Project 4

Problem 1:

Betweeness Cardinality
Highest 20

Number	Node	Frequency
1.	760	362706
2.	590	319406
3.	859	284588
4.	757	280906
5.	858	279710
6.	1021	265018
7.	374	260010
8.	92	253474
9.	931	253012
10.	857	239952
11.	758	238712
12.	393	236134
13.	496	230234
14.	775	229436
15.	1093	227884
16.	932	227724
17.	1094	226770
18.	835	226154
19.	589	226134
20.	751	225778

Problem 2
TSP Dynamic Programming
(Increase heap size to run for 24 nodes, for nodes 10-15 heap size increasing won't be needed)

2D

```
TSP with Dynamic Programming  with 2D array
Minimum travelling  cost: 6733
Path taken to visit all nodes: [0, 1, 21, 11, 14, 13, 2, 3, 4, 5, 12, 7, 6, 19, 17, 23, 18, 22, 15, 8, 20, 16, 10, 9, 0]
```

1D

```
TSP with Dynamic with 1D array
Minimum travelling  cost : 6733
Path taken: 0 ->1 ->21 ->11 ->14 ->13 ->2 ->3 ->4 ->5 ->12 ->7 ->6 ->19 ->17 ->23 ->18 ->22 ->15 ->8 ->20 ->16 ->10 ->9 ->0
```

TSP Branch and Bound

2D

```
TSP with Branch and Bound with 2D array
Minimum travelling  cost : 6733
Path taken to visit all nodes : 0 ->1 ->21 ->11 ->14 ->13 ->2 ->3 ->4 ->5 ->12 ->7 ->6 ->19 ->17 ->23 ->18 ->22 ->15 ->8 ->20 ->16 ->10 ->9 ->0
```

1D

```
TSP with Branch and Bound with 1D array
Minimum travelling  cost : 6733
Path taken to visit all nodes : 0 ->1 ->21 ->11 ->14 ->13 ->2 ->3 ->4 ->5 ->12 ->7 ->6 ->19 ->17 ->23 ->18 ->22 ->15 ->8 ->20 ->16 ->10 ->9 ->0
```

Problem 3:

```
Placing n queens in n*n*n cells

When n=2
Placing 2 queens in 8 cells
Legal number of queen solutions : 0

When n=3
Placing 3 queens in 27 cells
Legal number of queen solutions : 72

When n=4
Placing 4 queens in 64 cells
Legal number of queen solutions : 7196

When n=5
Placing 5 queens in 125 cells
Legal number of queen solutions : 981016
```