



ANSWER BOOK

Transportation problems

Decision Mathematics 2 · Year FM

6 questions · 18 marks

NAVY EDITION

SECTION A · Warm-up

- A1** Total supply is 120 and total demand is 105, so the problem is unbalanced. Add a dummy destination of demand 15, reachable from every source at a cost of zero. Whichever source ends up supplying the dummy is the one whose goods are not sent anywhere. [2]
- A2** $4 + 5 - 1 = 8$ cells. Using fewer means the solution is degenerate, which happens when a supply and a demand run out together. A zero allocation is recorded in a suitable cell to restore the count, without moving any goods. [2]

SECTION B · Standard

- B1** AX takes $\min(40, 35) = 35$, using up X. AY then takes A's remaining 5, using up A. BY takes 30, using up B. CY takes the last 10 that Y needs, and CZ takes 40. Allocations: AX 35, AY 5, BY 30, CY 10, CZ 40. Cost = $35(8) + 5(5) + 30(9) + 10(6) + 40(5) = 280 + 25 + 270 + 60 + 200 = 835$. [5]
- B2** It uses five cells and $3 + 3 - 1 = 5$, so the count is correct and no zero allocation is needed. The cost is poor, though: the method never looks at a cost, so it has put 30 units on BY at 9 per unit, the dearest route in the table. Its only purpose is to give the improvement machinery a feasible plan to start from. [2]
- B3** Give that cell a cost large enough that no improvement method would ever choose it, and say in your working that you have done so. A cost of zero would make the route look like the cheapest in the table, so the method would fill it first: the forbidden route needs to be made unattractive, not free. A dummy destination is the opposite case, where zero is right because nothing is actually moved. [3]

SECTION C · Stretch

- C1** The first cell takes $\min(20, 20) = 20$, which uses up the first supply and the first demand together. The remaining table has one source and one destination, so the second cell takes 30. That is only two cells against $2 + 2 - 1 = 3$, so the solution is degenerate. Record a zero allocation in one of the two empty cells, which restores the count so that all the shadow costs can be found later. No goods move, and the cost of 20 times the first rate plus 30 times the last is unaffected. [4]