CS 610- Data Structure & Algorithm

Section- 850

Programming Assingment-3

BY-

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This program is based on the Dijkstra’s algorithm. The goal is to find the shortest path between two nodes.

Here in this program the nodes are referred by using airports name and undirected edges as distance between the airports. The program takes input as number of number of airports, source node, destination node and the distances between the airports. The data is stored in 2D array with function setBaseArray() which makes all the entries as 99999 which is considered as very high number of the distances between airports. Also, the diagonal entries are set to 0 as the distance of an airport from itself would be 0. For the entries of the airports with the distances between, the program uses array named airport of size=number of airports, passed in the beginning. This array stores airport names as the entries comes in each time with a new airport name. Simultaneously, for the positions which are assigned to the airports are used to change the values in 2-D array. Now another 2D array named airIteration stores each entry of the iteration for the Dijkstra algorithm with the Iteration() function. Further the program outputs the shortest distance and shortest path between the source and destination.

The program also outputs the 2D array and the iteration in the outputs of the Dijkstra algorithm.

To run the program run the compile command

- **javac Dijkstra.java**

Then execute command

- **java Dijkstra**

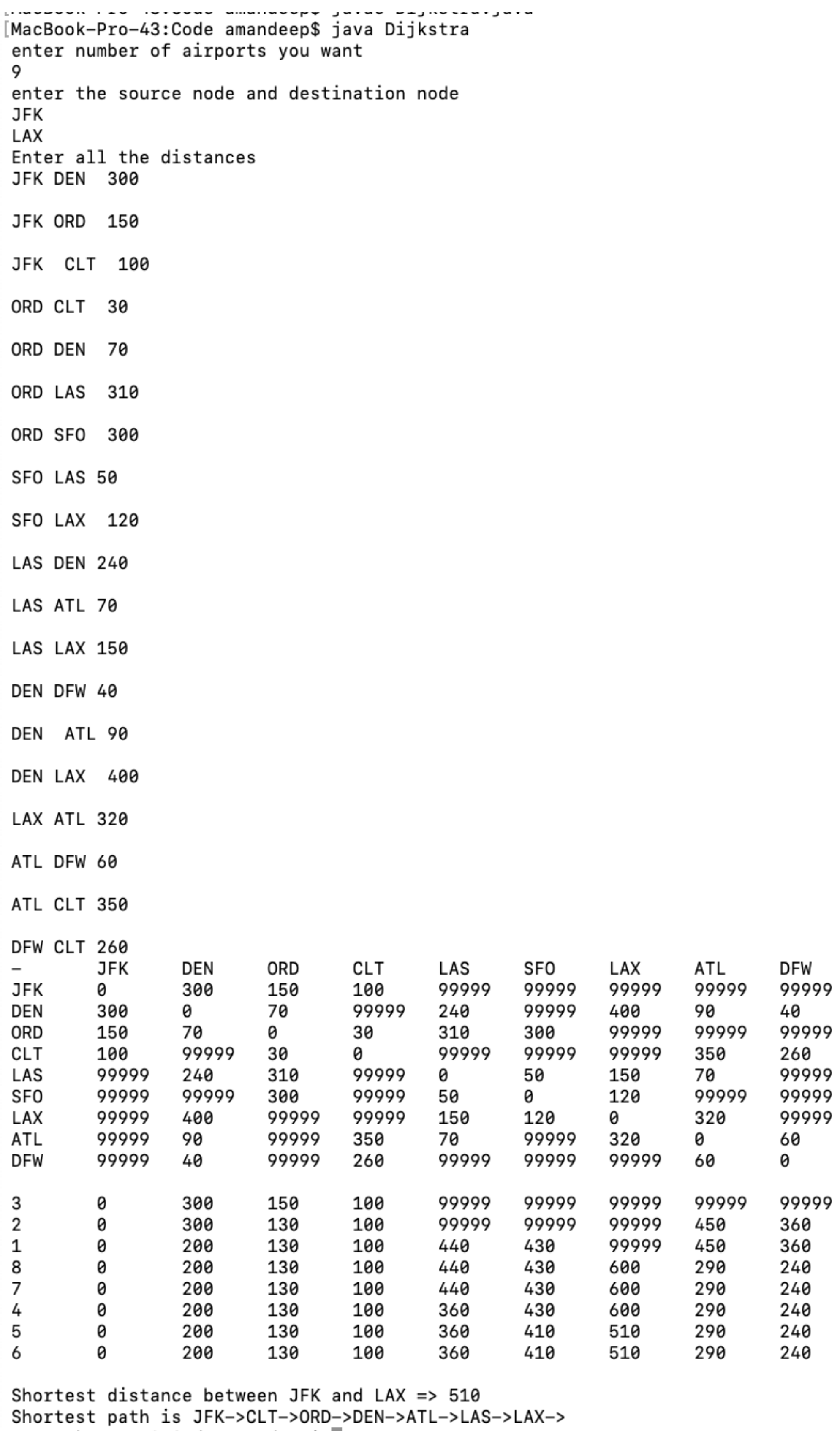
Give the inputs as requested.

Also, I have assumed that we know the number of data entries for distance between airports beforehand by which the while loop in the main function runs. It can be changed as with different number of outputs or if user can specify how many entries will be made or by passing a character to break the while loop. That is in line number 153 in the code where k is compared with 19 in the while loop. In case for testing, for different number of entries replace 19 in the while loop with the number of entries.

From the next page we have different sets of input to see how program runs in different situations –

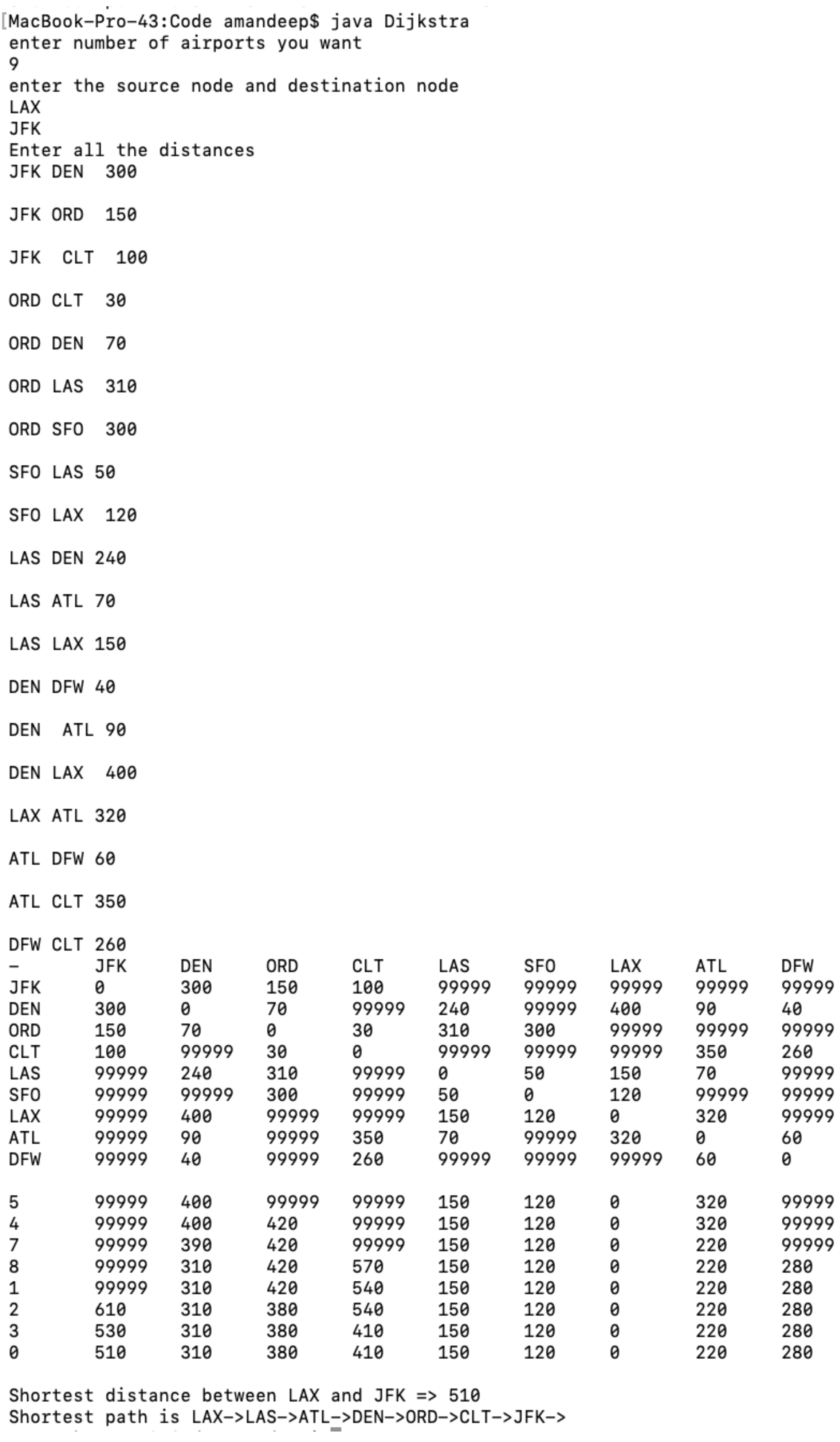
In all the different test of outputs the distances between the airport have been kept same. The changing field in all of them is source and destination airports.

1.



```
MacBook-Pro-43:Code amandeep$ javac Dijkstra.java
MacBook-Pro-43:Code amandeep$ java Dijkstra
enter number of airports you want
9
enter the source node and destination node
JFK
LAX
Enter all the distances
JFK DEN  300

JFK ORD  150

JFK  CLT  100

ORD CLT  30

ORD DEN  70

ORD LAS  310

ORD SFO  300

SFO LAS 50

SFO LAX  120

LAS DEN 240

LAS ATL 70

LAS LAX 150

DEN DFW 40

DEN  ATL 90

DEN LAX  400

LAX ATL 320

ATL DFW 60

ATL CLT 350

DFW CLT 260
-       JFK     DEN     ORD     CLT     LAS     SFO     LAX     ATL     DFW
JFK     0       300     150     100     99999   99999   99999   99999   99999
DEN     300     0       70      99999   240     99999   400     90      40
ORD     150     70      0       30      310     300     99999   99999   99999
CLT     100     99999   30      0       99999   99999   99999   350     260
LAS     99999   240     310     99999   0       50      150     70      99999
SFO     99999   99999   300     99999   50      0       120     99999   99999
LAX     99999   400     99999   99999   150     120     0       320     99999
ATL     99999   90      99999   350     70      99999   320     0       60
DFW     99999   40      99999   260     99999   99999   99999   60      0

3       0       300     150     100     99999   99999   99999   99999   99999
2       0       300     130     100     99999   99999   99999   450     360
1       0       200     130     100     440     430     99999   450     360
8       0       200     130     100     440     430     600     290     240
7       0       200     130     100     440     430     600     290     240
4       0       200     130     100     360     430     600     290     240
5       0       200     130     100     360     410     510     290     240
6       0       200     130     100     360     410     510     290     240

Shortest distance between JFK and LAX => 510
Shortest path is JFK->CLT->ORD->DEN->ATL->LAS->LAX->
```

2.



```
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SFO LAS 50

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LAS DEN 240

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LAS LAX 150

DEN DFW 40

DEN  ATL 90

DEN LAX  400

LAX ATL 320

ATL DFW 60

ATL CLT 350

DFW CLT 260
-       JFK     DEN     ORD     CLT     LAS     SFO     LAX     ATL     DFW
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DEN     300     0       70      99999   240     99999   400     90      40
ORD     150     70      0       30      310     300     99999   99999   99999
CLT     100     99999   30      0       99999   99999   99999   350     260
LAS     99999   240     310     99999   0       50      150     70      99999
SFO     99999   99999   300     99999   50      0       120     99999   99999
LAX     99999   400     99999   99999   150     120     0       320     99999
ATL     99999   90      99999   350     70      99999   320     0       60
DFW     99999   40      99999   260     99999   99999   99999   60      0

5       99999   400     99999   99999   150     120     0       320     99999
4       99999   400     420     99999   150     120     0       320     99999
7       99999   390     420     99999   150     120     0       220     99999
8       99999   310     420     570     150     120     0       220     280
1       99999   310     420     540     150     120     0       220     280
2       610     310     380     540     150     120     0       220     280
3       530     310     380     410     150     120     0       220     280
0       510     310     380     410     150     120     0       220     280

Shortest distance between LAX and JFK => 510
Shortest path is LAX->LAS->ATL->DEN->ORD->CLT->JFK->
```
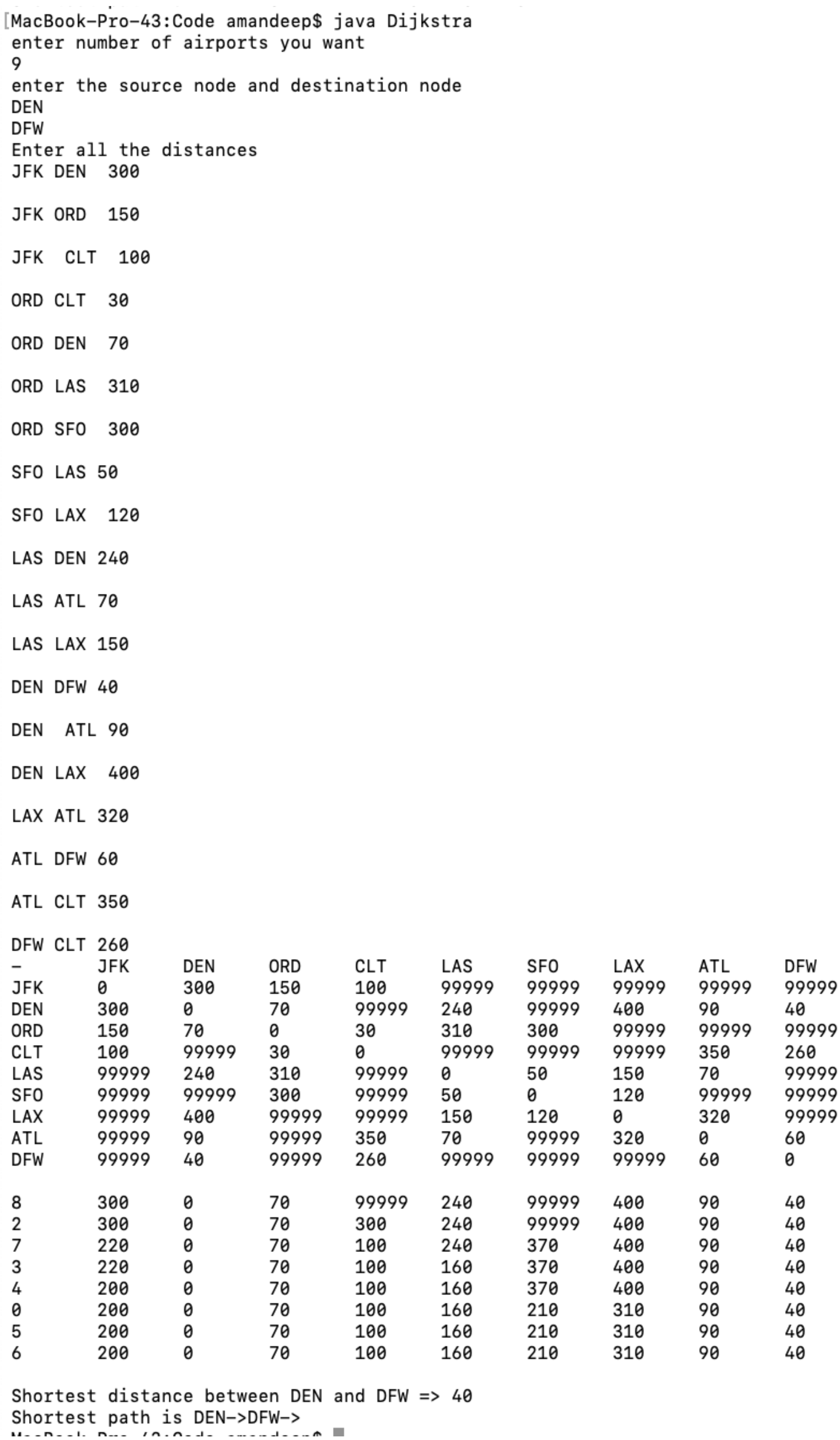

3.



```
[MacBook-Pro-43:Code amandeep$ java Dijkstra
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DFW
Enter all the distances
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ORD LAS  310

ORD SFO  300

SFO LAS 50

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LAS DEN 240

LAS ATL 70

LAS LAX 150

DEN DFW 40

DEN  ATL 90

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LAX ATL 320

ATL DFW 60

ATL CLT 350

DFW CLT 260
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DEN     300     0       70      99999   240     99999   400     90      40
ORD     150     70      0       30      310     300     99999   99999   99999
CLT     100     99999   30      0       99999   99999   99999   350     260
LAS     99999   240     310     99999   0       50      150     70      99999
SFO     99999   99999   300     99999   50      0       120     99999   99999
LAX     99999   400     99999   99999   150     120     0       320     99999
ATL     99999   90      99999   350     70      99999   320     0       60
DFW     99999   40      99999   260     99999   99999   99999   60      0

8       300     0       70      99999   240     99999   400     90      40
2       300     0       70      300     240     99999   400     90      40
7       220     0       70      100     240     370     400     90      40
3       220     0       70      100     160     370     400     90      40
4       200     0       70      100     160     370     400     90      40
0       200     0       70      100     160     210     310     90      40
5       200     0       70      100     160     210     310     90      40
6       200     0       70      100     160     210     310     90      40

Shortest distance between DEN and DFW => 40
Shortest path is DEN->DFW->
MacBook-Pro-43:Code amandeep$ ▮
```
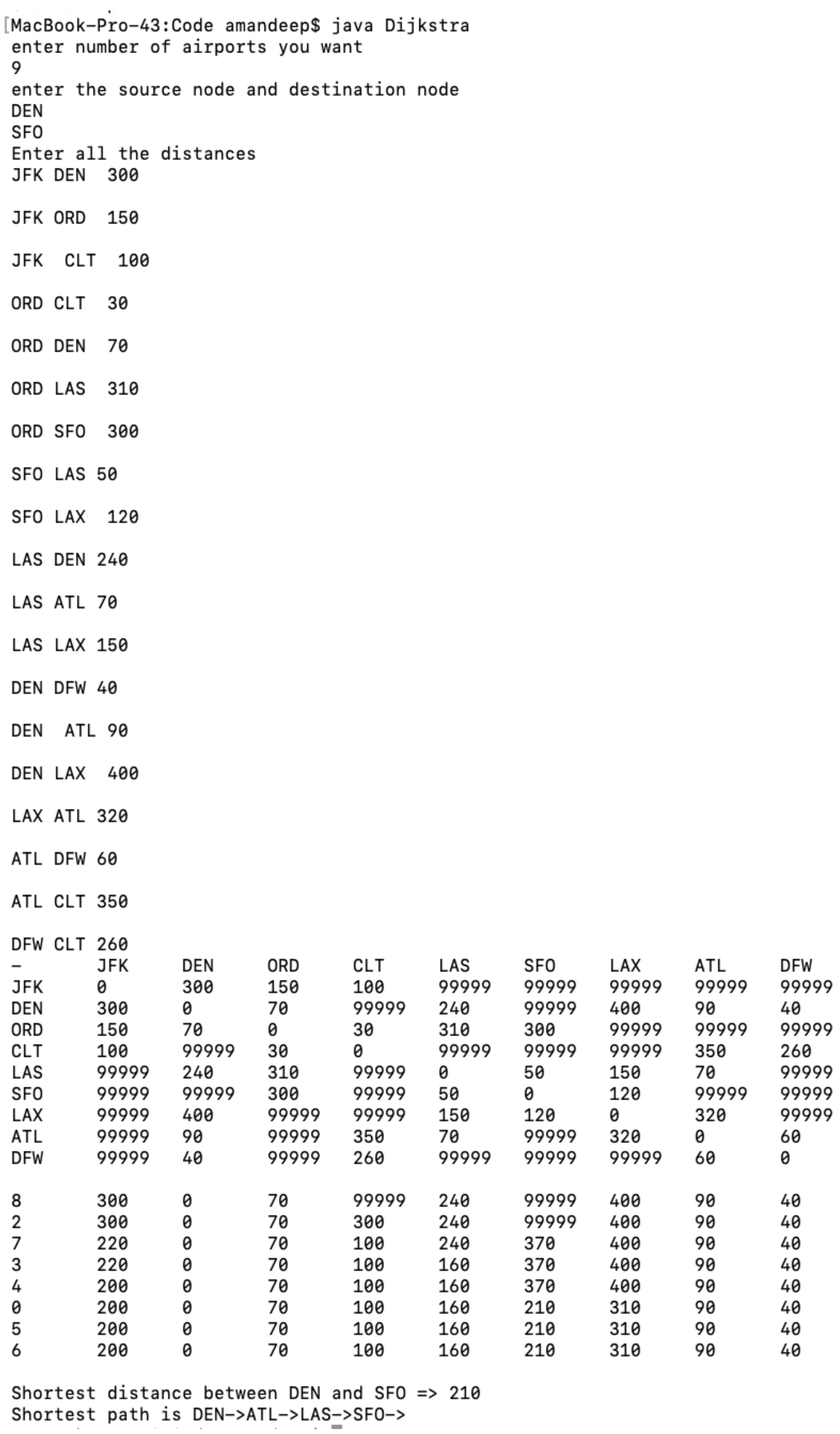

4.



```
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 ORD SFO  300

 SFO LAS 50

 SFO LAX  120

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 LAS ATL 70

 LAS LAX 150

 DEN DFW 40

 DEN  ATL 90

 DEN LAX  400

 LAX ATL 320

 ATL DFW 60

 ATL CLT 350

 DFW CLT 260
 -       JFK     DEN     ORD     CLT     LAS     SFO     LAX     ATL     DFW
 JFK     0       300     150     100     99999   99999   99999   99999   99999
 DEN     300     0       70      99999   240     99999   400     90      40
 ORD     150     70      0       30      310     300     99999   99999   99999
 CLT     100     99999   30      0       99999   99999   99999   350     260
 LAS     99999   240     310     99999   0       50      150     70      99999
 SFO     99999   99999   300     99999   50      0       120     99999   99999
 LAX     99999   400     99999   99999   150     120     0       320     99999
 ATL     99999   90      99999   350     70      99999   320     0       60
 DFW     99999   40      99999   260     99999   99999   99999   60      0

 8       300     0       70      99999   240     99999   400     90      40
 2       300     0       70      300     240     99999   400     90      40
 7       220     0       70      100     240     370     400     90      40
 3       220     0       70      100     160     370     400     90      40
 4       200     0       70      100     160     370     400     90      40
 0       200     0       70      100     160     210     310     90      40
 5       200     0       70      100     160     210     310     90      40
 6       200     0       70      100     160     210     310     90      40

 Shortest distance between DEN and SFO => 210
 Shortest path is DEN->ATL->LAS->SFO->
```