InkMaths

QUESTION WORKBOOK

Minimum spanning trees: Prim and Kruskal

Decision Mathematics 1 · Year FM

6 questions · 22 marks

NAVY SCREEN EDITION

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SECTION A · Warm-up

A1 Define a minimum spanning tree and state how many edges it has for a network of n nodes. [2]

A2 Describe Prim's algorithm and Kruskal's algorithm in one sentence each, and say what they have in common. [3]

SECTION B · Standard

B1 A network has nodes A to F and arcs AB 3, AC 5, BC 4, BD 8, BE 13, CD 9, CE 11, DE 7, DF 12, EF 6. Apply Prim's algorithm starting from A, listing the arcs in the order you add them, and state the weight of the tree. [4]

B2 A network has nodes A to F and arcs AB 3, AC 5, BC 4, BD 8, BE 13, CD 9, CE 11, DE 7, DF 12, EF 6. Apply Kruskal's algorithm, stating clearly any arc you reject and the reason. [4]

B3 Give one reason for choosing Prim's algorithm rather than Kruskal's when a network is given as a distance matrix. [2]

SECTION C · Stretch

C1 Six sites A to F are to be linked by cable. The cost matrix is symmetric, with row A reading -, 17, 23, 15, 30, 25; row B reading 17, -, 19, 28, 16, 33; row C reading 23, 19, -, 21, 27, 14; row D reading 15, 28, 21, -, 24, 20; row E reading 30, 16, 27, 24, -, 18; and row F reading 25, 33, 14, 20, 18, -. Apply Prim's algorithm from A, giving the order in which the sites join and the least total cost. The link BE then becomes unavailable. Find the least total cost of connecting the six sites without it. [7]