Module 8 · Assignment P16 · 8.0

SM pp. 514–536 (exercise 537–544). **A 7-mark assignment half in every December** (D23 jobs, D24 travelling salesman, D25 unbalanced road repairs) + an MCQ in June papers. Module 8 per paper: **J26-2 · D25-7 · J25-2 · D24-7 · J24-2 · D23-7** (J23-10). **Due in Dec'26.**

0 · Balance and convert
unequal → dummy row / column of zeros; maximise → subtract every cell from the largest; barred cell → a very large cost

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1 · Row, then column reduction
subtract each row's minimum, then each column's

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2 · Cover all zeros with the fewest lines
lines = order → optimal; else take the smallest uncovered number off the uncovered cells, add it at the crossings

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3 · Assign
a row or column with a single zero first; cross out the rest of its row and column

Paper	Asked
Dec'23	5 jobs to 5 mechanists, least cost (= SM Illus. 2 type)
Dec'24	travelling salesman, 5 cities, start and end at A (= Illus. 7 type; J23 Q8(b) matrix)
Dec'25	**= SM Illus. 4 with every bid doubled** (two R4 bids swapped): unbalanced, grant, discount for the eliminated contractor
MCQs	special case of transportation (J23) · maximisation → regret matrix (J24) · single-zero marking (J25) · 3 items × 3 vendors (J26)

PROBLEMS BOX · ASSIGNMENT (CHECKED OVER EVERY POSSIBLE ASSIGNMENT BY SCRIPT m08_patterns.py)

WORKED PATTERN · SM ILLUSTRATION 4 (= DEC'25 TEMPLATE), ₹ LAKH

- 5 contractors, 4 roads → a dummy road of zeros; two improvement rounds → optimal. [SM 523–524]
- Road 1 B 7 · Road 2 D 12 · Road 3 A 19 · Road 4 E 16 = **₹54 lakh**; grant ₹50 lakh → supplementary **₹4 lakh**; C gets the dummy → unsuccessful. [SM 525]

DEC'25 Q6(b) (OUR WORKING), ₹ LAKH

With C1 on R1 (18) and C5 on R2 (30) as the question states: R3 to C4 (36), R4 to C3 (38) → **₹122 lakh** (₹8 lakh over the ₹114 grant); **C2 is eliminated**. Cheapest way in for C2: R4 (39 v C3 38, with C4 still on R3) costs ₹1 lakh more → C2 must cut its bid by **more than ₹1 lakh**. ⚠ Without that condition the optimum is ₹108 lakh (C2 R1, C4 R2, C1 R3, C5 R4) and C3 is out — state the reading.

DEC'23 Q6(a) FIVE JOBS (OUR WORKING)

Job 1 → D (3), Job 2 → A (3), Job 3 → E (9), Job 4 → B (2), Job 5 → C (4) = **₹21** (the only optimum).

DEC'24 Q6(a) TRAVELLING SALESMAN (OUR WORKING)

Assignment first (no city to itself: put a large number on the diagonal); if the answer splits into sub-tours, try the next-best zero. Shortest round trip **74 km**, two routes: **A-B-C-D-E-A** (12 + 16 + 18 + 16 + 12) and **A-B-E-C-D-A** (12 + 7 + 23 + 18 + 14).

PRACTISE THESE

D25 Q6(b), D24 Q6(a), D23 Q6(a), J23 Q8(b) · MQP Q6(b), PTP Q6(b), postal Q8(a) · SM Illus. 1–8 (SM 515–536) · MCQs J23 Q7(i), J24 Q1(xiii), J25 Q1(vii), J26 Q1(vi), PTP Q1(vi) · **ICMAI Practice Workbook Ch6 illus. 1–12** · MCQ bank Q82, Q85–Q107, Q201.

Traps: balance first; for maximisation convert before reducing; check for alternative optima (SM Illus. 5) and sub-tours in the salesman problem; write the final table with each cost and the total.