বিদ্যাসাগর বিশ্ববিদ্যালয়

VIDYASAGAR UNIVERSITY

Question Paper

B.Sc. Honours Examinations 2021

(Under CBCS Pattern)

Semester - III

Subject : MATHEMATICS

Paper : SEC 1 - T

Full Marks : 40

Time : 2 Hours

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

[LOGIC AND SETS]

(Theory)

Group - A

1. Answer any ***three*** of the following questions : 12×3=36

(a) (i) If ρ be a relation in the set of real numbers defined by $a\rho b$ if and only if $a \geq b$ where $a, b \in R$. Is ρ an equivalence relation? Explain.

(ii) Let $A = \{a, b, c, d\}$ and consider the relation

$R = \{(a,a),(a,b),(a,c),(a,d),(b,b),(b,d),(c,c),(c,d),(d,d)\}$.

Show that R is a partial ordering.

(iii) A relation ρ is defined on $\mathbb{Z}$ by "$a\rho b$ if and only if $a^2 - b^2$ is divisible by 5 for $a, b \in \mathbb{Z}$". Prove that ρ is an equivalence relation on $\mathbb{Z}$.

4+4+4

(b) (i) Given $A = \{1, 3, 5, 7\}$, $B = \{2, 3, 5, 8\}$. List the elements of $(A \cap B) \times (B - A)$. Is $(A \cap B) \times (B - A)$ is a subset of $A \times B$? Justify.

(ii) Draw the graph for the relation 'congruent modulo 3' on the set $A = \{2, 3, 4, 6, 7, 9\}$ and hence show that the relation is reflexive, symmetric and transitive.

(iii) If A, B and C are any three sub-sets of a set X, then prove that $A \times (B \cup C) = (A \times B) \cup (A \times C)$. 4+4+4

(c) (i) Prove that the following proposition is Tautology (without truth table) :

$$\left[(p \vee q) \wedge (p \to r) \wedge (q \to r)\right] \to r$$

(ii) Using mathematical induction, prove that

$$\frac{1^2}{1.3} + \frac{2^2}{3.5} + \ldots\ldots + \frac{n^2}{(2n-1)(2n+1)} = \frac{n(n+1)}{2(2n+1)}.$$

(iii) If $p(x)$ be a predicate on the domain set D then prove that

$\sim \forall x p(x) \equiv \exists x \sim p(x)$. 4+5+3

(d) (i) Prove that the following set of premises is inconsistence

$p \to q, p \to r, q \to \neg r, p$.

(ii) Show that each group of logical implications 'conditional and contrapositive' and 'inverse and converse' is logically equivalence.

(iii) Find the negation of the following statements :

(a) $\exists x p(x) \wedge \exists y q(y)$, (b) $\forall x\, p(x) \vee \exists y\, q(y)$. 4+4+(2+2)

(e) (i) How many positive integers between 100 and 999 are (A) not divisible by neither 3 nor 4? (B) divisible by 3 but not by 4?

(ii) For any three subsets *A, B, C* of a universal set X, prove that

$A \cap B = (A \cup B) \Delta (A \Delta B)$.

(iii) Prove that $n(A \cup B) = n(A) + n(B) - n(A \cap B)$. 4+4+4

(f) (i) Let A_0, A_1 and A_2 be three subsets of Z (set of integers) defined by $A_i = \{3n + i : n \in Z\}$ for $i = 0, 1, 2$. Show that A_0, A_1 and A_2 form a partition of the set Z.

(ii) Establish the equivalence $p \to (q \vee r) \equiv (p \to q) \vee (p \to r)$.

(iii) Show that $\exists x Q(x)$ is a valid conclusion from the premises : $\forall(x)(p(x) \to Q(x))$ and $\exists x\ P(x)$. 4+4+4

Group - B

2. Answer any ***two*** of the following questions : 2×2=4

(a) What do you mean by argument and valid argument in propositional logic?

(b) If R be an equivalence relation on a non-empty set A and $a \in A$, then prove that $a \in [a]$.

(c) Define partial order relation with example.

(d) Translate the following sentence into a logical statement :

A necessary condition for x to be prime is that either x is odd or $x = 2$.

OR

[OBJECT ORIENTED PROGRAMMING IN C++]

(Theory)

Group - A

1. Answer any ***three*** of the following questions : 12×3=36

(a) (i) Write the differences between procedures oriented programming and object oriented programming.

(ii) Write about the basic concepts of object oriented programming? 4+8

(b) (i) What are the applications of void data type in C++?

(ii) Why is an array called a derived data type?

(iii) Describe enumeration data types with examples. 3+3+6

(c) (i) What is call by reference? Give an example.

(ii) What are the advantages of inline function?

(iii) What is a friend function? Explain with an example. 4+3+5

(d) (i) What is the difference between constructor and destructor?

(ii) Discuss about the different types of constructor with examples. 3+9

(e) (i) Write a C++ program to show the function overloading.

(ii) What is a polymorphism? Give an example. 6+6

(f) (i) Write about the different types of inheritance.

(ii) Write a C++ program to implement multiple inheritance. 6+6

Group - B

2. Answer any ***two*** of the following questions : 2×2=4

(a) What is an object oriented programming?

(b) What are the features of MS Word?

(c) What are the features of MS Excel?