Decision Mathematics 1

Edexcel IAL D1 (WDM01/01); sorting, packing, spanning trees, shortest paths, route problems, CPA, LP

Show the method, not just the answer

Task	**Required form**
sorting	the list after each pass
bin packing	the algorithm named, each placement
graph algorithms	the order chosen, final values
route inspection	odd nodes and pairings, then the total
linear programming	variables, objective, every constraint

Quick sort: middle pivot

Quote the pivot and the list after each pass.

- Pivot: the middle item.
- Keep each sublist in order.

Bin packing

First-fit and first-fit decreasing both use 3 bins here.

- Total 27: at least 3 bins.
- Name the algorithm.

Kruskal: cheapest edge, no cycles

MST total 6

- Kruskal: edge by edge.
- Prim: vertex by vertex.

Dijkstra's labels

A to D: 8, by A–C–B–D

- Smallest temporary label becomes permanent.
- Trace back from the end.

Route inspection

$15 + 3 = 18$

- Every edge at least once.
- Pair the odd vertices.

Bounding the travelling salesman

$14 \leq$ optimal tour ≤ 17

- Every vertex exactly once.
- Complete network of shortest distances.

The critical path

A–C–E: 12 days

- Forward pass: the max of arrivals.
- Backward pass: the min of departures.

Floats on a cascade chart

D's **total float**: $12 - (4 + 1 + 5) = 2$ days

- Float = latest finish − earliest start − duration.
- Critical: zero float.

The feasible region

$P_{\max} = 24$ at $(4, 6)$

- Maximise $P = 3x + 2y$.
- $x + y \leq 10$, $2x + y \leq 14$, $x, y \geq 0$.

Worked: the vertex method

1. **Vertices** $(0,0)$, $(7,0)$, $(4,6)$, $(0,10)$
2. **Corner** $x+y=10$ and $2x+y=14$: $x=4$, $y=6$
3. **Evaluate** $P=0,\ 21,\ 24,\ 20$

Decision

Maximum $P=24$ at $(4,6)$

Check yourself

Question	**Answer**
Quick sort's pivot?	the middle item
Kruskal rejects an edge when?	it makes a cycle
Postman: what is duplicated?	the least pairing of odd nodes
TSP lower bound?	delete a vertex, MST + two cheapest
Critical activities?	zero **total float**