K-Cores

Introduction to Network Science
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Topic 21

Sources

- Barabási 2016 Chapter 9
- Networks, Crowds, and Markets Ch 3
- C. Castillo (2017) Dense Sub-Graphs
- Tutorial by A. Beutel, L. Akoglu, C. Faloutsos [Link]
- Frieze, Gionis, Tsourakakis: "Algorithmic techniques for modeling and mining large graphs (AMAzING)" [Tutorial]
- A survey of algorithms for dense sub-graph discovery [link]

Remember: "hairballs"

Sometimes, at the center these graphs may have an interesting dense sub-graph

3

Remember: densest sub-graph

Sub-graph
having the
maximum
density
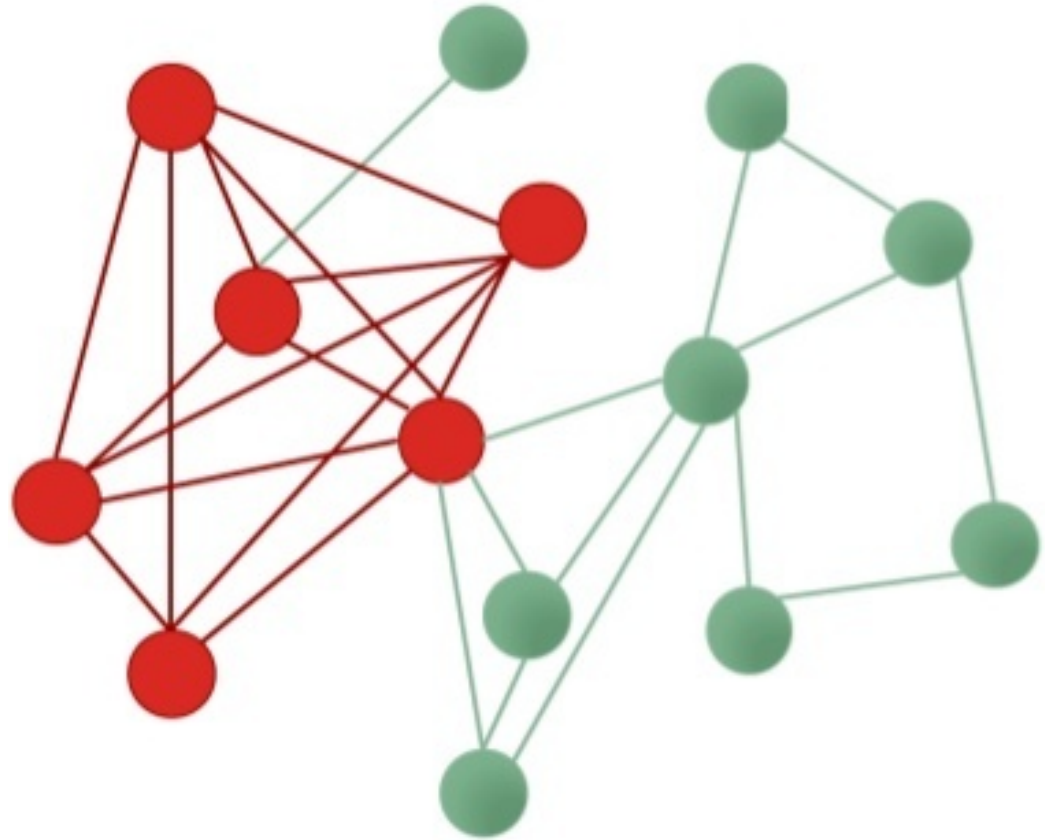
k-core decomposition
is a method to decompose
a graph into *layers*

k-core decomposition

- Remove all nodes having degree 1
  - Those are in the 1-core

- Remove all nodes having degree 2 *in the remaining graph*
  - Those nodes are in the 2-core

- Remove all nodes having degree 3 *in the remaining graph*
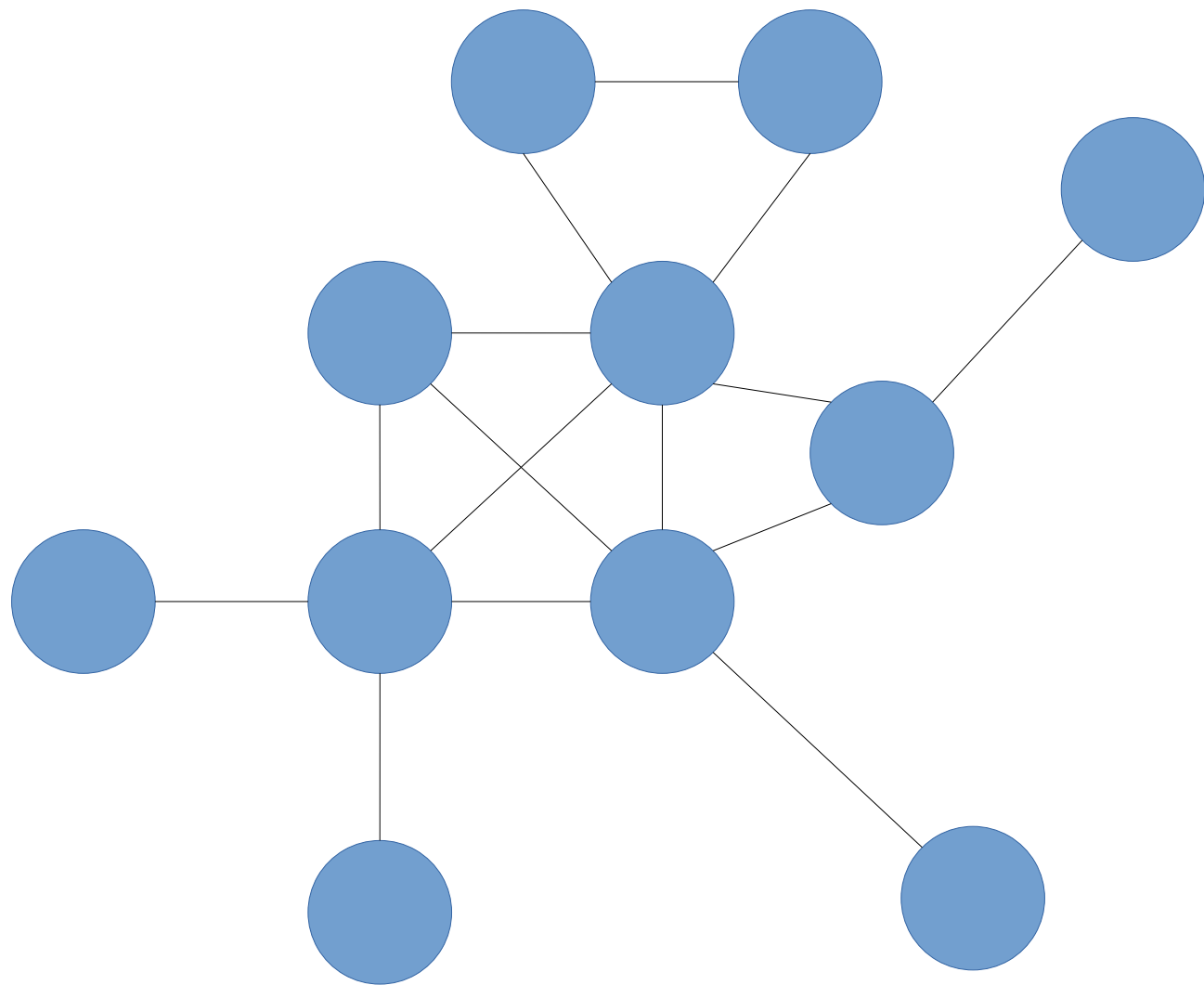 - Those nodes are in the 3-core

- Etc.

Example

K = 3

K = 2

K = 1

7
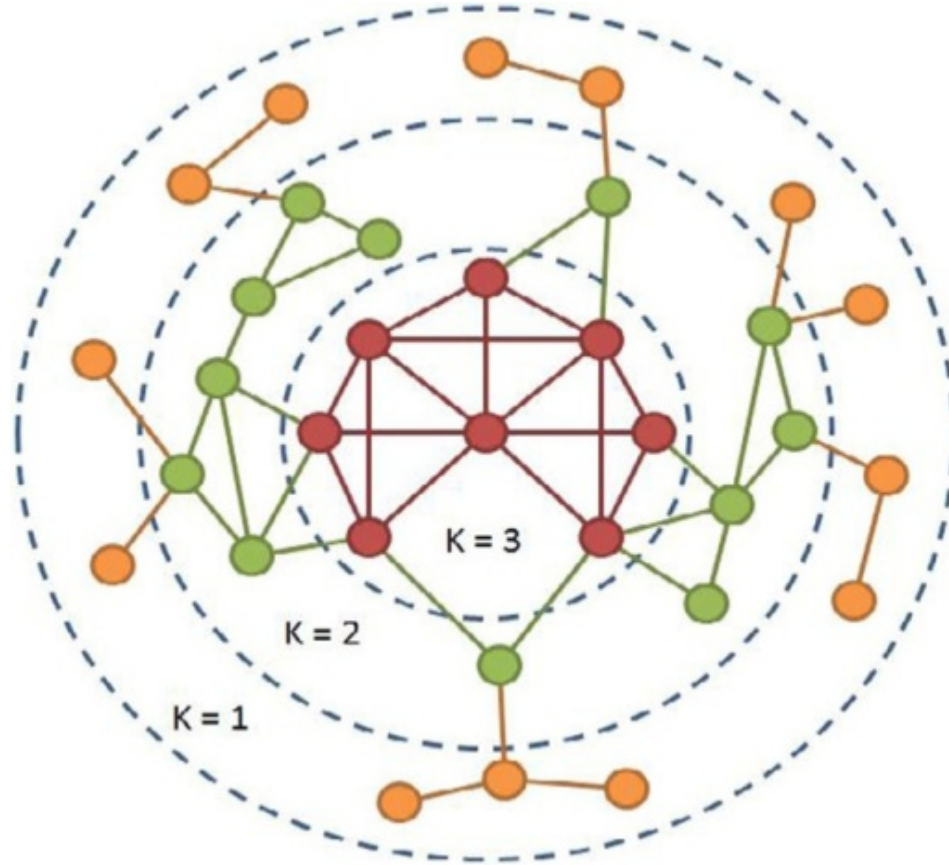
Exercise

For each node in the graph, indicate the max k-core to which it belongs
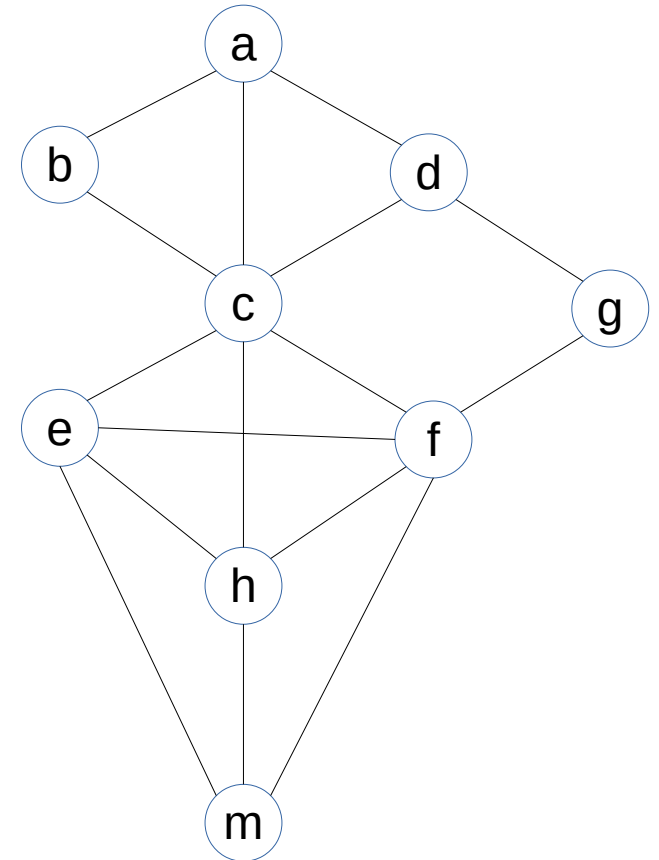
http://www.cpt.univ-mrs.fr/~barrat/NHM.pdf

9
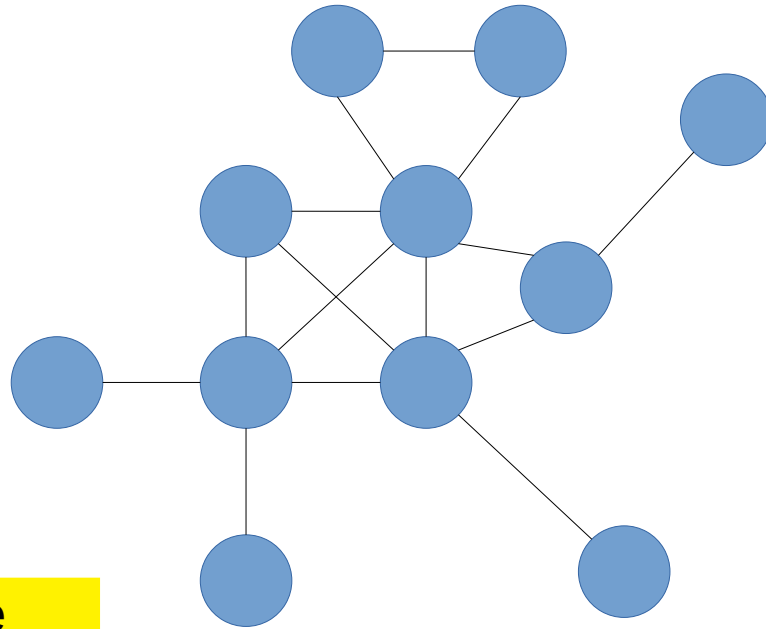
Summary

Things to remember

- What is the k-core decomposition
- How to compute it on a graph

Practice on your own

Find the 3-core of this graph

Solution by Vivekanand Khyade (start at 01:23)
https://youtu.be/8sNZ5d8eNC8?t=83