

Problem 1:

```
Project4_problem1 x
E:\Anaconda3\python.exe D:/Code/Algorithm/Project4_problem1.py
The top 20 betweenness centrality vertices in the road network are:
760,590,859,757,858,1021,374,92,931,857,758,393,496,775,1093,932,1094,835,589,751,|
Process finished with exit code 0
```

Problem 2:

Dynamic programming for the Traveling Salesperson Problem

1. two-dimensional array

```
Project4_Traveling Salesperson_DP x
4
3
2
1
The minimum distance is: 6733
Process finished with exit code 0
```

2. one-dimensional array

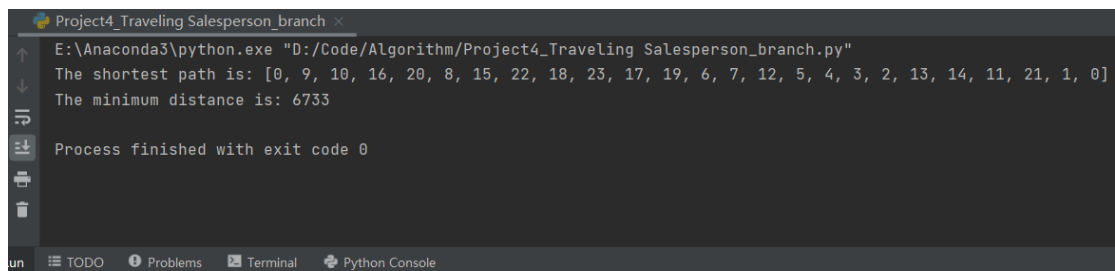
```
Project4_Traveling Salesperson_DP x
4
3
2
1
The minimum distance is: 6733
Process finished with exit code 0
```

Branch-and-bound for the Traveling Salesperson Problem

1. two-dimensional array

```
Project4_Traveling Salesperson_branch x
E:\Anaconda3\python.exe "D:/Code/Algorithm/Project4_Traveling Salesperson_branch.py"
The shortest path is: [0, 9, 10, 16, 20, 8, 15, 22, 18, 23, 17, 19, 6, 7, 12, 5, 4, 3, 2, 13, 14, 11, 21, 1, 0]
The minimum distance is: 6733
Process finished with exit code 0
```

## 2. one-dimensional array



```
Project4_Traveling Salesperson_branch x
E:\Anaconda3\python.exe "D:/Code/Algorithm/Project4_Traveling Salesperson_branch.py"
The shortest path is: [0, 9, 10, 16, 20, 8, 15, 22, 18, 23, 17, 19, 6, 7, 12, 5, 4, 3, 2, 13, 14, 11, 21, 1, 0]
The minimum distance is: 6733

Process finished with exit code 0
```

The screenshot shows a terminal window with a dark background. The title bar reads 'Project4\_Traveling Salesperson\_branch x'. The output text is as follows:

E:\Anaconda3\python.exe "D:/Code/Algorithm/Project4\_Traveling Salesperson\_branch.py"

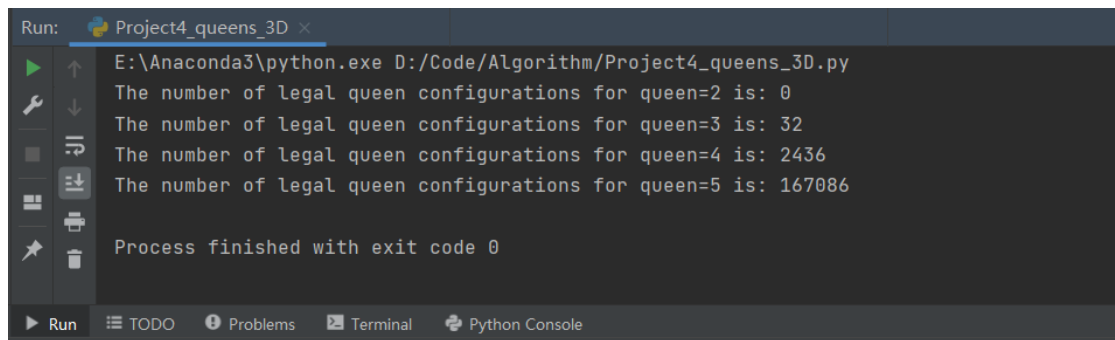
The shortest path is: [0, 9, 10, 16, 20, 8, 15, 22, 18, 23, 17, 19, 6, 7, 12, 5, 4, 3, 2, 13, 14, 11, 21, 1, 0]

The minimum distance is: 6733

Process finished with exit code 0

The bottom status bar shows icons for 'Run', 'TODO', 'Problems', 'Terminal', and 'Python Console'.

## Problem 3:



```
Run: Project4_queens_3D x
E:\Anaconda3\python.exe D:/Code/Algorithm/Project4_queens_3D.py
The number of legal queen configurations for queen=2 is: 0
The number of legal queen configurations for queen=3 is: 32
The number of legal queen configurations for queen=4 is: 2436
The number of legal queen configurations for queen=5 is: 167086

Process finished with exit code 0
```

The screenshot shows a terminal window with a dark background. The title bar reads 'Run: Project4\_queens\_3D x'. The output text is as follows:

E:\Anaconda3\python.exe D:/Code/Algorithm/Project4\_queens\_3D.py

The number of legal queen configurations for queen=2 is: 0

The number of legal queen configurations for queen=3 is: 32

The number of legal queen configurations for queen=4 is: 2436

The number of legal queen configurations for queen=5 is: 167086

Process finished with exit code 0

The bottom status bar shows icons for 'Run', 'TODO', 'Problems', 'Terminal', and 'Python Console'.