Minimum-cost and maximum-profit assignments

6 questions | 14 marks

Equivalent correct methods earn the corresponding marks.

1. Form the opportunity-loss matrix for the supplied profits using $K = 19$. [3 marks]

Profit ($100 units) from assigning each team to one distinct contract.

Team	Contract 1	Contract 2	Contract 3
P	18	14	13
Q	15	17	12
R	16	11	19

Subtract each original profit from 19.

Answer: $\begin{bmatrix} 1 & 5 & 6 \\ 4 & 2 & 7 \\ 3 & 8 & 0 \end{bmatrix}$.

2. For a four-person problem with $K = 30$, the minimum transformed total is 17. Find the maximum profit. [2 marks]

The complete transformed total is $4 \times 30 - P$.

$P = 120 - 17 = 103.$

Answer: 103 profit units.

3. Two workers have profits A:$[12, 8]$ and B:$[10, 11]$. Find the best complete assignment. [2 marks]

The two feasible totals are $12 + 11 = 23$ and $8 + 10 = 18$.

Choose the larger.

Answer: A→1, B→2; total profit 23.

4. For costs A:$[12, 8]$ and B:$[10, 11]$, find the minimum assignment and compare it with the previous profit objective. [2 marks]

The same numbers give a different optimum when lower is better.

$18 < 23$.

Answer: A→2, B→1; total cost 18.

5. If 5 is added to every profit in a three-person square table, does the optimal pairing change? What happens to its total? [2 marks]

Each complete assignment selects exactly three entries.

The same constant shift preserves the ranking.

Answer: The optimal pairing does not change; every complete total rises by 15.

6. An assignment gives predicted profits \$700, \$900 and \$600, but the last two contracts compete for the same machine. Explain why adding them may overstate the achievable profit. [3 marks]

The nominal sum is \$2,200.

The machine conflict may prevent both contracts being completed as modelled; costs or scheduling need revision.

Answer: The independent-addition/resource assumption is violated.