4E4161

Roll No.

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B. Tech. IV Sem. (Main/Back) Exam., June/July-2014
Computer Science and Engineering
4CS2A Discrete Mathematical Structures
Common with IT

Time: 3 Hours

Maximum Marks: 80

Min. Passing Marks: 24

Instructions to Candidates:-

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No.205)

1. NIL
2. NIL

UNIT – I

Q.1 (a) (i) Prove, for finite sets A and B;

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$ [4]

(ii) In a class of 50 students, 15 play Tennis, 20 play Cricket and 20 play Hockey, 3 play Tennis and Cricket, 6 play Cricket and Hockey, and 5 play Tennis and Hockey. 7 play no game at all. How many play Cricket, Tennis and Hockey? [4]

(b) (i) Define floor function and ceiling function with example. [4]

(ii) "If f and g are two bijections such that gof is defined then gof is also a bijection." Prove it. [4]

OR

Q.1 (a) (i) If f: A $\rightarrow$ B be one-one onto then the inverse map of f is unique. Prove it. [4]

(ii) Show that set of even positive integers is a countable set. [4]

(b) Sate and prove the Pigeonhole and Generalized Pigeonhole Principles. [8]

UNIT – II

Q.2 (a) Define the following with example:-

(i) Equivalence relation [2]

(ii) Congruence relation [2]

(iii) Partial order relation [2]

(iv) Total order relation [2]

(b) Explain closure of relations. Let A = {1,2,3,4} and let R = {(1,2) (2,3) (3,4), (2,1)} be a relation on A. Find the transitive closure of R using Warshall's algorithm. [8]

OR

Q.2 (a) Let A = Z, the set of integers relation R define in A by aRb as "a is congruent to b mod 2". Prove that R is an equivalence relation. [8]

(b) (i) Show that (Z^+, divisibility) is a poset. [4]

(ii) Compute the number of partitions of a set with four elements. [4]

UNIT – III

Q.3 (a) (i) Prove $p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$. [4]

(ii) Write contrapositive, converse and inverse of the statement.

"The home team wins whenever it is raining". Also construct the truth table for each statement. [4]

(b) (i) Prove that the linear search algorithm works correctly for every $n \geq 0$. [4]

(ii) Sort the list X = {64, 25, 12, 22, 11} using selection sort algorithm. [4]

OR

Q.3 (a) Every amount of postage of 12 cents or more can be formed using just 4-cent and 5-cent stamps. Prove this by using principle of complete induction. [8]

(b) Prove the implication "If n is an integer not divisible by 3, then $n^2 \equiv 1 (\text{mod } 3)$". [8]

UNIT – IV

Q.4 (a) Define the following with example:-

(i) Complete graph, [2]

(ii) Bipartite graph, [2]

(iii) Isomorphic graph, [2]

(iv) Planar graph, [2]

(b) (i) Suppose that G = (V,E) be a graph with K – component, where each component is a tree. Derive a formula in terms of $|V|$, $|E|$ and K. [4]

(ii) Let there is a tree with n-vertices of degree 1, 2 vertices of degree 2, 4 vertices of degree 3 and 3 vertices of degree 4. Obtain the value of n. [4]

OR

Q.4 (a) Prove that a simple graph with n vertices and k components can have almost

$$\frac{1}{2}[(n-k)\ (n-k+1)] \text{ edges.}$$ [8]

(b) Show that the complete bipartite graph $k_{3,3}$ is a non – planar graph. [8]

UNIT – V

Q.5 (a) (i) Explain Tautology, contradiction and contingency. [2]

(ii) Show that $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$ is a tautology. [2]

(iii) Show that $p \wedge \sim p$ is a contradiction. [2]

(iv) Show that $(p \rightarrow q) \wedge (p \vee q)$ is a contingency. [2]

(b) Test the validity of the following argument:

If I like mathematics, then I will study.

Either I study or I fail.

Therefore, if I fail then I do not like mathematics. [8]

OR

Q.5 (a) Check the validity of the following argument:

Lions are dangerous animals.

There are lions.

Therefore, there are dangerous animals. [8]

(b) (i) ~~Define the quantifiers. Explain types~~ of quantifiers. [4]

(ii) Over the universe of animals, let

$P(x)$: x is a whale ; $Q(x)$: x is a fish

$R(x)$: x lives in water.

Translate the following into English

$\exists x (\sim R(x))$

$\exists x (Q(x) \wedge \sim P(x))$

$\forall x (P(x) \wedge R(x)) \rightarrow Q(x)$ [4]
