

Route Logic Lab

Find the least-cost path through each graph.

HIGH SCHOOL • MA.912.LT.2.2

MA.912.LT.2.2 "Solve problems involving paths in graphs."

NAME _____

DATE _____

CHOOSE THE SHORTEST PATH

A path is a route that follows connected edges from a start vertex to an end vertex. For a weighted graph, add the weights along each possible path, then choose the path with the smallest total.

WORKED EXAMPLE

All edges are bidirectional. Find the shortest path from A to D: A-B = 14, B-D = 9, A-C = 7, C-D = 12, B-C = 6.

1. Add A-B-D: $14 + 9 = 23$.
2. Add A-C-D: $7 + 12 = 19$.
3. Add A-B-C-D: $14 + 6 + 12 = 32$, and A-C-B-D: $7 + 6 + 9 = 22$.
4. Compare the totals. The smallest total is 19.

Answer: A-C-D, with a total weight of 19

PRACTICE 6 problems

- 1** All edges are bidirectional. Find the shortest path from P to S: P-Q = 3, Q-S = 10, P-R = 8, R-S = 5, Q-R = 2.

ANSWER _____

- 2** All edges are bidirectional. Find the shortest path from X to W: X-Y = 15, Y-W = 3, X-Z = 4, Z-W = 16, Y-Z = 8.

ANSWER _____

- 3** All edges are bidirectional. Find the shortest path from M to T: M-N = 2, N-T = 18, M-O = 10, O-T = 8, N-O = 11.

ANSWER _____

- 4** All edges are bidirectional. Travel from A to E and pass through C. Find the shortest path: A-B = 17, B-C = 1, A-C = 13, C-D = 19, D-E = 2, C-E = 8.

ANSWER _____

- 5** All edges are bidirectional. Find the shortest path from G to J: G-H = 8, H-J = 16, G-I = 13, I-J = 4, H-I = 3.

ANSWER _____

- 6** All edges are bidirectional. Find the shortest path from A to F: A-B = 5, B-F = 17, A-C = 10, C-F = 4, B-C = 2.

ANSWER _____

APPLY IT Show your work

- 1** At a gaming tournament, Maya wants to walk from the lobby, L, to the arena, A. The hallways are bidirectional: L-R = 4 minutes, R-A = 11 minutes, L-S = 10 minutes, S-A = 5 minutes, and R-S = 2 minutes. Which route takes the fewest minutes, and how long does it take?

WORK SPACE

ANSWER _____

- 2** A student journalist must travel from the school studio, S, to the interview room, I, and must stop at the media lab, M. The hallways are bidirectional: S-H = 8, H-M = 4, S-M = 15, M-C = 3, C-I = 10, and M-I = 16. Find the shortest route that includes M.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

All edges are bidirectional. Find every shortest path from A to F: A-B = 2, A-C = 4, B-D = 5, C-D = 3, B-E = 8, C-E = 8, D-F = 8, E-F = 5. List all shortest paths and their common total weight.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	All edges are bidirectional. Find the shortest path from P to S: $P-Q = 3$, $Q-S = 10$, $P-R = 8$, $R-S = 5$, $Q-R = 2$.	P-Q-R-S, with a total weight of 10
2	All edges are bidirectional. Find the shortest path from X to W: $X-Y = 15$, $Y-W = 3$, $X-Z = 4$, $Z-W = 16$, $Y-Z = 8$.	X-Z-Y-W, with a total weight of 15
3	All edges are bidirectional. Find the shortest path from M to T: $M-N = 2$, $N-T = 18$, $M-O = 10$, $O-T = 8$, $N-O = 11$.	M-O-T, with a total weight of 18
4	All edges are bidirectional. Travel from A to E and pass through C. Find the shortest path: $A-B = 17$, $B-C = 1$, $A-C = 13$, $C-D = 19$, $D-E = 2$, $C-E = 8$.	A-C-E, with a total weight of 21
5	All edges are bidirectional. Find the shortest path from G to J: $G-H = 8$, $H-J = 16$, $G-I = 13$, $I-J = 4$, $H-I = 3$.	G-H-I-J, with a total weight of 15
6	All edges are bidirectional. Find the shortest path from A to F: $A-B = 5$, $B-F = 17$, $A-C = 10$, $C-F = 4$, $B-C = 2$.	A-B-C-F, with a total weight of 11

PART 2 • APPLY IT

- L-R-S-A, 11 minutes** Compare the possible routes from L to A. L-R-S-A has a total of $4 + 2 + 5 = 11$ minutes, which is the least.
- S-H-M-C-I, with a total weight of 25** The shortest way to reach M is S-H-M, with weight 12. From M, going through C to I adds 13, for a total of 25.

CHALLENGE

A-B-D-F, A-C-D-F, and A-B-E-F. Each has a total weight of 15.

Accept equivalent path notation, such as A to B to D to F. For the challenge, students must list all three shortest paths and state the common total.