Floyd's algorithm

Answers

Further Maths topic practice

This topic online

Q	Answer	Marks
1	**a)** Distance rows: A - 6 9 ∞; B 6 - 2 11; C 9 2 - ∞; D ∞ 11 4 -. Route table: every entry in column X is X **b)** Iteration 1 goes via A; the only routes through A are B-A-C (15 > 2) and C-A-B (15 > 2), and D cannot reach A directly, so nothing is shorter	4
2	BD becomes 8, CB becomes 7, CD becomes 5, DB becomes 8, each with route entry A	3
3	**a)** ABCE, 15 miles **b)** ECD, 10 miles	4
4	**a)** Final distance table: A - 5 3 11; B 5 - 2 6; C 3 2 - 8; D 4 9 7 -. Final route table: A A C C C; B C B C D; C A B C B; D A C A D **b)** DACB, 9 minutes	9
5	**a)** Iteration 3 (C): AE = 12, BE = 8 (route C). Iteration 4 (D): EA = 11, EB = 9 (route D). Iteration 5 (E): CD = 7, DC = 7 (route E) **b)** CED, 7 minutes	7
6	**a)** AB with weight 12 and an arrow from A to B; AC with weight 6, no arrow; DA with weight 7 and an arrow from D to A **b)** Iteration 1: DB becomes 19, route A. Iteration 2: AE becomes 20, route B	6
7	**a)** Dijkstra finds the shortest distance (and route) from one vertex to every other vertex; Floyd finds the shortest distance (and route) between every pair of vertices **b)** For an entry in row k the new value would be d(k,k) + d(k,j) = 0 + d(k,j), which equals the current entry and is not smaller; similarly for column k **c)** 37.5 seconds	5
8	**a)** Distance rows: A - 9 4 14 ∞; B 9 - ∞ 3 10; C 4 ∞ - 7 13; D ∞ 3 7 - ∞; E ∞ ∞ 13 2 -. Route table: every entry in column X is X **b)** Iteration 1 (A): BC = 13, CB = 13. Iteration 2 (B): AD = 12, AE = 19, DA = 12, DE = 13	6
9	**a)** Row A column C: D; row C column A: B; row D column A: E; row E column B: A **b)** EDC, 8 minutes	6
10	**a)** Some roads are one-way (e.g. A to C is a direct one-way road), so the quickest route from C back to A must use different roads: 21 minutes against 9 **b)** C, longest return journey 36 minutes **c)** C to F is CDF, F to C is FBC: CDFBC, 36 minutes	8

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11	**a)** D first then E: 39 minutes (the other order takes 47) **b)** A F D E F A **c)** The quickest route from A to D goes via F and the quickest route from E back to A also goes via F; the tables give the best route for each stage separately	8
12	**a)** Distance rows: A - 10 6 ∞ ∞; B 10 - 3 12 ∞; C ∞ 3 - 5 14; D ∞ 12 ∞ - 4; E 8 ∞ 14 4 -. Route table: every entry in column X is X **b)** Iteration 1 (A): EB = 18. Iteration 2 (B): AD = 22, CA = 13, DA = 22, DC = 15. Iteration 3 (C): AB = 9, AD = 11, AE = 20, BD = 8, BE = 17, EB = 17 **c)** A to E: ACDE, 15 minutes; E to B: EDB, 16 minutes **d)** Walking time less than 12 minutes	12

Full worked solutions, written out by hand, are on the solutions sheet for this topic.

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