CBCS SCHEME

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18MCA23

Second Semester MCA Degree Examination, Aug./Sept.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. Examine whether the following conditional is a tautology:
$\{p \to (q \to r)\} \to \{(p \to q) \to (p \to r)\}$ **(06 Marks)**

b. Using the laws of logic prove the following logical equivalence:
$\neg[\{(p \vee q) \wedge r\} \to \neg q] \Leftrightarrow \neg[\neg \{(p \vee q) \wedge r\} \vee \neg q] \Leftrightarrow q \wedge r$ **(07 Marks)**

c. Write down the following proposition in symbolic form and find its negation:
"All integers are rational numbers and some rational numbers are not integers". **(07 Marks)**

OR

2 a. Test whether the following argument is valid:

$$\begin{array}{l} p \to r \\ \neg p \to q \\ \underline{q \to s} \\ \therefore \neg r \to s \end{array}$$

(06 Marks)

b. Indicate how many rows are needed for the truth table of the compound proposition:
$(p \vee \neg q) \leftrightarrow [(\neg r \wedge s) \to t]$
Find the truth value of this proposition if p and r are true and q, s, t are false. **(07 Marks)**

c. Give (i) an indirect proof (ii) proof by contradiction of the following statement
For every integer n, if n^2 is odd then n is odd. **(07 Marks)**

Module-2

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

b. In a class of 52 students, 30 are studying C++, 28 are studying Java and 13 are studying both languages:
i) How many in this class are studying at least one of these languages?
ii) How many are studying neither of these languages? **(06 Marks)**

c. State and prove Baye's theorem. **(07 Marks)**

OR

4 a. Using laws of set theory simplify the following:
$\overline{\overline{(A \cup B) \cap C} \cup \overline{B}}$ **(07 Marks)**

b. If A and B are two events, then prove:
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ **(06 Marks)**

c. In a class 70% are boys and 30% are girls 5% of boys, 3% of the girls are irregular to the classes:
i) What is the probability of a student selected at random is irregular to the class?
ii) What is the probability that the irregular student is a girl? **(07 Marks)**

Module-3

5 a. Prove by mathematical induction, $4n < n^2-7$ for all positive integers $n \geq 6$. (07 Marks)

b. The Lucas numbers are defined recursively by $L_0 = 2$, $L_1 = 1$ and $L_n = L_{n-1} + L_{n-2}$ for $n \geq 2$. Evaluate L_2 to L_{10}. (06 Marks)

c. How many positive integers 'n' we can form using the digits 3, 4, 4, 5, 5, 6 and 7 if we want 'n' to exceed 5,000,000? (07 Marks)

OR

6 a. Prove the following by using Mathematical induction for every positive integer $n \geq 1$:

$$1.2 + 2.3 + 3.4 + \ldots.. + n(n+1) = \frac{1}{3}n(n+1)(n+2)$$ (07 Marks)

b. Find the number of arrangements of the letter TALLAHASSEE which have no adjacent A's. (07 Marks)

c. Write a recursive formula for the sequence 3, 8, 15, 24,..... (06 Marks)

Module-4

7 a. Derive the mean and standard deviation of the binomial distribution. (07 Marks)

b. The probability distribution of a finite random variable X is given by

X	10	20	30	40
P(x)	1/8	3/8	3/8	1/8

Find the mean and variance. (07 Marks)

c. If x is normally distributed with mean 12 and standard deviation 4, find:
i) $P(x \geq 20)$ ii) $P(x \leq 20)$ given A(2) = 0.4772 (06 Marks)

OR

8 a. When a coin is tossed 4 times, find the probability of getting
i) exactly one head ii) at most 3 heads iii) at least 2 heads (07 Marks)

b. The number of accidents in a year to taxi drivers in a city follows a Poission distribution with mean 3. Out of 1000 taxi drivers find approximately the number of taxi drivers with
i) no accident in a year ii) more than 3 accidents in a year. (07 Marks)

c. If x is an exponential variate with mean 3. Find: i) $P(x > 1)$ ii) $P(x < 3)$ (06 Marks)

Module-5

9 a. Ten participants in a contest are ranked by two judges as follows:

x :	1	6	5	10	3	2	4	9	7	8
y :	6	4	9	8	1	2	3	10	5	7

Calculate the rank correlation coefficient ρ. (06 Marks)

b. The two regression equations of the variables x and y are $x = 19.13 - 0.87y$ and $y = 11.64 - .50x$.
Find: i) Mean of x's ii) Mean of y's iii) Correlation coefficient between x and y (07 Marks)

c. Fit a second degree parabola of the form $y = a + bx + cx^2$ to the following data:

x :	0	1	2	3	4
y :	1	1.8	1.3	2.5	2.3

(07 Marks)

OR

10 a. Fit a curve of the form $y = ae^{bx}$ for the data

x :	0	2	4
y :	8.12	10	31.82

(10 Marks)

b. Obtain the lines of regression and hence find the coefficient of correlation for the data:

x	1	3	4	2	5	8	9	10	13	15
y :	8	6	10	8	12	16	16	10	32	32

(10 Marks)

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