Lecture Introduction to Network Science
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Assignment 5 – Network Motifs

Released: 27.5.2024 Exercise Session: 7.6.2024

Question 1

Answer the following questions:

a) Given the definition of empirical P-values on Slide 8, what is the lowest possible P-value for a general given resolution n?

b) Why did we not use Erdös-Renyi graphs for our random background model?

c) What is a graph isomorphism?

d) What is the complexity of the graph isomorphism problem? Why can we still "afford" to use it in our case?

Question 2 – Enumerating subgraphs

Apply the `EnumerateSubgraphs` algorithm on Slide 22 to the network visualized in Figure 1 to obtain all subgraphs of size $k = 3$. Which of the resulting subgraphs are isomorphic?

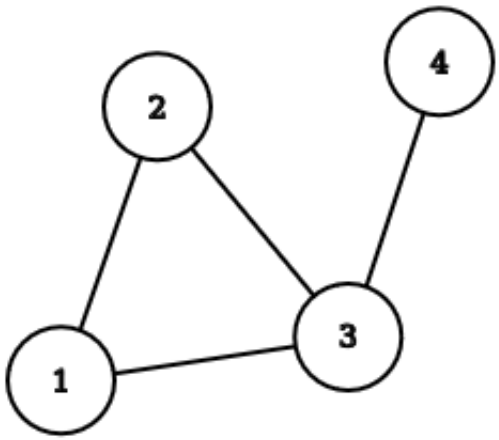

Figure 1: Example network for Question 2.

Question 3 – Random sampling

Extend the python implementation from the lecture such that it allows random sampling as described on Slide 26. Analyze how well the sampled concentrations approximate the actual concentrations without sampling.