CS 591: Graph Theory and Computational Topology **Summer 2017**

Problem Set 4

Lecturer: Prof. Peter Chin *Due: June 30, 2017*

◇ Please email the written portion (either type up your answer or scan your handwritten solution) & code and report to `zhouxiao@bu.edu` by 23:59PM on the due date.

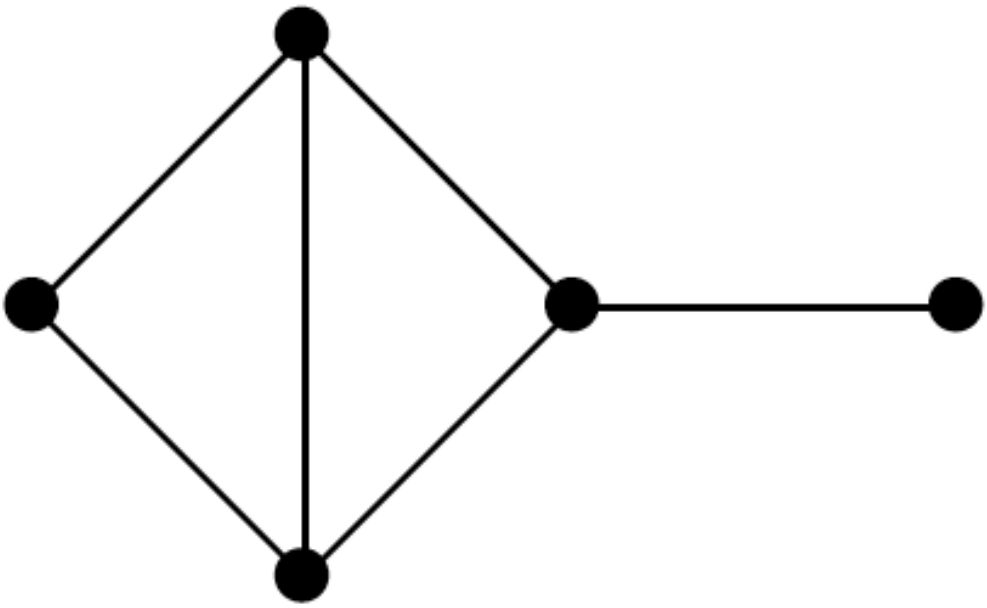
◇ Late policy: there will be a penalty of 10% per day, up to three days late. After that no credit will be given.

1. **Mathematical calculations**

   (a) Show that for every graph G,

   $$\chi(G) < 1 + \lambda_{max}(G)$$

   where $\chi(G)$ is the chromatic number of the graph G and $\lambda_{max}(G)$ is the largest eigenvalue of the adjacency matrix of G.



   (b) Find the eigenvalues of adjacency matrix of the graph above.

   (c) if H is an induced subgraph of G show that

   $$\lambda_{min}(H) > \lambda_{min}G)$$

   .

2. **Programming assignment**

   (a) Write a program using a language of your choice that calculates the shortest paths from a given node to the rest of nodes in a weighted graph using Dikstra's algorithms that we covered in class. Generate an example of graphs so that you can test out your program. For submission, zip the following 3 items: your program, Readme File, 10 examples of graphs, and the outcome. Your program should handle graphs of size up 100 nodes so your examples should have various sizes from small to 100.