

Homework Assignment Three
Complex Networks
College of the Atlantic
Fall 2008

Due Wednesday 29 October, 2008.

Note: If you consult any books or web pages as you do these problems, that's fine, but please cite your sources.

1. **Modularity.** Consider the network shown in Fig. 1. Determine the modularity for the following partitions:
 - (a) $\{1, 2, 3, 4, 5\}, \{6, 7, 8, 9, 10\}$
 - (b) $\{1, 3, 4, 5\}, \{2, 6, 7, 8, 9, 10\}$

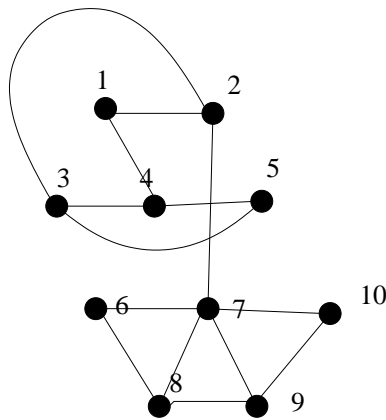


Figure 1: The network for problem 1.

2. **Analyzing Algorithms.** For each of the following tasks, describe an algorithm needed to complete the task. What is the order of the algorithm's runtime? Include a brief but clear explanation.
- (a) You need to multiply together two n -digit numbers.
 - (b) You need to calculate the average cluster coefficient for a network with n nodes.
 - (c) There are n points on a map. You need visit all of them once and only once. Your task is to find the minimum length path that meets this criterion.
3. **Some Network Workbench Explorations.** Use network workbench to reproduce Figures 1 and 2 from Duncan Watts and Steven Strogatz, The Collective Dynamics of 'Small-World' Networks, Nature 393(6684):440-2. 1998. Your figures do not have to be identical, but they should contain the same information. Use excel or some graphing program to reproduce Fig. 2. You don't need to put plots of C and ℓ on the same graph. You can make two plots if it's easier.