Artificial Intelligence
Assignment I
Report

Lobna ElHawary
900160270

**note: That the number of nodes visited includes the root and end goal*

A.

- **BFS**

```
-----------------------------------------------
1
Please enter the starting city
Paris

Please enter the ending city
Vienna




----------------- PATH ----------------------

the path is
Paris Genoa Trieste Vienna and it costs 1307

----------------- VISITED -------------------

The number of visited nodes are 13

-----------------------------------------------
```

- **UCS**

```
-----------------------------------------------
5
Please enter the starting city
Paris

Please enter the ending city
Vienna




------------------ PATH -------------------

The path costs 1195 and is
Paris Brussels Amsterdam Munich Vienna

------------------ VISITED ----------------

The number of visited nodes are 15

-------------------------------------------
```

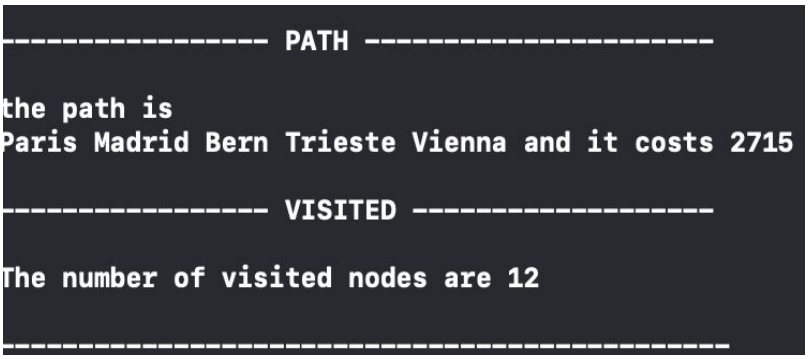
- **Greedy**

```
4
Please enter the starting city
Paris

Please enter the ending city
Vienna
Please enter the heuristic's factor
1


---------------- PATH --------------------

The path costs 1307 and is
Paris Genoa Trieste Vienna

---------------- VISITED -----------------

The number of visited nodes are 4

------------------------------------------
```

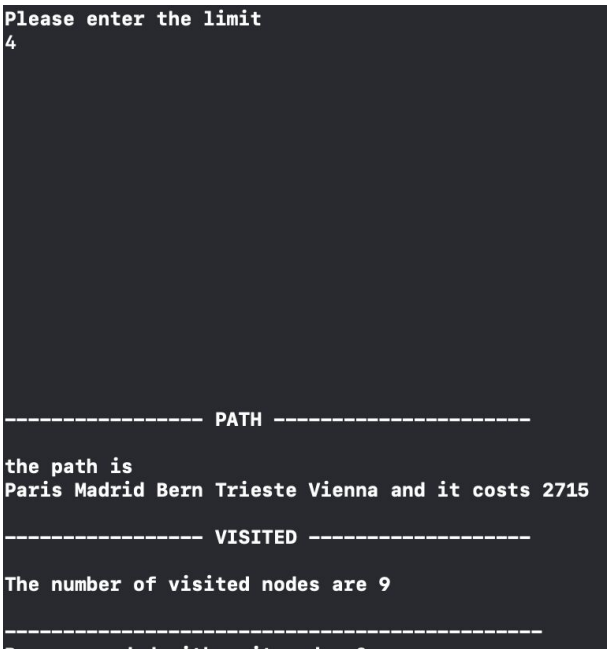
- **AStar**

```
------------------------------------
6
Please enter the starting city
Paris

Please enter the ending city
Vienna
Please enter the heuristic's factor
1



----------------- PATH ----------------

The path costs 1195 and is
Paris Brussels Amsterdam Munich Vienna

----------------- VISITED -------------

The number of visited nodes are 9

------------------------------------
```

- **DFS**


---------- PATH ----------
the path is
Paris Madrid Bern Trieste Vienna and it costs 2715
---------- VISITED ----------
The number of visited nodes are 12

- **IDS**


Please enter the limit
4
---------- PATH ----------
the path is
Paris Madrid Bern Trieste Vienna and it costs 2715
---------- VISITED ----------
The number of visited nodes are 9

- **Data Summary**

	BFS	USC	Greedy	Astar	DFS	IDS
Nodes	**13**	**15**	**4**	**9**	**12**	**9**
Cost	**1307**	**1195**	**1307**	**1195**	**2715**	**2715**

The order of the number of nodes generated was:
Greedy, Astar and IDS, DFS, BFS, USC

The order of cost in ascending order was:
BFS and Greedy, Astar and USC, and IDS and DFS

Remarks:

This shows us that the goal node from Paris to vienna was deeper and more to the left (since DFS created less nodes), but that the DFS was much more costly than the BFS

Also, we can conclude from this that the heuristic cost (h) (Greedy) was the most successful than the heuristic + the node's cost to reach from the start node (h+g) (Astar) in both cost and number of nodes

We also concluded that the IDS was better in terms of number of nodes generated (for the last level not in total) was less than that of DFS and was less expensive than DFS.

Additionally, out of USC, Greedy, Astar the order of better cost and less nodes visited were Greedy, Astar, USC.

B.

- **Breadth nodes < Depth nodes**
  Hamburg -> Vienna

  Breadth:

```
---------------- PATH ---------------------

the path is
Hamburg Amsterdam Munich Vienna and it costs 1144

----------------- VISITED ------------------

The number of visited nodes are 10

--------------------------------------------
```

  Depth:

```
----------------- PATH ---------------------

the path is
Hamburg Berlin Warsaw Vienna and it costs 991

----------------- VISITED ------------------

The number of visited nodes are 15

--------------------------------------------
```

- **Depth nodes < Breadth nodes**
  Vienna -> Madrid

  Breadth:

```
----------------- PATH ----------------------

the path is
Vienna Munich Bern Madrid and it costs 1695

----------------- VISITED -------------------

The number of visited nodes are 15

---------------------------------------------
```

  Depth:

```
----------------- PATH ----------------------

the path is
Vienna Trieste Genoa Madrid and it costs 1629

----------------- VISITED -------------------

The number of visited nodes are 7

---------------------------------------------
```

C.

I. Factor = 0.5

- **Greedy**

```
----------------------------------------
4
Please enter the starting city
Paris

Please enter the ending city
Vienna
Please enter the heuristic's factor
0.5




----------------- PATH -----------------

The path costs 1307 and is
Paris Genoa Trieste Vienna

---------------- VISITED ---------------

The number of visited nodes are 13
```

- **AStar**

```
----------------------------------------
6
Please enter the starting city
Paris

Please enter the ending city
Vienna
Please enter the heuristic's factor
0.5




----------------- PATH -----------------

The path costs 1195 and is
Paris Brussels Amsterdam Munich Vienna

---------------- VISITED ---------------

The number of visited nodes are 15

----------------------------------------
```

II. Factor = 1.0

- **Greedy**

```
----------------------------------------
4
Please enter the starting city
Paris

Please enter the ending city
Vienna
Please enter the heuristic's factor
1


----------------- PATH ----------------

The path costs 1307 and is
Paris Genoa Trieste Vienna

---------------- VISITED -------------

The number of visited nodes are 4

----------------------------------------
```

- **AStar**

```
6
Please enter the starting city
Paris

Please enter the ending city
Vienna
Please enter the heuristic's factor
1.0



----------------- PATH ----------------

The path costs 1195 and is
Paris Brussels Amsterdam Munich Vienna

---------------- VISITED -------------

The number of visited nodes are 9

----------------------------------------
```

III. Factor = 1.5

- **Greedy**

```
4
Please enter the starting city
Paris

Please enter the ending city
Vienna
Please enter the heuristic's factor
1.5


---------------- PATH ----------------

The path costs 1307 and is
Paris Genoa Trieste Vienna

---------------- VISITED -------------

The number of visited nodes are 4

--------------------------------------
```

- **AStar**

```
6
Please enter the starting city
Paris

Please enter the ending city
Vienna
Please enter the heuristic's factor
1.5



---------------- PATH ----------------

The path costs 1195 and is
Paris Brussels Amsterdam Munich Vienna

---------------- VISITED -------------

The number of visited nodes are 9
```

Factor	0.5	1.0	1.5
Greedy Cost	1307	1307	1307
Greedy Nodes	13	4	4
Astar Cost	1195	1195	1195
Astar Nodes	15	9	9

Conclusion:

Here we can see that when the heuristic factor increased, the number of nodes visited decreased and the cost stayed the same.