

INKMATHS FLASHCARDS

Decision Mathematics 2 allocation, flow and games

18 cards · fronts and backs

Print double-sided, flipping on the long edge, and each answer lands behind its question. Cut along the card borders.

Definitions in precise wording, the standard results the formulae booklet does not print, a check-yourself question per topic, and the slips that lose marks. The same cards run on the website with spaced-repetition scheduling, at inkmaths.co.uk/flashcards.

DEFINITION

Define: North-west corner method.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Define: $m + n - 1$.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

STANDARD RESULT

Improvement index:

index of an unused cell = ?

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Define: The stepping-stone loop.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Define: Hungarian reduction.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Define: The minimum lines test.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Define: Maximising an allocation.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Define: Capacity of a cut.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

The number of cells a solution to an m by n transportation problem must use, which is exactly enough to fix the shadow costs. Fewer means degeneracy, fixed by recording a zero allocation.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Fill the top-left cell as far as supply and demand allow, cross off whichever runs out, repeat. It never looks at a cost, so the plan is usually poor: its job is to be feasible, not good.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

From the entering cell, trace a closed route through cells in use, alternating plus and minus. The value moved is the smallest minus-cell allocation, that cell exits, and the cost falls by that value times the index.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

STANDARD RESULT

cost - R - K, where $R + K$ = cost at every cell in use

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

If the fewest horizontal and vertical lines covering every zero equals the matrix size, an allocation of zeros exists. If fewer, subtract the smallest uncovered entry from all uncovered ones and add it to every doubly covered one.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Subtract each row's minimum from that row, then each column's from that column. Every complete allocation loses the same total, so the cheapest one is unchanged and the zeros mark the bargains.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

The total capacity of the arcs directed from the source side to the sink side only. Arcs crossing back towards the source contribute nothing at all.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Subtract every entry from the largest entry in the matrix, then minimise as usual. The biggest profit becomes the smallest cost, so the allocation found is the one of greatest total.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

STANDARD RESULT

Max-flow min-cut theorem:

maximum flow = ?

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Define: Flow-augmenting path.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Define: Bellman's principle of optimality.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Define: Play safe and stable.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Define: Dominance.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Define: Solving a mixed game.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Define: Expected monetary value.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

SPOT THE ERROR

Say what is wrong with this claim:

The entering cell is the unused cell with the lowest cost in the table.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

A route from source to sink using spare capacity forwards or existing flow backwards. It carries the smallest of those numbers along it, and at least one arc becomes saturated.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

STANDARD RESULT

capacity of the minimum cut

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

The row player takes the row whose worst entry is best, the maximin; the column player takes the column whose largest is smallest, the minimax. The game is stable exactly when the two agree, and that number is its value.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Any part of an optimal path is itself optimal between its own two ends. That is what licenses working backwards from the final stage, quoting values already found.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

Play the first row with probability p , write the expected pay-off against each column as a line in p , and take the highest point of the lower boundary. Equate the two lines meeting there for p and the value.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

A row is dominated when another is at least as good in every column; a column is dominated when another is at least as small in every row. Dominated options are deleted outright, often reducing a game to a two by two.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

SPOT THE ERROR

It is the cell with the most negative improvement index. The index accounts for what the rest of the plan must change, which the raw cost ignores, so a cell can be cheapest in the table and still have a positive index.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

DEFINITION

A chance node takes the probability-weighted average of its branches, a decision node takes the best available, working back to the first decision. Costs come off along the branch where they are met.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

SPOT THE ERROR

Say what is wrong with this claim:

Once every route from source to sink contains a full arc, the flow is maximal.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

CHECK YOURSELF

Why might a firm reject the option with the highest expected monetary value?

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

CHECK YOURSELF

Expected monetary value is an average over many repetitions, and a one-off decision is not many repetitions. If the bad outcome would ruin the firm, a smaller certain gain is the better choice, which is what utility measures.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES

SPOT THE ERROR

An augmenting path may run backwards along an arc that already carries flow, freeing capacity elsewhere. Only the absence of any augmenting path settles it, proved by a cut of the same capacity as the flow.

DECISION MATHEMATICS 2: ALLOCATION, FLOW AND GAMES