



Allowed Tables and Charts : None

Answer all the following questions: [100 Marks]

**Question 1 (35 marks)**

A) Find the solution of the Linear programming problem Graphically only

$$\begin{aligned} \text{Min } F &= 2x_1 - x_2 \\ \text{S.t. } & x_1 + x_2 \geq 5 \\ & -x_1 + x_2 \leq 1 \\ & 5x_1 + 4x_2 \leq 40 \\ & x_1, x_2 \geq 0 \end{aligned}$$

And then show on the graph each of the following expressions:

- i) Vertex points      ii) Convex set      iii) Feasible region  
iv) Hyper plane      v) Optimal solution      (10 marks)

B) Use the simplex method to

$$\text{Max } Z = 3x_1 + 2x_2 + x_3$$

and Subjected to:

$$\begin{aligned} 4x_1 + x_2 + x_3 &= 30, \\ 2x_1 + 3x_2 + x_3 &\leq 60, \\ x_1 + 2x_2 + 3x_3 &\leq 40, \\ x_1, x_2, x_3 &\geq 0 \end{aligned} \quad (10 \text{ marks})$$

(C) Discuss with graph each of the following expressions:

- (i) Unbounded solution      (ii) Infeasible solution      (iii) Redundant constrained,  
(iv) Multiple optima      (v) Unbounded feasible region (unbounded solution),  
(vi) Unbounded feasible region (bounded solution).      (5 marks)

(D) If the sample space of a random experiment is  $S = \{1, 3, 5\}$ , find the algebra and verify that it satisfies the three conditions.      (5 marks)

(E) One card is drawn at random from a box containing 40 cards numbered from 1 to 40, find the probability of each of the following:

- (i) The event A = Drawing a card carrying a number divisible by 4.  
(ii) The event B = Drawing a card carrying a number divisible by 6.  
(iii) The event C = Drawing a card carrying a number divisible by 4 and by 6.  
(iv) The event D = Drawing a card carrying a number divisible by 4 or by 6.  
(v) The event E = Drawing a card carrying a number only divisible by 4.      (5 marks)

**Question 2 (65 marks)**

(A) The weights in grams of 50 apples picked out at random from a consignment are as follows:

106 107 76 82 109 107 115 93 187 95 123 125 111  
 92 86 70 126 68 130 129 139 119 115 128 100 186  
 84 99 113 204 111 141 136 123 90 115 98 110 78  
 90 107 81 131 75 84 104 110 80 118 82

Form the grouped frequency table by dividing the variant range into intervals of equal width, each corresponding to 20 grams, in such a way that the mid-value of the first class corresponds to 70 grams. (5 marks)

(B) Given the following frequency table (10 marks)

Class	15 - 25	25 - 35	35 - 45	45 - 55	55 - 65
Frequency	2	3	6	5	4

Calculate (i) the Arithmetic Mean (ii) the Median. (iii) the Mode

(C) Given the following frequency table

Classes	10-20	20-30	30-40	40-50
Frequency	40	25	80	45

Calculate (i) The Harmonic Mean. (ii) The Geometric Mean (10 marks)

(D) For the following data, 12, 17, 13, 15, 16, 8, 9, 10 Calculate: (15 marks)

- (i) The arithmetic mean (ii) Geometric mean (iii) Harmonic mean  
 (iv) The Median (v) The Mode (vi) The Mean Deviation  
 (vii) Variance, (viii) Standard Deviation (ix) The Coefficient of variation

(E) For a continuous random variable, let  $f(x) = \begin{cases} x+1 & -1 \leq x \leq 0 \\ \frac{-x}{4} + \frac{3}{4} & 1 \leq x \leq 3 \\ 0 & \text{elsewhere} \end{cases}$

Is  $f(x)$  a density function? If so find the distribution function  $F(x)$ . (10 marks)

(F) Calculate the Mean deviation, Variance, Standard Deviation, and the Coefficient of variation for the following data: (10 marks)

Class	10-20	20-30	30-40	40-50	50-60	total
$f$	10	20	30	25	15	100

(G) A discrete random variable  $x$  of range  $\{0, 1, 2, 3\}$  and its probability distribution is given by the function  $P(x) = a(1/2)^{x-1}$  for each  $x$  in the range, Find the value of  $a$ . (5 marks)

This exam measures the following ILOs											
Question Number	Q1-a	Q2-a	Q1-b	Q2-b	Q2-c	Q2-e	Q1-c		Q1-d	Q1-e	Q2-f
Skills					Q2-d				Q2-g		
	Knowledge & understanding skills				Intellectual Skills				Professional Skills		

With my best wishes

Associate Prof. Dr. Islam M. Eldesoky