

Question 1

Use the simplex method to solve the following simplex problems.

a) Maximise $-5x_1 - x_2 - 3x_3$ subject to

$$-x_1 + 4x_2 + 2x_3 \leq 0,$$

$$7x_2 + x_3 \leq 1,$$

$$-2x_1 + x_2 - 3x_3 \leq -2$$

$$x_1, x_2, x_3 \geq 0.$$

b) Maximise $2x_1 + 3x_2 + 2x_3$ subject to

$$3x_1 + x_2 + 2x_3 \leq 6,$$

$$x_1 + x_2 + x_3 \leq 4,$$

$$2x_1 + 6x_2 + 6x_3 \leq 20$$

$$x_1, x_2, x_3 \geq 0.$$

c) Maximise $3x_1 + x_2 + 4x_3 + 5x_4$ subject to

$$x_1 + x_2 + x_3 + x_4 \leq 6,$$

$$2x_2 - x_3 + 4x_4 = 1,$$

$$3x_1 + x_3 = 6$$

$$x_1 \text{ unrestricted, } x_2, x_3, x_4 \geq 0.$$

(15 marks)

Question 2

Consider the primal linear programming problem below.

Maximise $8x_1 + 10x_2 + 8x_3$,

subject to

$$8x_1 + 6x_2 + 3x_3 \leq 12,$$

$$6x_1 + 12x_2 + 16x_3 \leq 20,$$

$$x_1, x_2, x_3 \geq 0.$$

a) Construct the dual problem and solve it graphically.

b) Determine a solution to the primal problem, stating clearly any results that you use (do not use the simplex algorithm).

(12 marks)

Question 3

Three car showrooms A, B and C are supplied by cars from three ports, 1, 2 and 3. The table below gives the cost, in pounds, of transporting a car from each port to each showroom.

Ports 1, 2 and 3 have stocks of 600, 400 and 800 cars respectively.

A, B and C require 400, 500 and 700 cars respectively.

The aim is to minimise the total cost of transporting the cars.

	A	B	C
1	10	9	3
2	14	11	5
3	16	10	7

- Formulate, but do not solve, the problem in the form of a linear program.
 - Now write the problem in the form of a transportation array, explaining how you deal with the fact that the total demand and the total supply are not equal.
 - Find the optimal transportation solution.
- (15 marks)

Question 4

Five candidates for five jobs are given an aptitude test for each job. The scores for the five candidates and the five jobs are given as follows;

Cand/Job	1	2	3	4	5
1	69	68	69	64	71
2	77	58	58	66	68
3	62	63	61	74	69
4	81	71	70	75	66
5	79	70	65	64	65

- Each of the five candidates must be assigned exactly one job. Find the optimal job assignments.
 - How would this assignment change if candidate 2 was pre-assigned to do job 2?
- (10 marks)