INKMATHS FLASHCARDS

Decision Mathematics 1 algorithms and networks

15 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 inkphysics.co.uk/maths/flashcards.

DEFINITION

Define: Order of an algorithm.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

RECALL

State the bin packing lower bound.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

DEFINITION

Define: Eulerian and semi-Eulerian.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

DEFINITION

Define: Minimum spanning tree.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

RECALL

Explain how Prim and Kruskal differ.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

RECALL

State Dijkstra's rule.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

STANDARD RESULT

Route inspection:

shortest closed route = ?

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

RECALL

State the travelling salesman lower bound.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

RECALL

The total of the items divided by the bin size, rounded up. If an algorithm achieves it the packing is optimal; falling short proves nothing either way.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

DEFINITION

How the number of operations grows with the size n of the problem. An order n^2 algorithm takes four times as long on a list twice as long.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

DEFINITION

A set of edges joining all n nodes, using n - 1 edges and closing no cycle, of the least total weight any such set can have.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

DEFINITION

In a connected graph, no odd nodes means a closed trail exists using every edge once. Exactly two odd nodes means such a trail exists but has to start at one of them and finish at the other. More than two means neither.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

RECALL

Make permanent the smallest temporary label anywhere in the network, not the cheapest edge from where you are. Read the route back by starting at the destination and stepping to a neighbour whose label plus the edge weight equals the label you are on, repeating to the start. A matching edge on its own only says it lies on some shortest route to its higher-labelled end.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

RECALL

Prim grows one connected lump from a starting node, taking the cheapest edge out of what it already holds. Kruskal sorts every edge and works down the list, rejecting any edge that closes a cycle, so it builds separate fragments that join up late. Both reach the same total weight.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

RECALL

Delete a node, find a minimum spanning tree on what is left, then add back the two shortest edges from the deleted node. Any tour at all gives an upper bound.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

STANDARD RESULT

total weight + cheapest pairing of the odd nodes

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

DEFINITION

Define: Critical activity.

STANDARD RESULT

Total float:

float = ?

STANDARD RESULT

Lower bound on workers:

least workers = ?

DEFINITION

Define: Slack, surplus and artificial.

RECALL

State the Simplex rules.

SPOT THE ERROR

Say what is wrong with this claim:

The nearest neighbour algorithm gives the shortest tour.

CHECK YOURSELF

Why must the number of odd nodes in any graph be even?

STANDARD RESULT

latest finish - earliest start - duration

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

DEFINITION

One whose earliest and latest start times agree, so it has zero float. The critical activities form a continuous path whose durations total the project duration.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

DEFINITION

A ≤ constraint gains a slack variable; a ≥ constraint loses a surplus variable and then gains an artificial one so that a starting solution exists at all.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

STANDARD RESULT

total work ÷ project duration, rounded up

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

SPOT THE ERROR

It gives one valid tour, so it gives an upper bound and nothing stronger. Taking the cheapest edge available at each step forces an expensive jump back to the start at the end. Run it from every vertex and quote the smallest result, and still call it an upper bound.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

RECALL

Pivot on the most negative entry in the objective row, choosing the row by the smallest non-negative ratio of value to pivot-column entry. Stop when no negative entries remain.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS

CHECK YOURSELF

The orders total twice the number of edges, which is even. The even nodes contribute an even amount, so the odd ones must too, which needs an even number of them.

DECISION MATHEMATICS 1: ALGORITHMS AND NETWORKS