4.2 Decision Maths: Graphs, Trees and Minimum Spanning Trees: 10-minute Pack

Calculator allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 The table below represents a network of possible cable routes, with distances in km, between four substations K, L, M, N (a dash indicates no direct route).

	K	L	M	N
K	-	6	-	9
L	6	-	5	7
M	-	5	-	4
N	9	7	4	-

(a) Use Kruskal's algorithm to find a minimum spanning tree for the network represented by the matrix above, showing the edges in the order considered. **(4)**

(b) State the two edges of the network that were not required in the minimum spanning tree, and explain why neither could reduce the total weight if used instead of an edge already chosen. **(2)**

(Total for Question 1 is 6 marks)

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Mark scheme · 4.2 Decision Maths: Graphs, Trees and Minimum Spanning Trees: 10-minute Pack

Question 1

(a) edges from the matrix correctly listed: KL=6, KN=9, LM=5, LN=7, MN=4 **M1**

(a) edges sorted into ascending order: MN(4), LM(5), KL(6), LN(7), KN(9) **M1**

(a) MN, LM, KL correctly accepted in order; LN and KN correctly rejected as each would form a cycle **A1**

(a) total weight = 15 (km) cao **A1**

(a) Answer: Minimum spanning tree = {KL, LM, MN}, weight 15 km.

(b) LN(7) and KN(9) correctly identified as the two edges not required **B1**

(b) LN(7) exceeds both edges on L-M-N (5,4); KN(9) exceeds every edge on K-L-M-N (6,5,4). To retain a spanning tree after adding either edge, remove an edge on its resulting cycle. Every valid replacement therefore increases the total weight, so neither can reduce it (oe). **B1**

(b) Answer: LN(7) and KN(9) are not required.

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