(T) Roll No. .....

ID—8038

B.C.A. EXAMINATION, 2022

(Second Semester)

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Code : BCA-108

Time : 3 *Hours* *Maximum Marks* : 80

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *five* questions in all. Q. No. 1 is compulsory and attempt *four* more questions by selecting *one* question from each Unit. All questions carry equal marks.

1. (a) Find the standard deviation of :

11, 13, 14, 16, 17.

(b) Define binary search algorithm.

(c) Define 'Big-O' notation.

(d) If the mean of 7, 9, 11, x and 15 is 12, find the value of x.

(e) Define LHRRW.

(f) Find the first four terms of a sequence from the recursive formula $a_n = 5a_{n-1}$, $n \geq 1$, with the initial condition $a_0 = 3$.

(g) Convert the binary number 11011 into decimal number.

(h) Define complete binary tree with the help of example.

Unit I

2. (a) Find the line of regression of y on x for the following data :

x	:	10	9	8	7	6	4	3
y	:	12	7	10	8	9	6	8

(b) Calculate Karl Pearson's Coefficients of Correlation for the following data :

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

3. (a) Find the missing frequencies in the following frequency distribution table, it being given that the mean of this distribution is 50 :

Class in Interval	Frequency
0-20	16
20-40	?
40-60	31
60-80	?
80-100	17
Total	110

(b) Find the median of the following frequency distribution :

Marks	No. of Students
0-10	12
10-20	19

20-30	17
30-40	27
40-50	15
50-60	17

Unit II

4. (a) (i) Write the algorithm to find the HCF of two numbers.

(ii) Write an algorithm to find whether given number is odd or not.

(b) What do you mean by complexity of an algorithm ? Explain the concept of best case and worst case time complexity.

5. (a) Explain isomorphic and homeomorphic graphs with the help of examples.

(b) Prove that the degree of any vertex in a simple graph of 'n' vertices cannot exceed n 1.

Unit III

6. (a) Convert the following decimal numbers into binary numbers :

   (i) 125.125

   (ii) 64.123

   (b) What is minimum spanning tree ? Explain Kruskal's algorithm for minimum spanning tree with the help of example.

7. Explain bubble sort technique with algorithm— Use bubble sort algorithm to sort the following list of numbers :

   30, 40, 70, 10, 20, 60, 50, 80.

Unit IV

8. (a) Using Principle of mathematical induction, prove that $n^3 + 2n$ is divisible by 3 for all integers n.

   (b) Solve the recurrence relations subject to given initial conditions :

   $a_n = 4a_{n-1} - 5a_{n-2}$, for $n \geq 2$ with $a_0 = 5$, $a_1 = 13$

9. (a) Decrypt the message "YZW WKH ERPE" which is encrypt by the formula $p + 3 \pmod{26}$.

   (b) Find the g.c.d of 595 and 252 and express it in the form 252 m + 595 m.