National University of Computer and Emerging Sciences, Lahore Campus

Course Name:	Operations Research	Course Code:	MT 4031
Degree Program:	BS	Semester:	Spring 2024
Exam Duration:		Total Marks:	40
Submission Date:	27-03-2024	Weight	3
Section:	G & H	Page(s):	
Exam Type:	Assignment-2		

Reference book: Hamdy A. Taha, Operations Research, An Introduction (10th Edition)

Instruction:

- Clearly write your name, Roll no, Section, Course title and assignment title on the first page.
- Use A4 size sheets only. Use both sides of paper.
- Don't mention question number only, write full statement.
- Late submission will have no credit.

Questions 1: [5}

Write dual of the following problem. Solve the dual, and then find the optimal solution of primal from the solution of the dual. (Use excel solver for solution. Attach the screenshots of all steps).

$$\text{Minimize } z = 50x_1 + 60x_2 + 30x_3$$

$$5x_1 + 5x_2 + 3x_3 \geq 50$$
$$x_1 + x_2 - x_3 \geq 20$$
$$7x_1 + 6x_2 - 9x_3 \geq 30$$
$$5x_1 + 5x_2 + 5x_3 \geq 35$$
$$2x_1 + 4x_2 - 15x_3 \geq 10$$
$$12x_1 + 10x_2 \geq 90$$
$$x_2 - 10x_3 \geq 20$$
$$x_1, x_2, x_3 \geq 0$$

Question 2: [5]

Consider the following LP model,

$$\text{Maximize } z = 3x_1 + 2x_2 + 5x_3$$

subject to

$$x_1 + 2x_2 + x_3 + x_4 = 30$$
$$3x_1 + 2x_3 + x_5 = 60$$
$$x_1 + 4x_2 + x_6 = 20$$
$$x_2, x_2, x_3, x_4, x_5, x_6 \geq 0$$

Construct the entire simplex tableau associated with the following basic variables and check it for optimality and feasibility.

$$\text{Basic variables} = (x_2, x_3, x_1), \text{ Inverse} = \begin{pmatrix} \frac{1}{4} & -\frac{1}{8} & \frac{1}{8} \\ \frac{3}{2} & -\frac{1}{4} & -\frac{3}{4} \\ -1 & \frac{1}{2} & \frac{1}{2} \end{pmatrix}$$

Question 3: [10]

   a. Solve the following LLP using dual simplex method.

$$\text{minimize } z = 2x_1 + x_2$$

subject to
$$x_1 + x_2 = 4$$
$$2x_1 - x_2 \geq 3$$
$$x_1, x_2 \geq 0.$$

   b. Use generalized simplex method to solve the following LLP.

$$\max z = 5x_1 + 2x_2$$

subject to
$$6x_1 + x_2 \geq 6$$
$$4x_1 + 3x_2 \geq 12$$
$$x_1 + 2x_2 \geq 4$$
$$x_1, x_2 \geq 0.$$

Question 4: [10]

   a. A car rental company is faced with an allocation problem resulting from rental agreements that allow cars to be returned to locations other than those at which they were originally rented. At the present time, there are two locations (sources) with 15 and 13 surplus cars respectively and four locations (destinations) requiring 9, 6, 7 and 9 cars respectively. Unit transportation costs (in dollars) between the locations are as follows:

	1	2	3	4
1	45	17	21	30
2	14	18	19	31

Find the optimal solution using excel solver.

   b. In the unbalanced transportation problem in Table 5.36, if a unit from a source is not shipped out (to any of the destinations), a storage cost is incurred at the rate of $5, $4, and $3 per unit for sources 1, 2, and 3, respectively. Additionally, all the supply at source 2 must be shipped out completely to make room for a new product. Find the optimal solution using excel solver.

$1	$2	$1	20
$3	$4	$5	40
$2	$3	$3	30
30	20	20	