Centrality in networks

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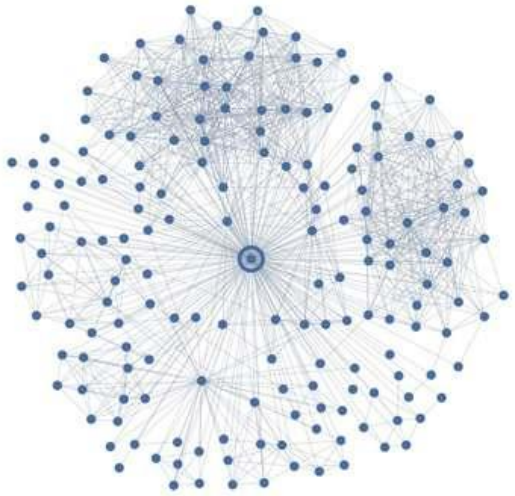

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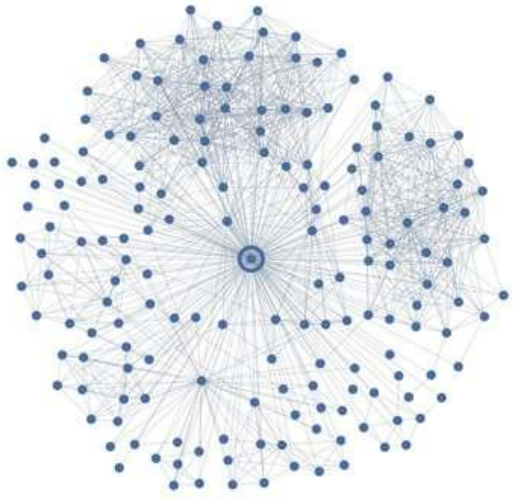
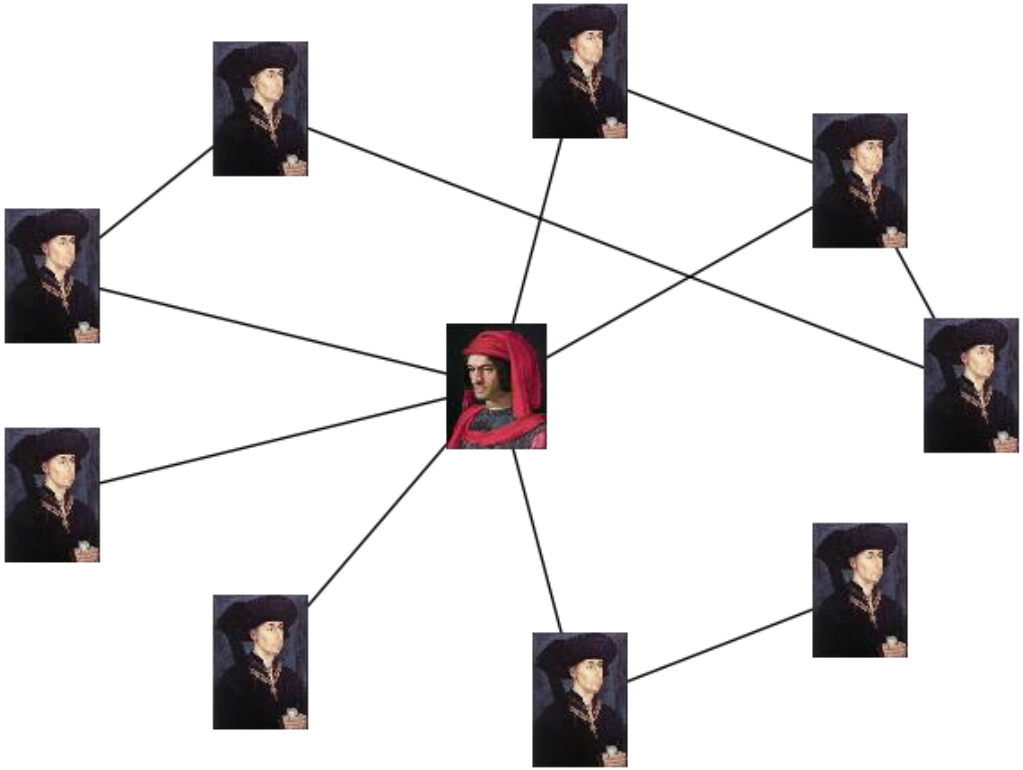


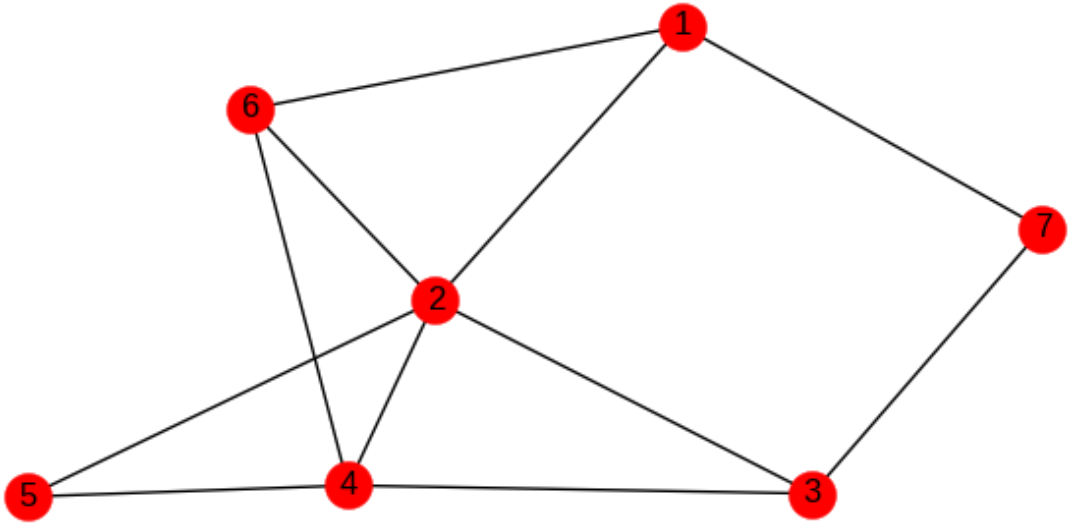
Network of FB connections of an individual

The Medici family



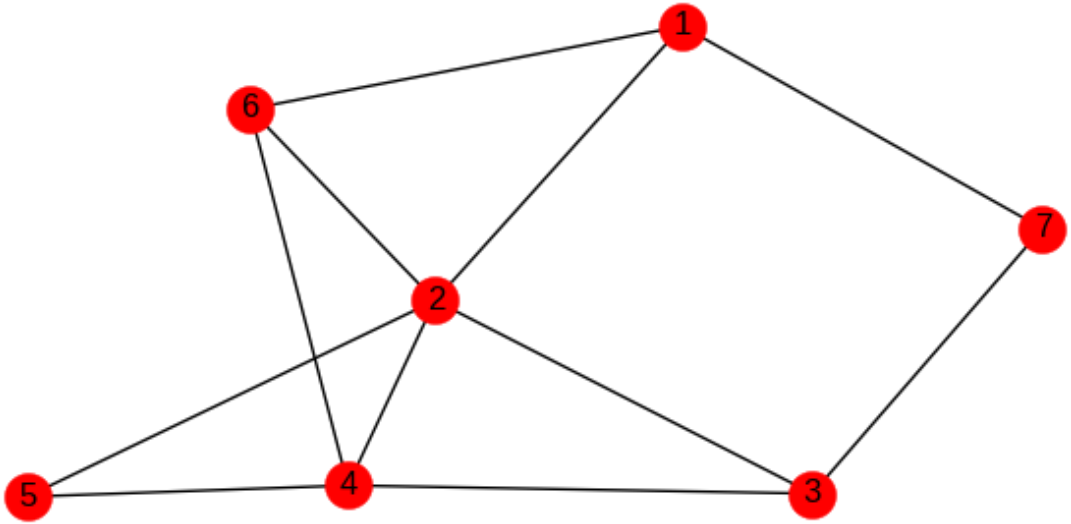
Which concepts are important?

Concept: Shortest Path



Concept: Shortest Path

- Fastest way to go from one node to another



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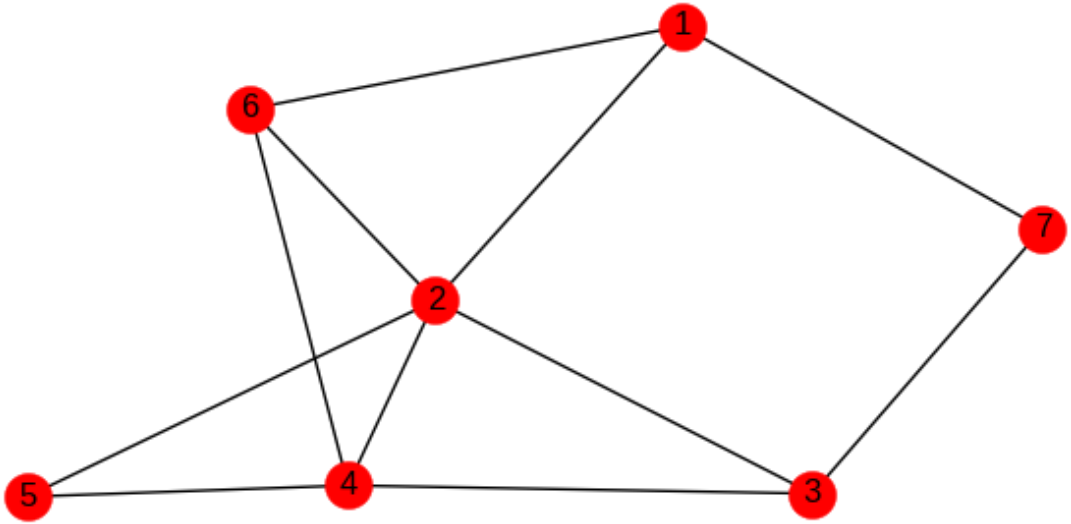

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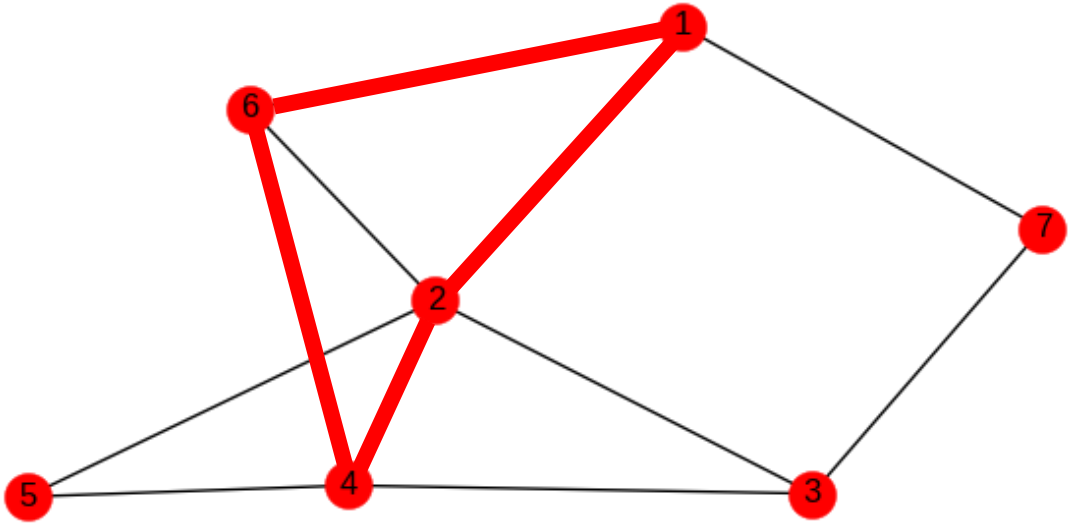

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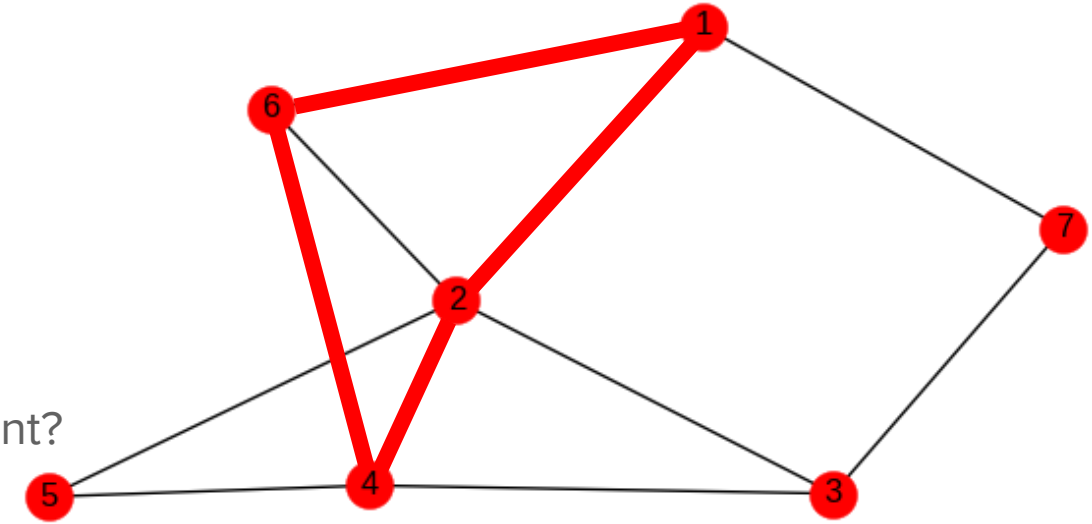
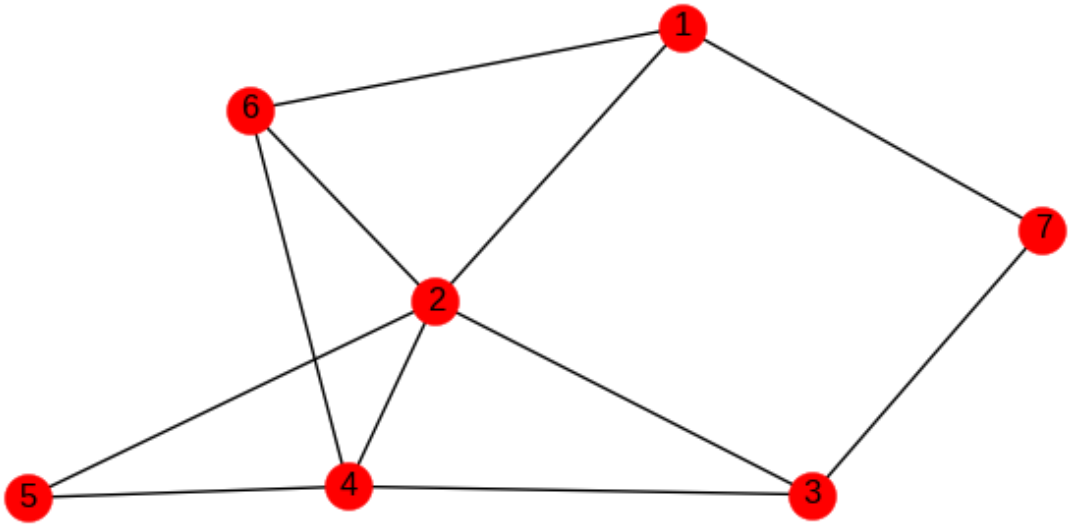
- Why do you think it is important?



Concept: Betweenness centrality



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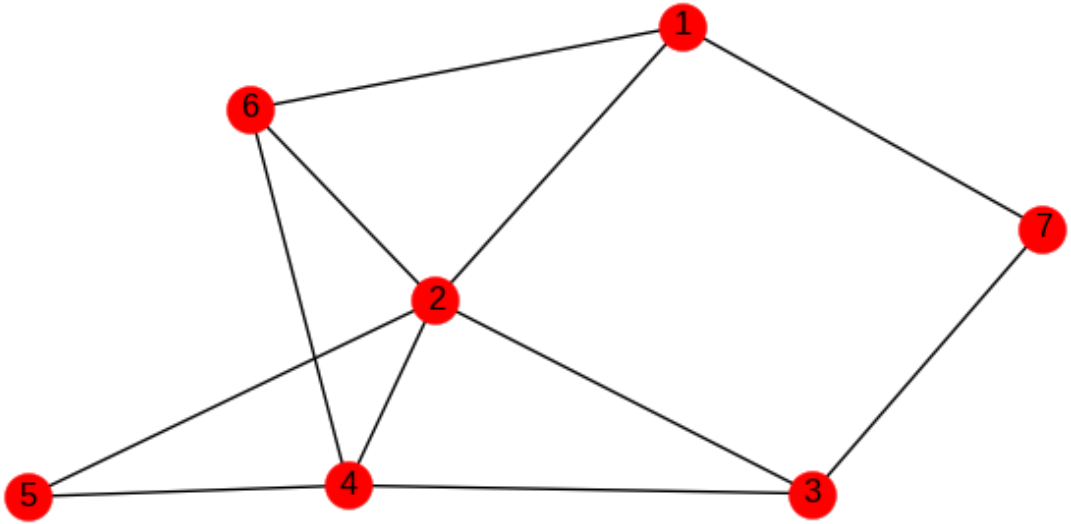
- Average proportion of shortest paths a node lies on



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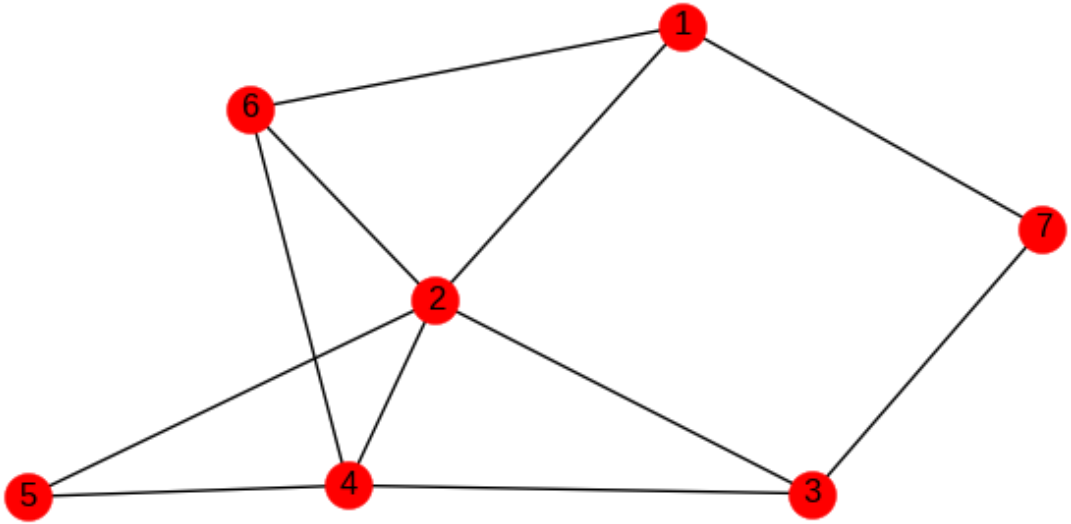
- Average proportion of shortest path a node lies on

- What is the betweenness centrality of node 2?



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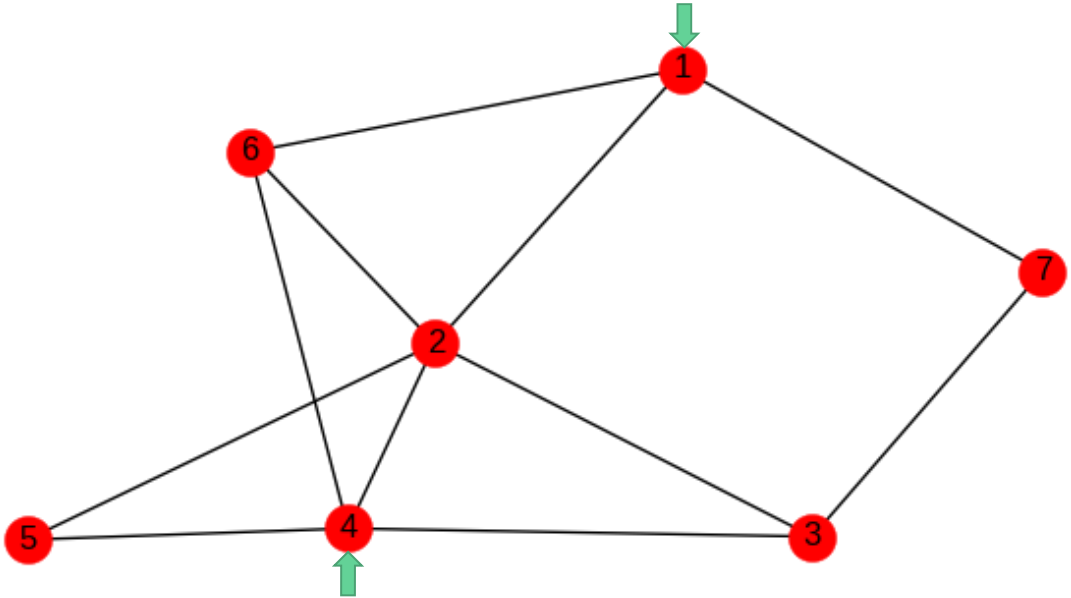
- What is the betweenness centrality of node 2?

  -Pick two nodes: (1, 4)



Concept: Betweenness centrality

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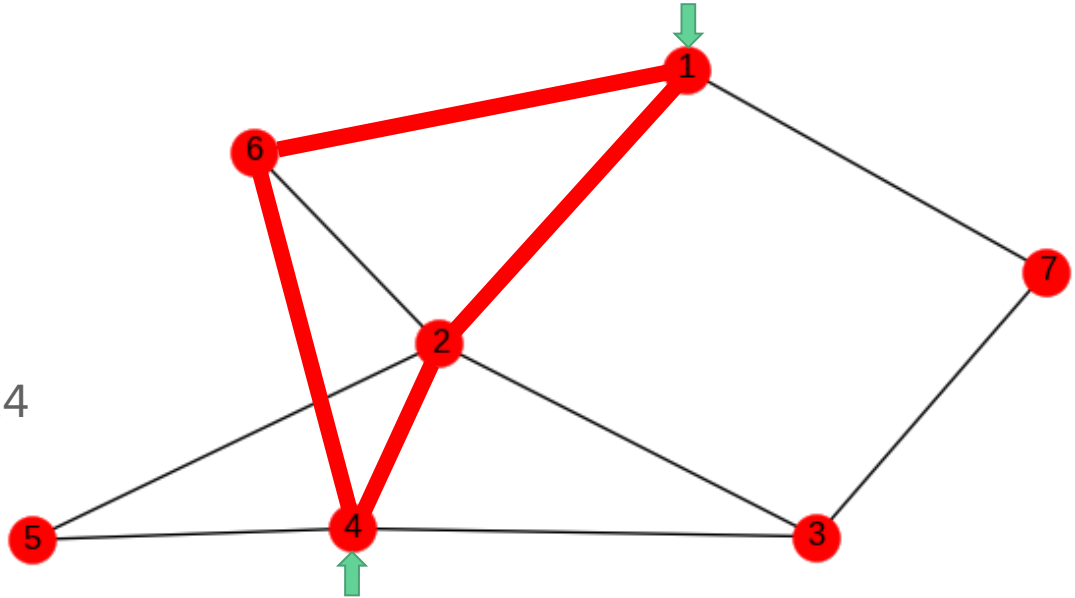
  -Pick two nodes: (1, 4)

  -Find shortest paths: 1,2,4 / 1,6,4



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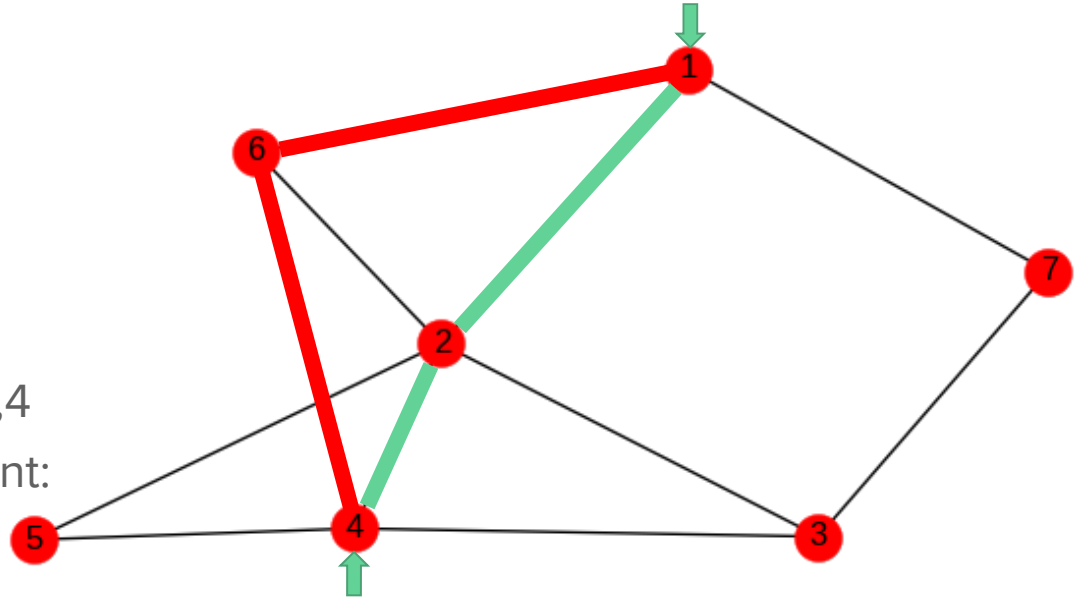
- What is the betweenness centrality of node 2?

  -Pick two nodes: (1, 4)
  -Find shortest paths: 1,2,4 / 1,6,4
  -Count those where 2 is present:
  1 out of 2 = 50%



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- What is the betweenness centrality of node 2?

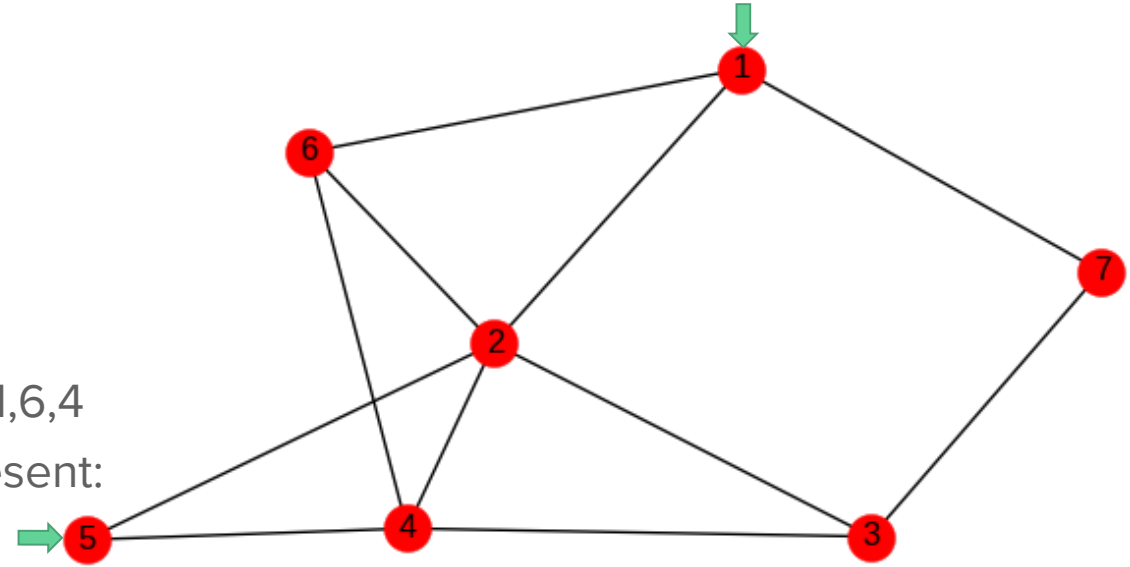
  -Pick two nodes: (1, 4)

  -Find shortest paths: 1,2,4 / 1,6,4

  -Count those where 2 is present:

  1 out of 2 = 50%

  -Loop on all pairs, pick two other nodes...



Concept: Betweenness centrality

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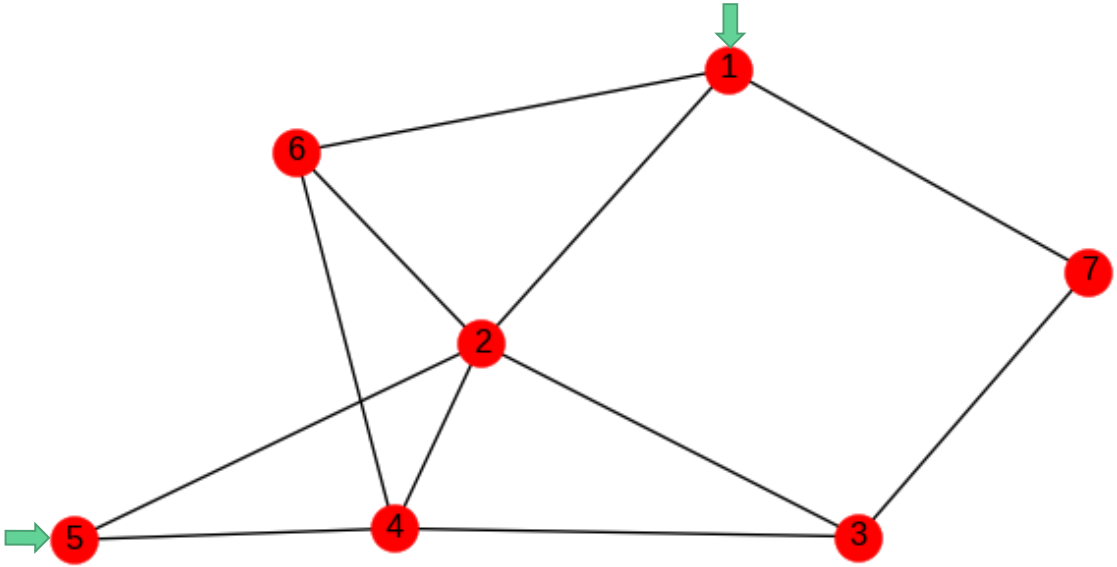
- What is the betweenness centrality of node 2?

  (1, 4) → 1,**2**,4 / 1,6,4 → 50%

  (1, 5)



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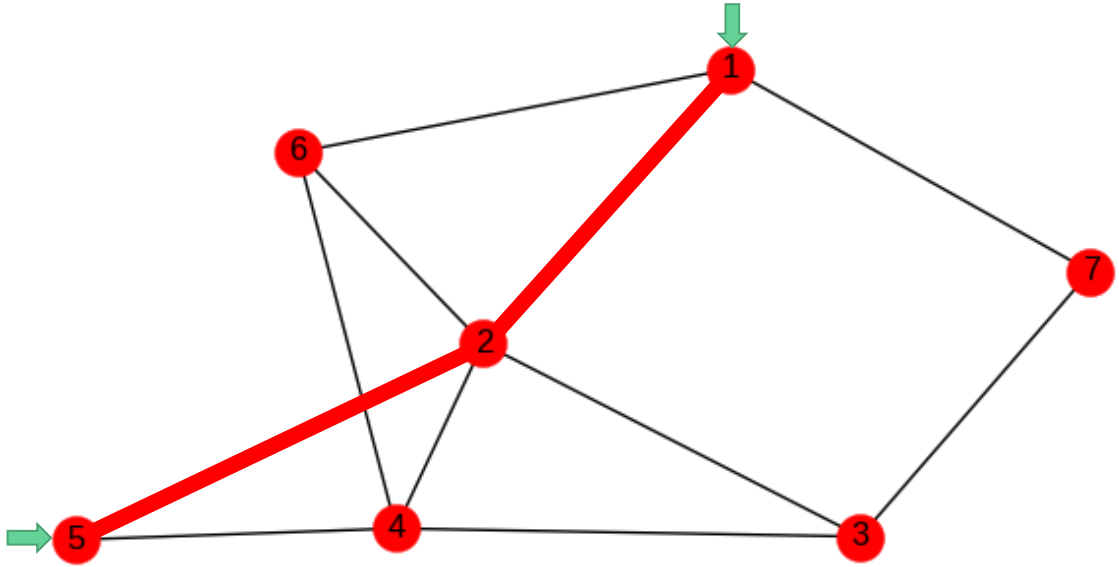

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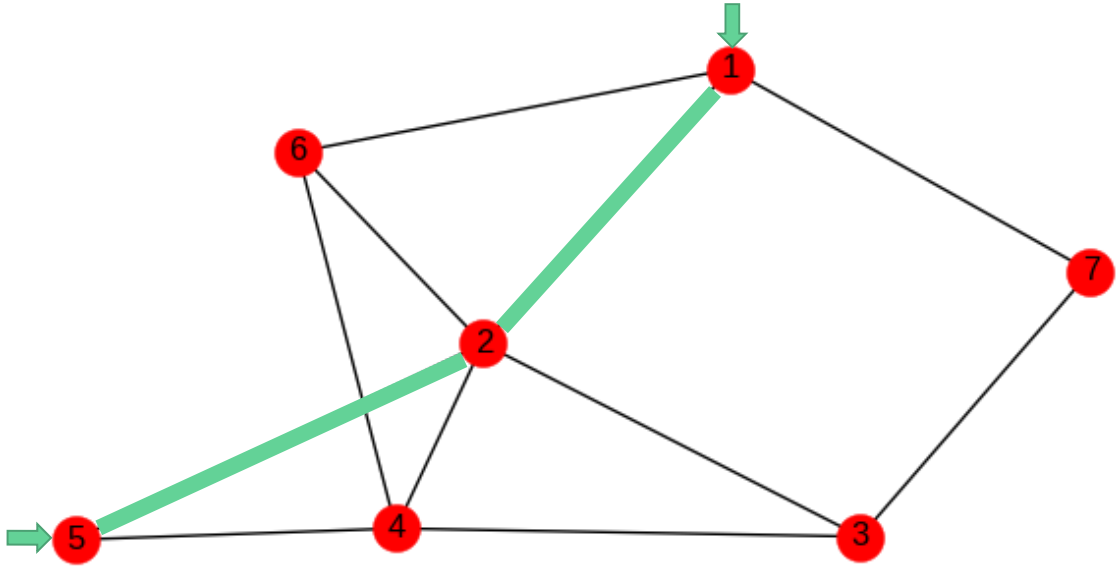

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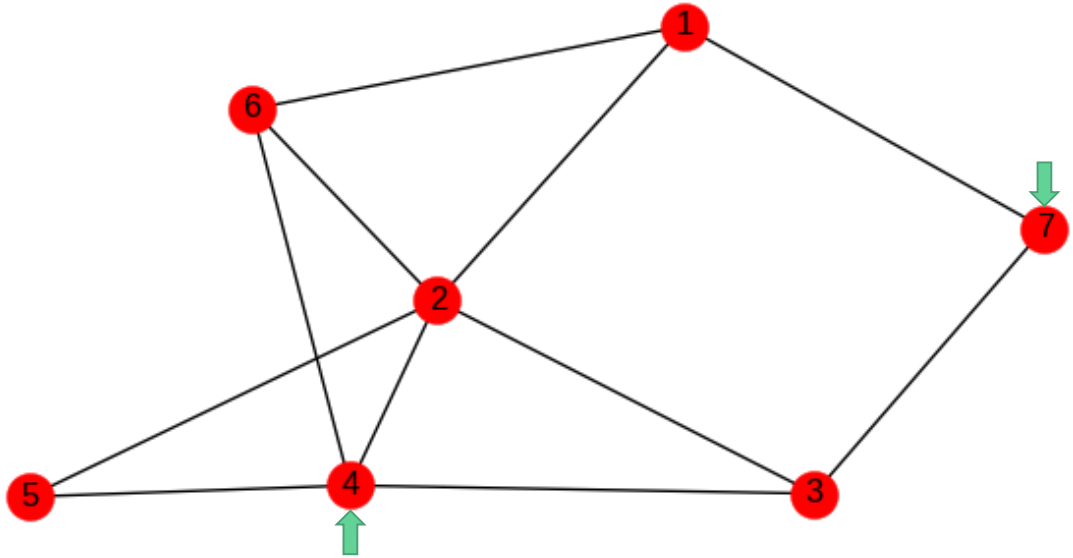
  (7, 4)



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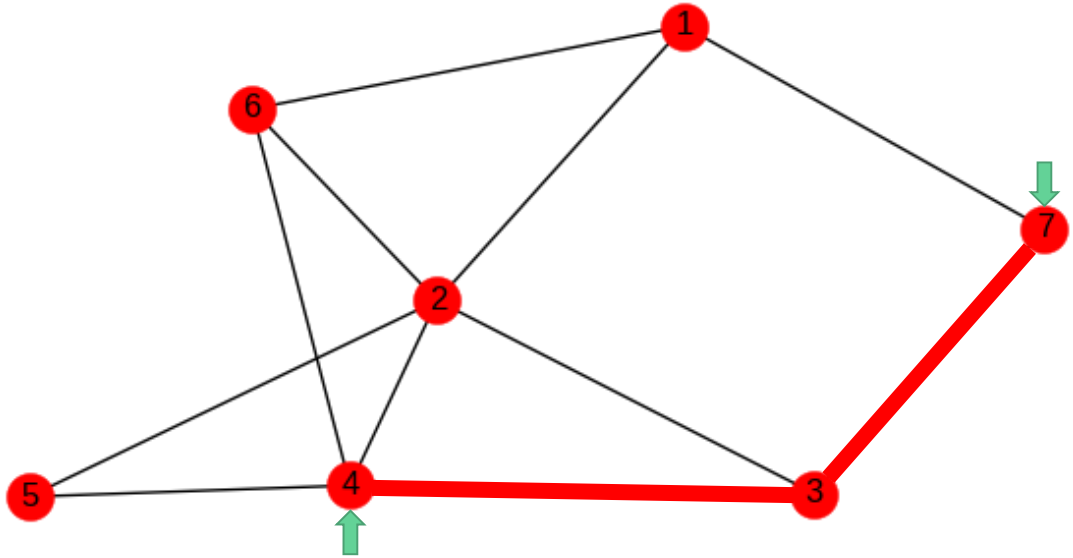

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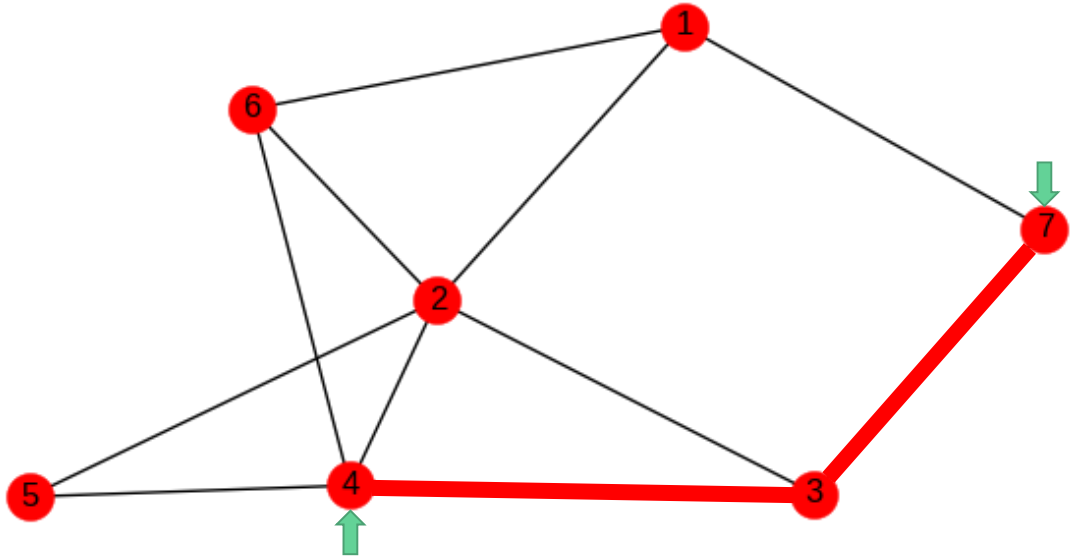
  (1, 4) → 1,**2**,4 / 1,6,4 → 50%
  (1, 5) → 1,**2**,5 → 100%
  (7, 4) → 7,3,4 → 0%
  …



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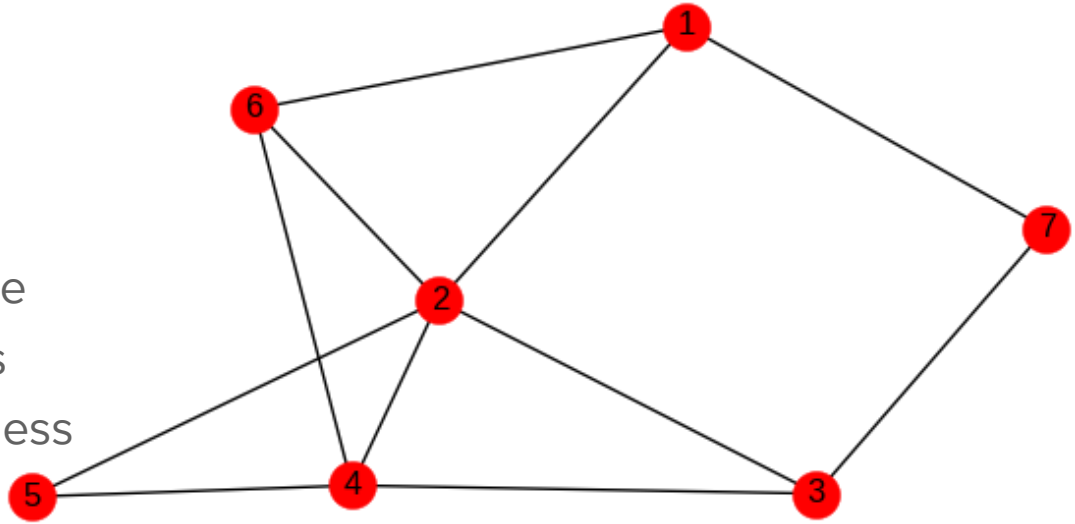
  In this example, 2 is on average on **27.8%** of the shortest paths which is the highest betweenness of the network.



- Why do you think it is important?

Time to play

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- Form two teams
- The goal is to relatively have the highest betweenness centrality at the end, to be the most influential player
- At each round, you will choose an edge you want to create or destroy to improve your centrality in the network
- The network will initially be empty and other AI competitive players might also try to become the most popular person in the network

The two teams

Team 1

Team 2

Other players

What to remember

- In small networks where you are the only active player, you can be greedy

- In real life, too many players want to achieve the same goal, best players form alliances and you should too if you want to become popular