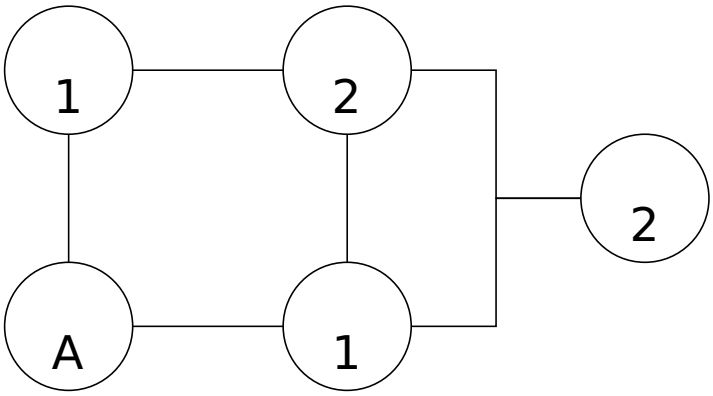
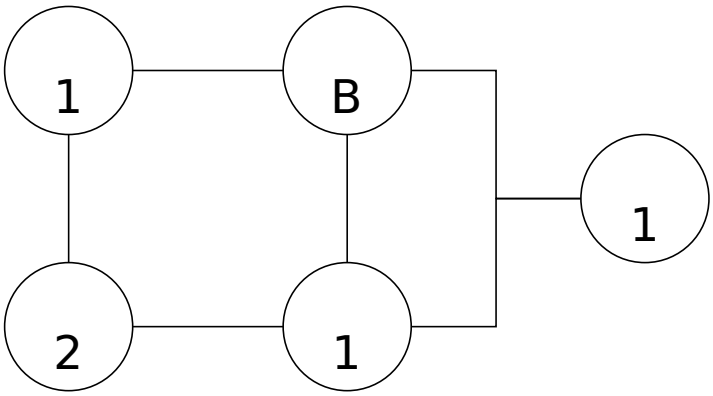
Supervision 4

Graph algorithms

Let A be an arbitrary node in the graph. Peform a breadth-first search from A. Let B be a furthest node from A. Perform another breadth-first search from B. The maximum distance from B to any node is the diameter of the graph.





In the above graph, the diameter is calculated to be 2 when in fact it is 3.

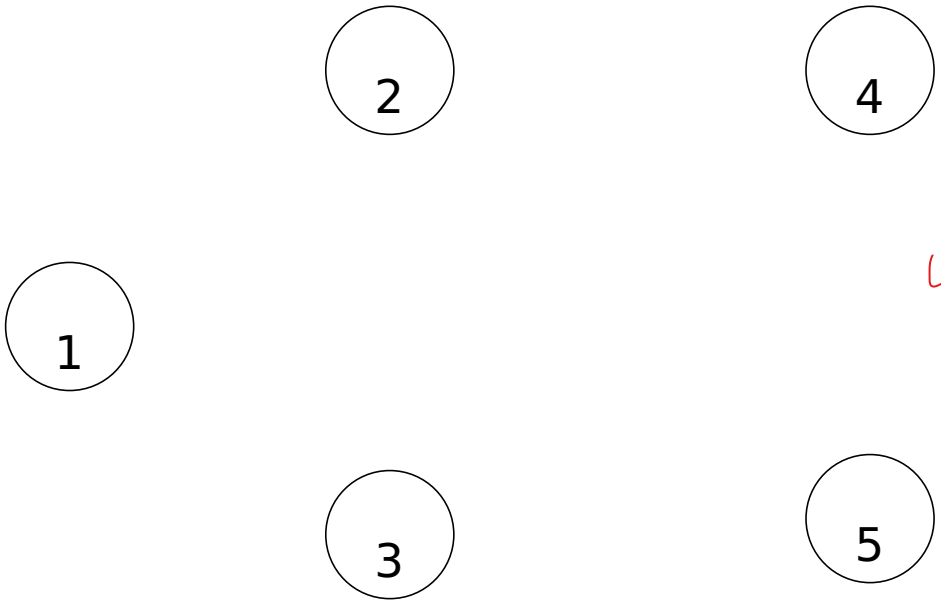
Betweenness centrality and Newman-Girvan method examples

1

Node	Centrality
1	1.0
2	1.0
3	1.0
4	1.0
5	1.0

Edge	Centrality
(1,2)	3.0
(2,3)	3.0
(3,4)	3.0
(4,5)	3.0

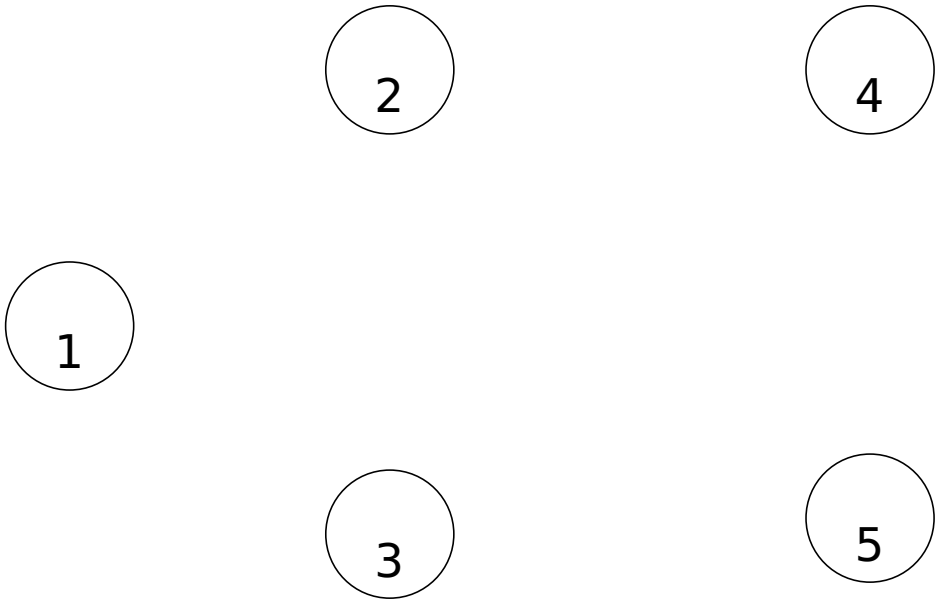
Edge	Centrality
(1,5)	3.0



2

Node	Centrality
1	6.0
2	0.0
3	0.0
4	0.0
5	0.0

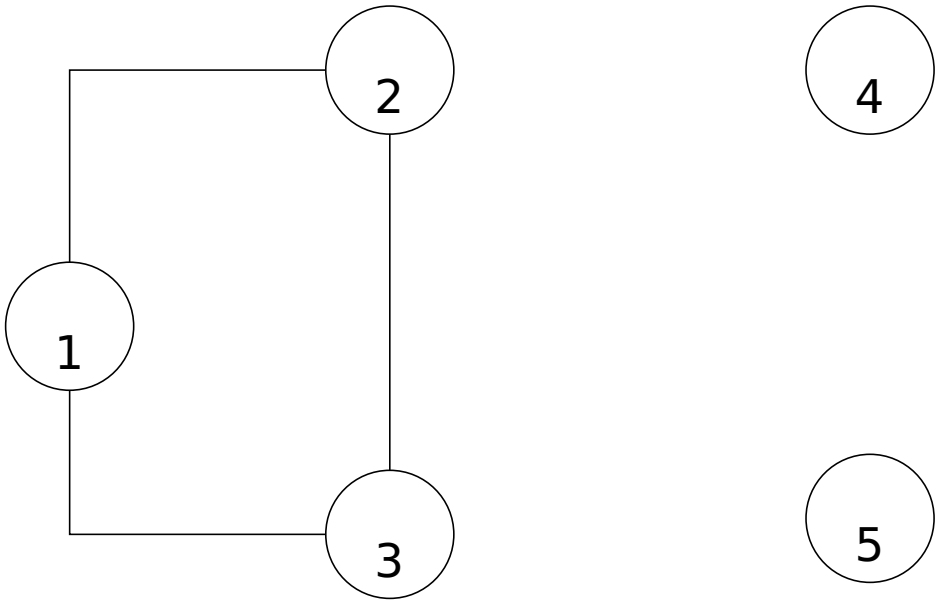
Edge	Centrality
(1,2)	4.0
(1,3)	4.0
(1,4)	4.0
(1,5)	4.0



3

Node	Centrality
1	5.0
2	0.0
3	0.0
4	0.0
5	0.0

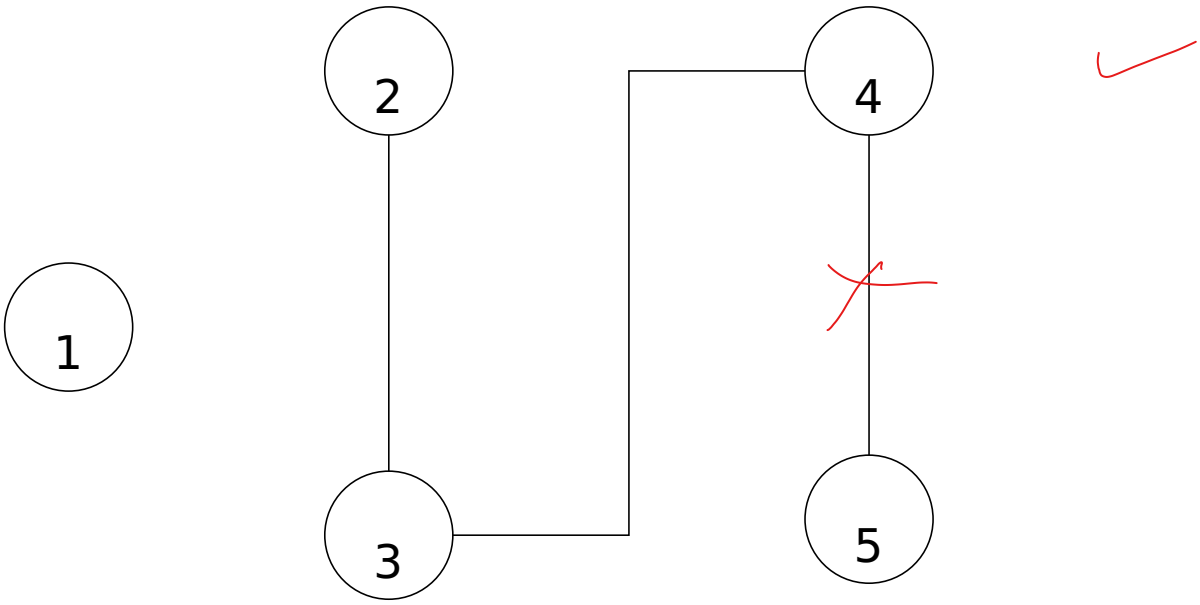
Edge	Centrality
(1,2)	3.0
(1,3)	3.0
(1,4)	4.0
(1,5)	4.0
(2,3)	1.0



4

Node	Centrality
1	0.0
2	3.0
3	0.0
4	3.0
5	0.0

Edge	Centrality
(1,2)	4.0
(2,3)	2.0
(2,4)	4.0
(3,4)	2.0
(4,5)	4.0

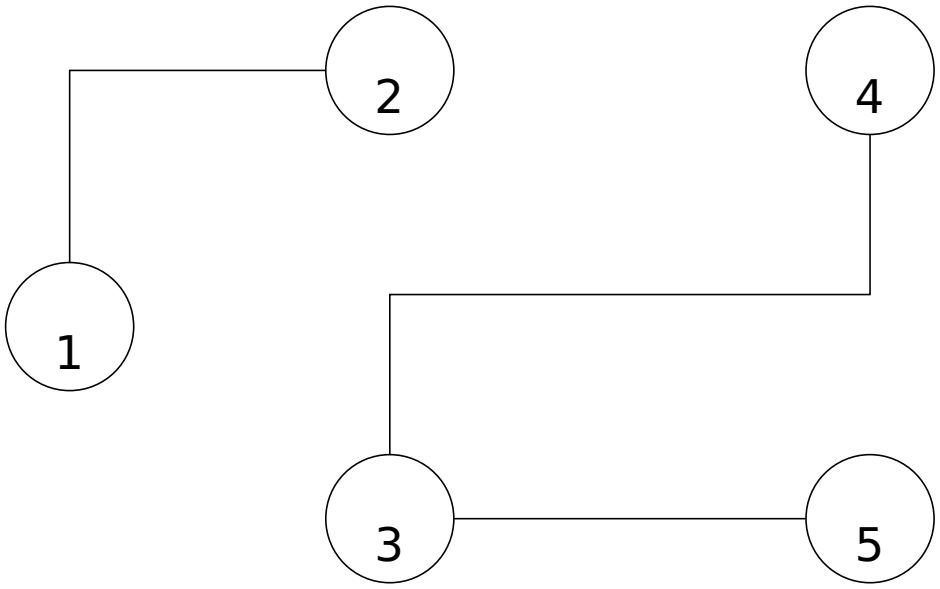


5

Node	Centrality
1	0.0
2	3.0
3	4.0
4	0.0
5	0.0

Edge	Centrality
(1,2)	4.0
(2,3)	6.0

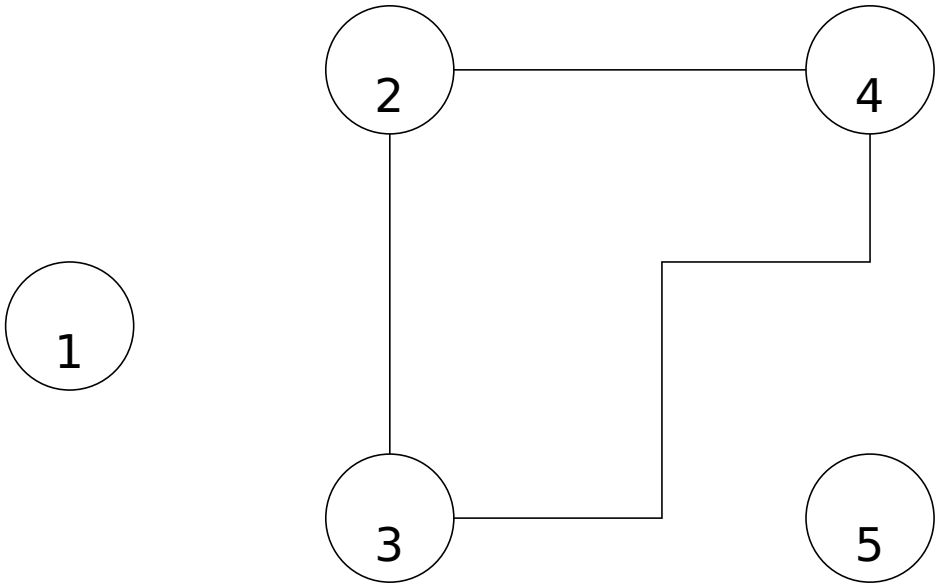
Edge	Centrality
(3,4)	3.0
(4,5)	1.0
(3,5)	3.0



6

Node	Centrality
1	0.0
2	5.0
3	0.0
4	0.0
5	0.0

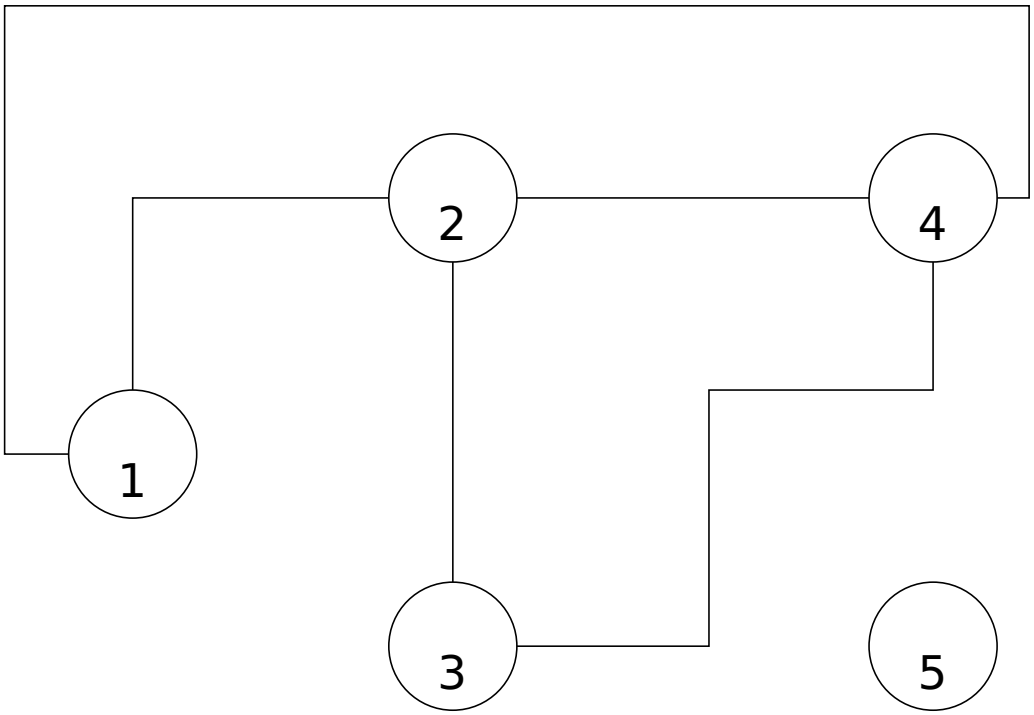
Edge	Centrality
(1,2)	4.0
(2,3)	3.0
(3,4)	1.0
(2,4)	3.0
(2,5)	4.0



7

Node	Centrality
1	3.0
2	1.0
3	0.0
4	1.0
5	0.0

Edge	Centrality
(1,2)	3.0
(2,3)	2.0
(2,4)	1.0
(3,4)	2.0
(1,4)	3.0
(1,5)	4.0



Random graphs and metrics

Erdős–Rényi

The degree of the nodes is going to be binomally distributed.

Most of the nodes will probably be connected assuming p and n are both large enough.

The lengths of the shortest paths will be binomially disributed

There will be little clustering

Watts-Strogatz model

For a given node, its degree will vary from k to a a uniformly random integer as p varies from 0 to 1.

Most of the nodes will be connected.

There will probably be a high degree of clustering

Collaboration network

The degrees of nodes will probably be distributed normally

Most of the components will be connected

The shortest paths will also be distributed normally

There will be a high degree of clustering