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OD-2482

B.C.A. Odd Semester
Examination 2024-25

MATHEMATICAL FOUNDATION IN COMPUTER SCIENCE

Paper : III (BCA-103)

Time : 2 : 30 Hours]   [Max. Marks : 70

Note :– Attempt any *five* questions. All questions carry equal marks.

Q. 1. Attempt any *two* from the following :   [7×2=14]

   (a) Define a set and provide examples of both finite and infinite sets.

   (b) Describe the union, intersection, and difference of two sets with examples.

   (c) What is the power set of a given set ? Calculate the power set of {a, b, c}.

   (d) Explain the concept of a Cartesian product of two sets with an example.

   (e) What is a binary operation ? Give an example of a binary operation on the set of integers.

(f) Define a relation. Provide examples of reflexive, symmetric, and transitive relations.

(g) Explain the composition of relations. How is the composition of two relations R and S represented ?

(h) Define a partial ordering relation. How does it differ from a total ordering relation ? Provide an example.

Q. 2. Attempt following : [7×2=14]

(a) Describe the composition of functions. If $f : A \rightarrow B$ and $g : B \rightarrow C$, what is the composition of $g°f$? Provide an example.

(b) State and explain Peano's axioms. How do they relate to the natural numbers ?

Q. 3. Attempt following : [7×2=14]

(a) What is mathematical induction ? Prove that the sum of the first n natural numbers is $(n(n+1))/2$ using mathematical induction.

(b) Explain the concept of generating functions. How are they used in solving discrete numeric functions ? Provide an example.

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Q. 4. Attempt following : [7×2=14]

(a) What is a recurrence relation ? Provide an example of a simple recurrence relation with constant coefficients.

(b) Solve the recurrence relation an=3an-1 + 4 with the initial condition aO=2.

Q. 5. Attempt all from the following : [7×2=14]

(a) What is asymptotic notation ? Explain the significance of Big O, Big Omega (Ω), and Big Theta (Θ) notations in analyzing the efficiency of algorithms.

(b) Explain the difference between an Abelian group and a non-Abelian group. Provide examples of each.

Q. 6. Attempt following : [7×2=14]

(a) Given the functions $f(n)=3n2+2n$ and $g(n)=n2$, determine whether $f(n)=0(g(n))$, $f(n)=\Omega(g(n))$, or $f(n) = \Theta(g(n))$.

(b) Describe the concepts of homomorphism, isomorphism, and automorphism in the context of group theory. Provide examples to illustrate each concept.

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(3)

P.T.O.

Q. 7.   Write short notes on *any* four :   [3.5×4=14]

(a)   Define a proposition. Provide examples of both a true and a false proposition.

(b)   What is first-order logic, and how does it differ from prepositional logic ?

(c)   Explain basic logical operations (AND, OR, NOT, IMPLIES) with truth tables.

(d)   What is a tautology ? Give an example of a logical expression that is a tautology.

Q. 8.   Attempt following :   [7×2=14]

(a)   What is a partially ordered set (poset) ? Provide an example and explain the conditions that make a set a poset.

(b)   Explain what a Hasse diagram is and how it is used to represent a poset.

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