

QQQ – Decision 2 – Chapter 1 – Transportation Problems (Version 2)

Total Marks: 23

(23 = Platinum, 21 = Gold, 18 = Silver, 16 = Bronze)

1. Three warehouses, P, Q and R, supply washing machines to four retailers, A, B, C and D. The table gives the cost, in pounds, of transporting a washing machine from each warehouse to each retailer. It also shows the number of washing machines held at each warehouse and the number of washing machines required by each retailer. The total cost of transportation is to be minimised.

	A	B	C	D	Supply
P	11	22	13	17	25
Q	21	8	19	14	27
R	15	10	9	12	28
Demand	18	16	20	26	

Formulate this transportation problem as a linear programming problem. You must define your decision variables and make the objective function and constraints clear.

You do not need to solve this problem.

(7)

(Total 7 marks)

2. Table 1 shows the cost, in pounds, of transporting one unit of stock from each of four supply points, A, B, C and D, to each of four demand points, 1, 2, 3 and 4. It also shows the stock held at each supply point and the stock required at each demand point. A minimum cost solution to this transportation problem is required.

	1	2	3	4	Supply
A	24	32	21	34	27
B	28	31	29	37	41
C	25	41	33	35	31
D	23	32	31	36	14
Demand	33	35	25	20	

Table 1

Table 2 shows an initial solution given by the north-west corner method.

	1	2	3	4
A	27			
B	6	35		
C		0	25	6
D				14

Table 2

- (a) Explain why a zero has been placed in cell C2 in Table 2. State the other cell in Table 2 in which the zero could have been placed. (2)
- (b) State the shadow costs clearly and enter the improvement indices into Table 3 in your answer book. (3)

Taking the most negative improvement index to indicate the entering cell,

- (c) list the stepping-stone route that should be used to obtain the next solution. You should make clear the cells that are included in your route and state your entering and exiting cells. [You do **not** need to state the next solution. You do **not** need to solve this problem.] (2)

(Total 7 marks)

3. The table below shows the cost of transporting one unit of stock from each of four supply points, 1, 2, 3 and 4, to each of three demand points, A, B and C. It also shows the stock held at each supply point and the stock required at each demand point. A minimal cost solution is required.

	A	B	C	Supply
1	31	29	32	20
2	22	33	27	22
3	25	27	32	20
4	23	26	38	38
Demand	35	25	30	

(a) Add a dummy demand point and appropriate values to Table 1 in the answer book. (1)

Table 2 shows an initial solution given by the north-west corner method.

Table 3 shows some of the improvement indices for this solution.

	A	B	C	D
1	20			
2	15	7		
3		18	2	
4			28	10

Table 2

	A	B	C	D
1		-13		-9
2			-11	
3				
4	1	-7		

Table 3

(b) Calculate the shadow costs and the missing improvement indices and enter them into Table 3 in the **answer book**. (4)

- (c) Taking the most negative improvement index to indicate the entering square, use the stepping-stone method once to obtain an improved solution. You must make your route clear and state your entering cell and exiting cell. (4)

(Total 9 marks)