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Discrete Mathematics
Project 3 | Optimization

1)

A B C D A	B A C D B	C A B D C	D A B C D
A B D C A	B A D C B	C A D B C	D A C B D
A C B D A	B C A D B	C D B A C	D B A C D
A C D B A	B C D A B	C D A B C	D B C A D
A D C B A	B D C A B	C B A D C	D C A B D
A D B C A	B D A C B	C B D A C	D C B A D

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2)

A	B	C	D
83	85	85	83
85	83	**80**	**80**
80	**80**	85	85
85	83	83	**80**
83	85	83	85
80	**80**	**80**	83

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3)

If starting from **A**: (A, C, B, D, A) *or* (A, D, B, C, A)
If starting from **B**: (B, C. A, D, B) *or* (B, D, A, C, B)
If starting from **C**: (C, A, D, B, C) *or* (C, B, D, A, C)
If starting from **D**: (D, A, C, B, D) *or* (D, B, C, A, D)
      These are all the same length (80)

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4)

It took so many steps because each node has six different paths. You have to find these paths and, one by one, carefully calculate the total distance. Then, after finding all this, you can compare them to find the optimal path.

It would take a very long time to find the optimal path of something with 20 nodes or more with this brute force method. The process would be the same-- start by finding all the paths for one of the nodes before continuing on. There would be the same amount of paths per node, however you would still need to find each individual path's distance, so there wouldn't be much of a shortcut using the brute force method.

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5)

One method to finding a short path is to choose a starting point and choose the shortest path of the options to travel until all the options were visited. This would still take a while, but unlike the brute force method, you would only need to choose one optimal path per node. Then you could choose the shortest path from the results.

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6)

The path would start at (A,A) and end at (G,G) to traverse the table.

I used the heuristic method I tried up above and determined this to be the shortest path from start to end:

(A,A) → (A,B) → (B,B) → (C,B) → (C,C) → (C,D) → (D,D) → (E,D) → (E,E) → (F,E) → (F,F) → (G,F) → (G,G)

It was 13 nodes total and it added up to 68.

	A	B	C	D	E	F	G
A	0	12	32	24	9	21	17
B	12	0	10	14	30	2	20
C	32	10	0	5	12	10	16
D	24	14	5	0	22	31	4
E	9	30	12	22	0	12	24
F	21	2	10	31	12	0	7
G	17	20	16	4	24	7	0