CBCS SCHEME

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18MCA23

Second Semester MCA Degree Examination, Dec.2019/Jan.2020
Discrete Mathematical Structures and Statistics

Time: 3 hrs. Max. Marks: 100

Note: ***Answer FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Discuss different logical connectives with example and truth table. **(07 Marks)**

b. Without using truth table prove that

i) $p \to (q \to r) \Leftrightarrow (p \wedge q) \to r$

ii) $(p \to q) \wedge (\neg q \wedge (r \vee \neg q)) \Leftrightarrow \neg(q \vee p)$ **(07 Marks)**

c. By the method of direct proof show that "square of an even integer is an even integer". **(06 Marks)**

OR

2 a. Define tautology and contradictions. Prove that $[\neg p \wedge (p \to q)] \to \neg p$ is a tautology. **(07 Marks)**

b. Test validity of following argument

If I study,

I will not fail in examination

If I do not watch TV, I will study

I failed in examination

$\therefore$ I must have watched TV **(07 Marks)**

c. Consider the following open statements with set of real numbers as universe

$p(x) : x \geq 0$ q(x)! $x^2 \geq 0$ r(x)! $x^3 - 3x - 4 = 0$

s(x)! $x^2 - 3 > 0$. Then determine truth values of (i) $\exists x_1 p(x) \wedge q(x)$ (ii) $\forall x_1\ p(x) \to q(x)$ (iii) $\exists x_1 p(x) \wedge r(x)$ (iv) $\forall x_1 q(x) \to s(x)$ **(06 Marks)**

Module-2

3 a. Define a subset, Universal set, Power set compliment of a set, Union of two sets with examples. **(07 Marks)**

b. If A, B, C are any three sets then prove that

(i) $A \cap (B \cup C) = (A \cap B) \cup (B \cap C)$ ii) $\overline{A \cup B} = \overline{A} \cap \overline{B}$ **(07 Marks)**

c. In a certain college 4% of boys and 1% girls are taller than 1.8m. If 60% of students are girls. If student is selected at random is found to be taller than 1.8m. What is the probability that the student is a girl? **(06 Marks)**

OR

4 a. Using Venn diagram prove that $\overline{A \cup B \cap C} = (\overline{A} \cap \overline{B}) \cup \overline{C}$ for any three sets A, B, C. **(07 Marks)**

b. In a classes of 52 students 30 study English, 28 study Hindi, 13 study both languages. How many of these study at last one of these languages? How many study none of the languages. **(07 Marks)**

c. Define probability and conditional probability. For any two events A, B prove that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. **(06 Marks)**

Module-3

5 a. A bit is 0 or 1 and byte is 8 bits. Find : (i) Number of bytes (ii) Number of bytes begin with 11 and end with 11 (iii) Number of bytes begin with 11 but not end with 11. **(07 Marks)**

b. How many positive integers n can be formed using digits 3, 4, 4, 5, 5, 6, 7. If we want n to exceed 50, 00,000. **(07 Marks)**

c. If F_0, F_1 . . . . . are Fibonacci numbers then prove that $F_n = \frac{1}{\sqrt{5}}\left[\left(\frac{1+\sqrt{5}}{2}\right)^n - \left(\frac{1-\sqrt{5}}{2}\right)^n\right]$. **(06 Marks)**

OR

6 a. Find number of arrangements of all letters in TALLAHASSEE? How many of these arrangements have no adjacent A's. **(07 Marks)**

b. Find coefficient of
   i) x^9y^3 in the expansion of $(2x - 3y)^{12}$
   ii) x^0 in the expansion of $\left(3x^2 - \frac{2}{x}\right)^{15}$
   iii) x^{12} in the expansion of $(1 - 2x)^{10}x^3$ **(07 Marks)**

c. By mathematical indication prove that $1 + 2 + 3 + \text{- - - - -} + n = \frac{n(n+1)}{2}$ **(06 Marks)**

Module-4

7 a. A random variable X has following probability function for various values of x

x	0	1	2	3	4	5	6	7
P(x)	0	K	2K	2K	3K	K^2	$2k^2$	$7K^2 + K$

(i) Find K (ii) Evaluate $P(x < 6)$, $P(x \geq 6)$. **(07 Marks)**

b. The number of accidents in a year to taxi drivers in a year follows Poisson distribution with mean 3. Out of 1000 taxi drivers find approximately the number of the drivers with
   (i) No accident in a year
   (ii) More than 3 accidents in a year. **(07 Marks)**

c. The marks of 1000 students in a examination follows a normal distribution with mean 70 and standard deviation 5. Find number of students whose marks will be
   (i) Less than 65
   (ii) More than 75. **(06 Marks)**

OR

8 a. The probability that a pen manufactured by a factory be defective is $\frac{1}{10}$. If 12 such pens are manufactured, what is the probability that
   (i) Exactly 2 are defective (ii) At least 2 are defective. **(07 Marks)**

b. Derive expression for the mean and standard deviation of exponential distribution. **(07 Marks)**

c. In a normal distribution 31% of items are under 45 and 8% of items are over 64. Find mean and standard deviation of the distribution. **(06 Marks)**

Module-5

9 a. Find coefficient of correlation and equation of the lines of regression for the data :

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

(07 Marks)

b. Ten competitors of a beauty contest are judged by two judges in following order. Find coefficient of rank correlation.

I	1	6	5	3	10	2	4	9	7	8
II	6	4	9	8	1	2	3	10	7	7

(07 Marks)

c. Fit a least square geometric curve $y = ax^b$ for following data :

x	1	2	3	4	5
y	0.5	2	4.5	8	12.5

(06 Marks)

OR

10 a. Find correlation in coefficient and equation of lines of regression for

x	1	2	3	4	5
y	2	5	3	8	7

(07 Marks)

b. Find rank correlation from following data :

x	78	36	98	25	75	82	90	62	65	39
y	84	51	91	60	68	62	86	58	53	39

(07 Marks)

c. Fit a curve $y = ae^{bx}$ for the data

x	0	2	4
y	8.12	10	31.82

(06 Marks)

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