9. (a) Find the least positive incongruent solution of '7x $\equiv 5 (\text{mod } 256)$.

(b) Solve the recurrence relation $a_n = 2a_{n-1} + 8a_{n-2}$ for $n \geq 2$ with $a_0 = 4$ and $a_1 = 10$.

Roll No. .....

97667

BCA 2nd Semester (Full and Re-Appear) Examination – October, 2020

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Paper : BCA-108

Time : 1.45 hours] *[Maximum Marks : 80*

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

Note : Attempt any ***three*** questions. All questions carry equal marks.

1. (a) Find the arithmetic mean of the marks obtained by 8 students of a class given as :

24, 67, 55, 78, 15, 89, 90, 45

(b) Find the range of the following series :

15, 10, 11, 9, 13, 17, 20

(c) Write four merits of an algorithm.

(d) Write an algorithm to find greatest among three numbers.

(e) What is merge sort ?

(f) Define spanning tree with example.

(g) Find a such that $a \equiv 7 \pmod 5$.

(h) Find the first four terms of a sequence from the formula $a_n = 3a_{n-1} + 4a_{n-2}$ where n $\geq$ 3 with initial conditions $a_1 = 1$, $a_2 = 5$.

2. (a) Calculate the mean of the following distribution :

Class Interval	0-10	10-20	20-30	30-40	40-50	50-60
Frequency	12	18	27	20	17	6

(b) Find the median of the following data :

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of Students	15	17	19	27	19	12

3. (a) The mean and variance of 7 observations are 8 and 16. If five of the observations are 2, 4, 10, 12, 14, find the remaining two observations.

(b) Find the covariance between x and y for the following distribution :

x	1	2	3	4	5
y	2	4	6	8	10

4. (a) What is Big-O notation ? What are its advantages ? Determine whether x^3 is $O(x^2)$.

(b) What do you mean by binary search algorithm ? Write the algorithm for binary search.

5. (a) Define degree of a vertex and incoming degree of a vertex with the help of example.

(b) Draw a complete graph K_5, with vertices A, B, C, D, E.

(c) Draw the diagram of the graph G(V, E), where $V = \{a, b, c, d, e\}$ and $E = \{(a, c), (a, e), (d, e), (b, d), (d, d), (b, b), (c, a)\}$.

(d) Prove that degree of any vertex in a simple graph of n vertices cannot exceed $n - 1$.

6. (a) Prove that a connected graph with n vertices and $n - 1$ edges is a tree.

(b) Explain binary tree and pre order traversal algorithm with the help of examples.

7. (a) (i) Convert the decimal number 59.36 into its binary equivalent.

(ii) Convert the binary number 11101101 into its decimal equivalent.

(b) Sort the following list : 7, 8, 4, 6, 1, 0, 9 using bubble sort.

8. (a) Using principle of mathematical induction prove that $7^n - 3^n$ is divisible by 4, for all $n \in N$.

(b) Find g.c.d. and l.c.m. of 227, 148.