

Bioinformatics 525 – Module 3 – Homework 1
Due 3/29/2017, 5 pm

Work through the exercises below, and provide your answers in either paper or electronic form to Lauren Jepsen (ljepsen@umich.edu) by the deadline.

Students may discuss ideas, approaches, and technical hurdles with each other, but you should choose your own target network for Problem 1 and come up with an independent design for Problem 2.

Problem 1 – Network analysis

Choose a regulatory or metabolic network relevant to your research and load it into Cytoscape. (If you're feeling lazy, load one from Wikipathways; if you're feeling ambitious, you can typically find a cytoscape-compatible representation for a wide variety of network types with a little bit of googling). The network should have between 10 and 100 nodes and between 20 and 500 edges.

- a) **Provide a hand- or cytoscape-drawn image of your network of choice, and briefly discuss what is represented**
- b) **Use the network analysis tools in Cytoscape to determine whether your network shows a scale-free organization. Provide fitting statistics (r^2 and fitted coefficients) to back up your answer.**
- c) **Use the NetMatch* app to search for at least three of the classical motifs discussed in lecture. Provide the identities of the motifs that you searched for, and statistics on how your network compared to randomly sampled networks. How do your findings compare with what you would expect based on the type of network that you analyzed?**

Problem 2 – Synthetic Biology and Network Design

Design a BioBrick-based plasmid that will implement the following functionality:

During normal growth in glucose minimal media, yield constitutive expression of a cyan fluorescent protein (CFP). When the cells encounter any amount of xylose, transcription of CFP is reduced. In addition, upon **prolonged** exposure to xylose, a red fluorescent protein is induced.

Indicate the part numbers to be assembled (in order), draw a schematic of the resulting mini-network, and explain why your construct will implement the desired function.