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48 (DS)

[17–HDGKACRM–M3]

MCA/MScIT 3rd Semester Exam., 2017

DISCRETE MATHEMATICS

[MCA/MScIT (S3) 09]

Full Marks : 80

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Answer any *five* from the following : 2×5=10

(a) Let $f : R \to R$ and $g : R \to R$ be two functions such that $f(x) = x - 1$, $g(x) = \frac{x}{2}$. Then find $f \circ g$ and $g \circ f$.

(b) What is meant by principal disjunctive normal?

(c) Define complete bipartite graph. Give an example.

(d) Write the expressions for ${}^{n}P_{r}$ and ${}^{n}C_{r}$ in factorial notation.

(e) Define kernel of a homomorphism.

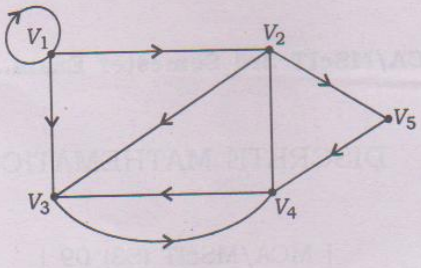
(f) State the principles of inclusion and exclusion.

2. Answer any *three* from the following : 4×3=12

(a) What are meant by algebraic systems? Give two examples.

(b) In how many ways can the letters of the word MATHEMATICS be arranged with the vowels only in the odd places?

(c) Define adjacency matrix. Write adjacency matrix of the following directed graph : 1+3=4



(d) When a statement formula is said to be in the normal form?

3. Answer any *three* from the following : 6×3=18

(a) Give an argument which will establish the validity of the following inference :

All integers are rational numbers.
Some integers are power of 2.
Therefore, some rational numbers are power of 2.

(b) Define a group. Prove that the set of positive rational numbers Q^+ is an Abelian group for operation '$*$', where $a * b = \frac{ab}{2} \quad \forall\, a, b \in Q^+$. 2+4=6

(c) Prove that a non-empty subset H of a group G is a subgroup of $(G, *)$, iff $a, b \in H \Rightarrow a * b^{-1} \in H$.

(d) How many combinations and permutations can be made with the letters of the word PARABOLA taken three at a time?

4. Answer any *four* from the following : 10×4=40

(a) Define planar graph. State and prove Euler's formula for planar graph. 2+8=10

(b) What is meant by homomorphism of a group? State and prove the fundamental theorem of homomorphism. 2+8=10

(Continued)

(c) State the two rules of inference. Describe 'Modus Ponens' with the help of examples. 2+8=10

(d) (i) Define tautology and contradiction. Find whether $q \vee (p \wedge \sim q) \vee (\sim p \wedge \sim q)$ is a tautology or not.

(ii) Show that the propositions $\sim(p \wedge q)$ and $\sim p \vee \sim q$ are logically equivalent. 5+5=10

(e) Prove that if A, B, C are three finite sets, then

$$n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)$$

In a certain government office, there are 600 employees, there are 250 men, 376 university graduates, 312 married persons, 194 male university graduates, 251 married university graduates, 219 married men, 172 married male university graduates. Find the number of single women who are not university graduates. 4+6=10

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