii) It is neither injective nor surjective
- (iii) It is Injective but not surjective
- (iv) It is surjective but not injective
- (c) Which operation combines two strings end-to-end ?
 - (i) Concatenation (ii) Reversal
 - (iii) Intersection (iv) Substitution
- (d) What is a contradiction in propositional logic ?
 - (i) A proposition that is always true
 - (ii) A proposition that is always false
 - (iii) A proposition that is true for some case and false for other
 - (iv) A compound proposition formed by $P \vee \neg P$
- (e) A predicate might be used to :
 - (i) Sort elements
 - (ii) Check conditions
 - (iii) Add elements to a list
 - (iv) Generate random numbers
- (f) The theory of automata is closely tied to the theory of :
 - (i) Graph theory
 - (ii) Formula language
 - (iii) Statistical methods
 - (iv) Artificial intelligence

(g) Which automation type can recognize context free language ?

- (i) DFA
- (ii) NFA
- (iii) Pushdown Automata(PDA)
- (iv) Turing Machine

(h) A deterministic Finite Automata has :

- (i) Multiple possible transitions for a single input symbol
- (ii) No ambiguity in state transitions
- (iii) Epsilon transitions
- (iv) A finite stack

(i) Which of the following is an example of grammar?

- (i) $S \rightarrow asb \mid ab$
- (ii) $\{a, b, ab, ba\}$
- (iii) $\{a, b\}$
- (iv) $\{ab, ba\}$

(j) Which of the following is a terminal symbol in grammar ?

- (i) A
- (ii) S
- (iii) a
- (iv) None of these

2. What is a formal language ? Provide examples. 5

Group – B

Answer any **three** questions of the following :

3. Define an automaton and list the different types of automata used in computational Theory. 15

4. (a) Define a set and explain its operations with examples. 8
(b) Explain the concept of a relation between two sets. Describe its types. 7
5. (a) What is a WFF in propositional logic ? Provide examples of valid and invalid WFF. 8
(b) Define a predicate and provide an example with a variable 7
6. (a) Define a DFA construct a DFA that recognizes the language of strings over the alphabet {a,b} end with 'ab'. 10
(b) What is a transition system of NFA. Explain its components. 5
7. (a) Define a regular language. Provide an example. 8
(b) What is the significance of the Kleene star operation on a language ? Provide an example. 7
8. Write short notes on any **three** of the following :
5×3 = 15
- (a) Turing machine
 - (b) Chomsky classification of Language
 - (c) Pushdown automata
 - (d) Graph
 - (e) Trees
 - (f) Pumping Lemma