

# HW3

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## Q1

### Centrality measures

ii. Calculate the different centrality measures of nodes 1, 50 and 100 over the friendship network (G1) :

node 1:

```
{'dc': 0.026501766784452298, 'cs': 0.3497065183812172, 'nbc': 0.008347578685386587, 'pr': 0.002245005694685942, 'auth': 0.0039765651520972355}
```

node 50:

```
{'dc': 0.022968197879858657, 'cs': 0.3543035993740219, 'nbc': 0.0038980095170968805, 'pr': 0.0018929372095642385, 'auth': 0.00395723506403841}
```

node 100:

```
{'dc': 0.0026501766784452294, 'cs': 0.2654784240150094, 'nbc': 7.142902633244772e-05, 'pr': 0.00038548565319589323, 'auth': 0.00017268773649941732}
```

iv. Running single step voucher function over G1:

node number 105

vi. Running multiple step voucher function over G1:

node number 23

viii. Running multiple step diminished voucher function over G1:

node number 23

As we can see we received the same node as in section v (multiple step\_voucher function) .

There is no difference because in section v we calculated the node based on the closeness centrality to all the other nodes.

It means we searched for the node that is the closest to all the other nodes in the network based on the average shortest path between all pairs of nodes.

In viii section we searched the node that can generate the highest amount of money when every step the ticket price reduced by 2.5%, and after 4 steps the ticket price is diminished.

With those parameters the node that generates the highest amount of money is the one that is the closest to all the other nodes in the network and closeness centrality calculation return that node.

viii. Running find most valuable function over G1:

node number 333

**Bonus section:**

I tried the function with different parameters and the results changed when I choose:

Rate = 2.5, steps =1, node = 105

Rate = 2.5, steps =3, node = 333

Rate = 5, steps =1, node = 105

Rate = 5, steps =3, node = 333

Rate = 10, steps =1, node = 105