Dijkstra algorithm & TSP

The structure of my report:

1. Introduction
2. Dijkstra algorithm
3. TSP

1. Introduction

At the beginning I want to explain our task which we have edited.
Our task was to find out for a logistics company which wants to send packages via drones, the shortest route.
The first problem was to plan the shortest route through a certain set of stations, where not all stations have to be reached. This problem can be solved with the “Dijkstra-algorithm“. Mentioned below the cities and distances (page 2 ff.).
Our starting point is the city Estepona (E) and our final destination is Västeras (A), because it is the farthest city from Estepona. It takes 3,005 km.

The second problem is called the “travelling salesman problem (TSP)“ which requires that all ehe delivering stations have to be reached in one tour. The challenge is to find out ehe shortest route which includes all stations (page 4 ff.).

	(A) Västerås	**(B) Blagnac**	**(C) Kassel**	**(D) Athens**	**(E) Estepona**
(A) Västerås	-				
(B) Blagnac	2,047 km	-			
(C) Kassel	1,020 km	1,013 km	-		
(D) Athens	2,455 km	1,916 km	1,839 km	-	
(E) Estepona	3,005 km	973 km	2,001 km	2,545 km	-

Yellow = Starting Node

Red = Ending Node

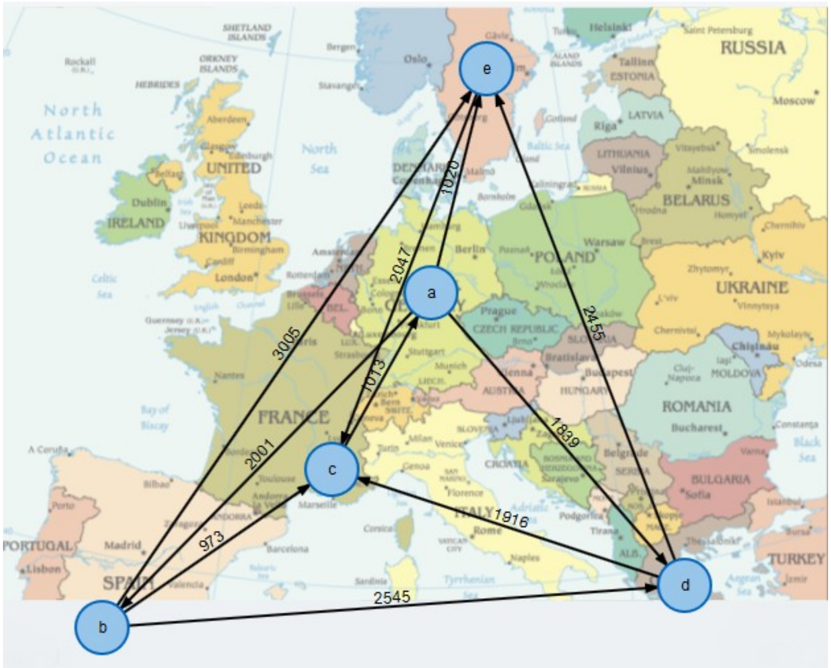
2. Dijkstra's algorithm

Following i want to explain the Dijkstra's algorithm.
The Dijkstra's algorithm is an iterative algorithm that finds the shortest path between two given nodes in a weighted graph.
It was invented by Edsger Wybe Dijkstra.
The Dijkstra algorithm finds the shortest path between the starting node and your ending node.
It does not work on graphs with negative
In our example we will find out the shortest way from the starting node (Estepona) to the ending node (Västerås). We compared the distances from node b to e (pic. 1).
Let’s start with the first path.
We start in Estepona and go to Blagnac.
The distance is 973 km. After that we go to Kassel. The distance is now 1986 km. After that we reach Västerås. The whole distance amounts 3006 km.
Now we will continue with the second way. Like before we travel to Blagnac but now we go directly to Västerås. The distance is 3020 km which is longer than the other way. The last way which is the shortest one is to go directly to Västerås. The distance is 3005 km. We found the shortest path to Västerås.

Dijkstra Algorithm – example (see table 1)

b > c > a > e = 3006 km
b > c > e = 3020 km
b > e = 3005 km

picture 1



a = Kassel

b = Estepona

c = Blagnac

d = Athens

e = Västerås

Dijkstra Algorithmus calculation from distances of some cities (see picture 1)

1. E > V = 3005 km
2. E > B > K > V = 3006 km
3. E > A > V = 5000 km
4. E > K > V = 3021 km
5. E > B > V = 3020 km

3. TSP = Travelling salesman problem

The travelling salesman problem is a problem of operations research, where the optimal order of locations is to be detemined where the total costs and times are minimum.
The travelling salesman problem is one of the best optimisation program.

The task is to select a tour for the visit of several locations in such a way that the entire travel route of the business traveller is as short as possible and the first stop is the same as the last stop. Ideally you solve the problem with an algorithm but it isn't that easy, so we decided to solve it by calculation every possible way.
There are 24 possible opportunities but it didn't took that long to calculate all.
If you have more than eight Cities for example, it would take several hours to calculate every possible opportunity.

Let's go on with an algorithm to solve our Problem: The nearest neighbour.
The task of the nearest neighbour is to calculate the shortest distance between several Cities in the TSP. First of all you have to select your start point (Estepona). If you have taken this point, you have to select the shortest distance to another City (the nearest possible neighbour of the start point). If you have done this, you have to choose the shortest distance to another City, which is not your last point.
After that you select the shortest distance to another City, which was not your last point and your take-off point. If you are done with all your Cities you go back to your start point in our Situation its Estepona. That's your shortest possible Route between all Cities.

The Table below shows all possible routes, that we have calculated with the TSP.

The Yellow marked are the two shortest possible ways.

TSP – All possible ways

1. E > K > V > B > A > E = 9529
2. E > K > B > A > V > E = 10480
3. E > K > B > V > A > E = 9003
4. E > K > V > A > B > E = 8365
5. E > K > A > B > V > E = 10808
6. E > K > A > V > B > E = 9315
7. E > V > K > B > A > E = 9499
8. E > V > K > A > B > E = 8753
9. E > V > A > B > K > E = 10480
10. E > V > A > K > B > E = 9285
11. E > V > B > A > K > E = 10808
12. E > V > B > K > A > E = 10449
13. E > A > B > V > K > E = 9529
14. E > A > B > K > V > E = 9449
15. E > A > K > V > B > E = 8424
16. E > A > V > K > B > E = 8006
17. E > A > V > B > K > E = 9003
18. E > A > K > B > V > E = 10449
19. E > B > V > K > A > E = 8424
20. E > B > A > V > K > E = 8365
21. E > B > V > A > K > E = 9315
22. E > B > A > K > V > E = 8753
23. E > B > K > A > V > E = 9258
24. E > B > K > V > A > E = 8006

(V) Västerås	**(B) Blagnac**	**(K) Kassel**	**(A) Athens**	**(E) Estepona**