Northern Border University Faculty of Engineering First Semester 1436/1437, Mid Term Exam



Subject: Operations Research IE311 Date: 16/1/1437, Time allowed: 1.5 Hrs Total Marks: 10 Points Instructors: Dr. **Mohamed Mostafa**

Solve the Following Problems

1) Solve the Following LPP by graphical method.

(2)

(5)

Minimize: $Z = 4 x_1 + 3 x_2$ Subject to the constraints

 $2 x_{1} + x_{2} \ge 10$ -3 x₁ + 2 x₂ \le 6 x₁ + x₂ \ge 6 And x₁, x₂ \ge 0

2) A manufacturing company engaged in producing three types of products: A, B and C. The production department daily produces component sufficient to make 50 units of A, 25 units of B and 30 units of C. The management is confronted with problem of optimizing the daily production of products in assembly department where only 100 man-hours are available daily to assemble the products. The following additional information is available.

Type of	Profit contribution per	Assembly time per
product	unit of product (SR)	product (hrs)
А	12	0.8
В	20	1.7
С	45	2.5

The company has a daily order commitment for 20 units of product A and total of 15 units of B and C products. **Formulates** this problem as an LP model so as to maximize the total profit. (3)

3) Solve the following LPP by Simplex Method Maximize $Z = 2 x_1 + x_2 + x_3$ Subject to the constraints $4 x_1 + 6x_2 + 3x_3 \le 8$ $3 x_1 - 6x_2 - 4x_3 \le 1$ $2 x_1 + 3x_2 - 5x_3 \ge 4$ and $x_1, x_2, x_3 \ge 0$

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Model Answer of Mid Term Exam Group [1] Solution of Problem #1



X1

Solution of Problem #2

LP model formulation: the data of the problem is summarized as follows:

Resources / Constraints	A	produ B	ct type C	total
Production capacity (units)	50	25	30	
Man hours per unit	0.8	1.7	2.5	100
Order commitment unit		20	15	
Profit contribution (Rs./unit) 12	20	45	
Decision variables: let x1, x produced respectively The LP model Maximize (total prof Subject to the constraints (a) labor and ma 0.8x1	(2, x3=1) (2,	numbers 12x1 + onstrain 2+2.5x3	ts $= <100$	F products A, B and C to be
x1 (b) order commi x1 x2	x2 tment c +x3 x1,x2	=< x3=< constrair >=20 >=15 2,x3>=0	50 25 30 hts	

Solution of Problem #3

Variable	Status	Value
X1	Basic	1.2857
X2	Basic	.4762
X3	Basic	0
slack 1	NONBasic	0
slack 2	NONBasic	0
surplus 3	NONBasic	0
surplus 4	Basic	1.2857
surplus 5	Basic	.4762
Optimal Value (Z)		3.0476

Note Multiple optimal solutions exist

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Model Answer of Mid Term Exam Group [2] Solution of Problem #1

Constraint Display											
C Min 6X1+5X2											
C 2X1+1X2>=12											
C -3X1+2X2<=8											
C 1X1+1X2>=8											
C 1X1>=0											
C 1X2>=0											
Image:											
	Corner Points										
X1	X2	Z									
8	0	48.									
2.285714	7.428571	50.86									
4	4	44.									



Solution of Problem #2

Resources / Constraints	А	product type B C		total
Production capacity (units) Man hours per unit Order commitment unit Profit contribution (Rs./unit)	50 0.8 14	25 1.7 20 22	30 2.5 15 47	100

Decision variables: let x1, x2, x3=numbers of units of products A, B and C to be produced respectively

The LP model Maximize (total profit) Z = 14x1 + 22x2 + 47x3Subject to the constraints labor and material constraints (c) 0.8x1 + 1.7x2 + 2.5x3 = <100=<50 x1 x2 =<25 x3=<30 order commitment constraints (d) >=20 x1 x2 >=15 +x3x1, x2, x3>=0

Solution of Problem #3

Equation form
Max 4X1 + 3X2 + 3X3
4X1 + 6X2 + 3X3 <= 10
3X16X24X3 <= 3
2X1 + 3X25X3 >= 6
X1 >= 0
X2 >= 0

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