National University of Computer and Emerging Sciences

Lahore Campus

Operations Research (MT 4031)

Sessional II

Date: 05-11-2025

Total Time **60 mins**

Total Marks: **30**

Total Questions: **3**

Course Instructor(s)

Dr. Misbah Irshad, Dr. Uzma Bashir, Dr. Farheen Ibraheem

Mr. Yasir Yasin, Mr. Toqeer Jameel.

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Roll No Section Student Signature

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Attempt all the questions.

CLO #: 1 Recognize the importance of operations research and linear programming by learning the characteristics of different types of decision-making environments, appropriate decision-making approaches, and tools to be used in each type.

Q.1: [10]

Consider the following model

Maximize $2x_1 + x_2 - 3x_3 + 5x_4$

$$x_1 + 2x_2 + 2x_3 + 4x_4 \leq b_1$$
$$2x_1 - x_2 + x_3 + 2x_4 \leq b_2$$
$$4x_1 - 2x_2 + x_3 - x_4 \leq b_3$$
$$x_1, x_2, x_3, x_4 \geq 0$$

The following optimal tableau corresponds the specific values of b_1, b_2 and b_3

Basic	x_1	x_2	x_3	x_4	s_1	s_2	s_3	RHS
Z	$\frac{3}{8}$	0	a	0	e	f	0	g
x_2	$-\frac{3}{4}$	1	b	0	$\frac{1}{4}$	$-\frac{1}{2}$	0	6
x_4	$\frac{5}{8}$	0	c	1	$\frac{1}{8}$	$\frac{1}{4}$	0	7
s_3	$\frac{25}{8}$	0	d	0	$\frac{5}{8}$	$-\frac{3}{4}$	1	29

Determine the following

a) The right-hand-side values of b_1, b_2 and b_3.

b) The optimal dual solution.

c) The elements a, b, c, d, e, f and g

CLO #: 2 Solve the Transportation Models, Assignment Models and Network Models.

Q2: [1+2+7]

A company has two production factories S_1 and S_2 with the production capacity of 100 and 110 units per week of a product, respectively. These units are to be shipped to Three warehouses D_1, D_2 and D_3 with requirements of 80, 70 and 60 units per week, respectively. The transportation cost (in $) per unit between factories to warehouses are given in the table below.

Destination / Sources	D_1	D_2	D_3
S_1	1	2	3
S_2	4	1	5

a) Formulate the transportation model
b) Find initial basic feasible solution using Northwest corner method.
c) Hence find optimal solution using the method of multipliers.

CLO #: 2 Solve the Transportation Models, Assignment Models and Network Models.

Q3: [10]

A logistics company manages deliveries among seven major distribution centers located in cities **A, B, C, D, E, F,** and **G**. Each city is connected by various roadways of different travel times (in minutes). The company has already applied **Floyd–Warshall's algorithm** to compute the **shortest distances** and **sequence matrix** between every pair of cities.(given below)

D

From/To	A	B	C	D	E	F	G
A	0	3	7	5	9	10	11
B	3	0	4	2	6	7	8
C	7	4	0	3	5	6	7
D	5	2	3	0	4	5	6
E	9	6	5	4	0	3	4
F	10	7	6	5	3	0	2
G	11	8	7	6	4	2	0

S

From/To	A	B	C	D	E	F	G
A	-	B	B	B	D	E	F
B	A	-	C	D	D	E	F
C	B	B	-	D	D	E	F
D	B	B	C	-	E	E	F
E	D	D	D	D	-	F	F
F	E	E	E	E	E	-	G
G	F	F	F	F	F	F	-

i. Using the matrices above, determine the shortest delivery routes and total travel time between the following pairs:
   a. $A \rightarrow F$
   b. $B \rightarrow E$
   c. $C \rightarrow G$
   d. $D \rightarrow A$
   e. $E \rightarrow C$

ii. Write each route as a sequence of cities.