Answer any **Five (05)** from the following questions. Figures at the right indicate the marks.

1. a) Explain Efficiency of an algorithm with example. Deduce the running time efficiency of Sequential search algorithm. 4

    b) What is Asymptotic Complexity? Give a short description about Θ-notation and Ω-notation. 3

    c) Analyze Insertion Sort. 2

    d) Compare the orders of growth of $\frac{1}{2}n(n-1)$ and $n2$. 3

2. a) Show that the largest element in a sub tree of a heap is at the root of the sub tree. 2

    b) Write down the algorithm *Heapify* to maintain the heap property. Illustrate the operation of the *Heapify* (A.3) on the array a={27,17.3,16,13,10,1,5,7,12,4,8,9,0}. 3+3

    c) Calculate the running time of *quick sort algorithm* in case of worst-case partitioning and best case partitioning. 4

3. a) What is the difference between the *binary search tree property* and the *heap property*? Can the heap property be used to print out the keys of an n-node tree in sorted order in O(n) time? 2+3

    b) Write down the algorithm to delete an item from the binary search tree. 4

    c) Show that "if a node in a binary search tree has two children, then its successor has no left child and its predecessor has no right child." 3

4. a) Write down the algorithm to find the minimum number of scalar multiplication of a given *n* matrices. 3

   b) Consider the following matrix with dimensions 5

Matrix	A_1	A_2	A_3	A_4
Dimensions	10x20	20x5	5x15	15x50

    Calculate the minimum number of scalar multiplication.

    c) a) Write the Greedy Recursive Activity selection algorithm. Show the operation of this algorithm using the following set S of activities. 4

i	1	2	3	4	5	6	7	8	9	10	11
s_i	1	3	0	5	3	5	6	8	8	2	12
f_i	4	5	6	7	8	9	10	11	12	13	14

5. a) What is meant by *back tracking method*? Draw a possible solution space for a 4-queen problem. 1+3

    b) Write down the basic concept of *relaxation*. 2

    c) Find the single source shortest path for the following graph using *Dijkstra's algorithm*. 3
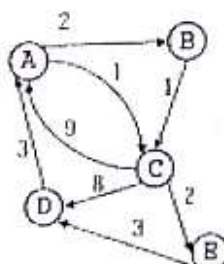
    d) How do you define *greedy choice property*? Prove that *the 0/1 knapsack problem cannot be solved using greedy method*. 3

P.T.O

6. a) What are the *0-1 knapsack* and *fractional knapsack* problem? How do you explain whether *dynamic programming* or *greedy* would be applicable for computing the optimal solutions for these two problems and the other algorithm would fail.

b) Consider a data file with 35000 characters. The characters in the file occur with the 5 frequencies given by:

	C	d	g	h	j	k
Frequency (in thousand)	6	9	3	4	7	6

Generate the variable length code word using *Huffman code algorithm*.

c) What down the algorithm of *activity selection problem* 3

7. a) Write down the *Prim's algorithm* to calculate the *minimum spanning tree (MST)* of a graph. 3

b) Consider the following graph. 4
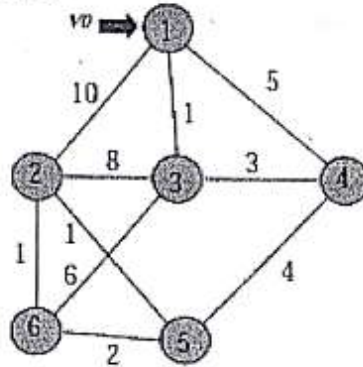
Compute the minimum spanning tree for the above mentioned graph using *Prim's algorithm.*

c) Apply Kruskal's algorithm to find a minimum spanning tree of the following graphs. Does 5 Kruskal's algorithm work correctly on graphs that have negative edge weights?

END

[Answer any **FIVE** of the following questions. Each set of questions carry equal marks]
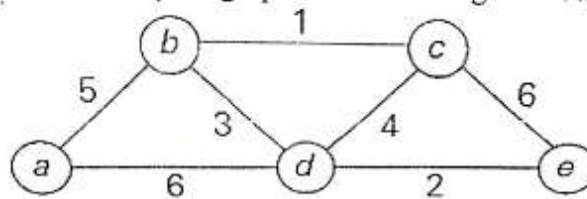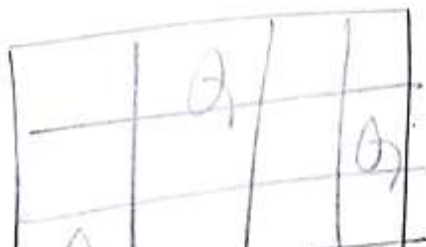
1.(a) What do you mean by statistics? Write down the important applications of statistics in information technology. Define data with example.   4

(b) Define variable with example. Briefly explain the qualitative and quantitative variable.   4

(c) What is frequency distribution? Why do you use such distribution? Why graphical presentation is so important?   4

2. (a) What is dispersion? What are the measures of dispersion?   4

(b) Write down the merits and demerits of mean deviation and standard deviation. 4

(c) A frequency distribution of weights (in kg) of 45 students are given below:

Income in Taka	45-50	50-55	55-60	60-65	65-70	70-75	75-80
Frequency	5	6	6	8	10	6	4

Compute the mean deviation and coefficient of variation.   4

3.(a) What is coefficient of variation (CV)? Why coefficient of variation is so important?   4

(b) Establish the relation between μ's and v's.   4

(c) Compute the kurtosis (based upon the fourth moment about the mean)of the following frequency distribution.   4

Weight of student	0-99	100-199	200-299	300-399	400-499	500-599	600-699
Number of families	50	70	203	406	403	42	5

4. (a) Write down the uses of correlation coefficient.   3

(b) The following table shows the data of the heights of father and his son :   9

Height of father(cm) (x)	165	166	167	168	167	169	170	172
Height of son(cm) (y)	167	168	165	172	168	172	169	171

   i.   Fit the regression equation of the line of y on x.

   ii.   Fit the regression equation of the line of x on y.

   iii.   Calculate the correlation coefficient.

5.(a) Define the terms experiment, sample space and event with example. Write down the properties of the probability.   4

(b) Two thousand randomly selected adults were asked if they think they are financially better off than their parents. The following table gives the two-way classification of the responses based on the education levels of the

persons included in the survey and whether they are financially better off, the same as, or worse off than their parents. 8

	Less than high school(X)	High school(Y)	More than high school(Z)
Better off(A)	140	450	420
Same as (B)	60	250	110
Worse off(C)	200	300	70

If one adult is selected at random from these 2000 adults, find the probability that this adult is

    i) P(Financially better off given less than high school)
    ii) P(High school given financially worse off)
    iii) P(better off and high school)
    iv) P(more than high school and worse off)

6. (a) Write down the conditions of a binomial experiment. 2
    (b) According to a National Public Radio poll, 46% of American school principals believe that students pay little attention to science education provided in schools. Suppose that this result is true for the current population of American school principals. 10

    i) Let x be a binomial random variable denoting the number of American school principals in a random sample of 7 who do not believe that students pay little attention to science education taught in schools. Write the probability distribution of x and draw a graph of the probability distribution. Determine the mean and standard deviation of x.

    ii) Find the probability that in a random sample of 7 American school principals, at most 4 believe that students pay little attention to science education taught in schools.

7. (a) Define hypothesis. What is null and alternative hypothesis? Define level of significance. 4
    (b) What is power of the test and p-value? Define confidence interval with example. 3

    (c) Suppose the manager of a textile industry suspects that the mean time lost due to the sickness of the night shift workers exceeds the mean time for the day shift workers. To check it, the manager randomly selected 12 workers in each shift category and record the number of days lost due to sickness within the past year.

Night Shift	12	10	20	15	18	9	12	10	21	25	13
Day Shift	8	10	15	9	12	16	15	20	5	18	12

If the number of days per year lost due to the sickness for the night shift and day shift workers are normally distributed with mean μ_1 and μ_2 and variance σ_1^2 and σ_2^2 respectively, test the significance of the difference of population means if the population variances are not equal. The table value is at 5% level of significance is 1.72.