CSE 595 Independent Study

Graph Theory

Week 3

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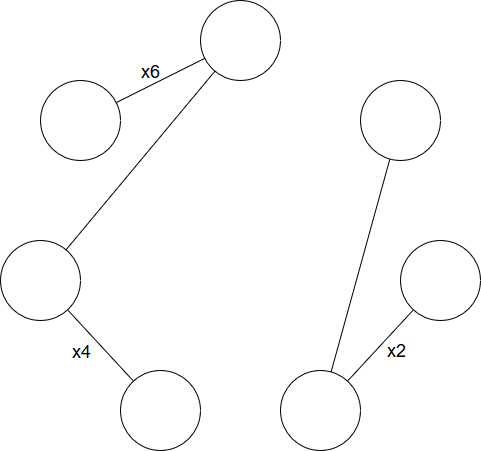
Chapter 1 Problem 53 (Multigraphs)



1. This sequence is not capable of a multigraph because of Corollary 1.5 [1] which states

*Every graph has an even number of odd vertices*.

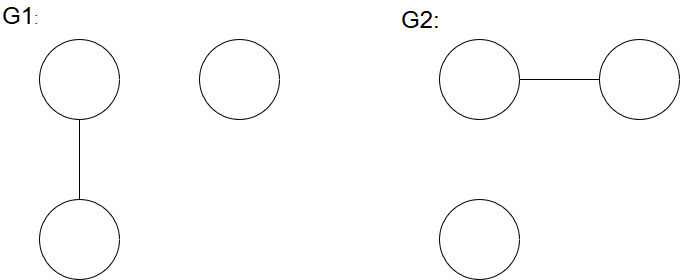
It is, however, capable of a pseudograph, where a loop (an edge which is connected to the same node) exists.

1. This sequence also contradicts the Corollary 1.5 from part a, and therefore a multigraph does not exist.
2.  The following does exist as a multigraph, shown below.

Chapter 2 Problem 3 (Connected Graphs)



1. Let be vertices in graph respectively. A matrix is equal iff they have the same dimensionality and the corresponding elements are the same. Therefore, if then these graphs must be isomorphic with each vertex having the same exact adjacent vertices as its counterpart . Hence, if then is true.
2. Assume that this statement is true. Therefore, there should not exists two graphs such that and . Examining the following two adjacency matrices

 Obviously, these matrices are not equal, however the graphs are isomorphic, as seen below.

Thus, the statement if , then is not true.

Chapter 2 Problem 5 (Connected Graphs)



The adjacency matrix of graph *G* is,

The adjacency matrix of graph *G* with walk length 2 is,

The adjacency matrix of graph *G* with walk length 3 is,

Chapter 2 Problem 7 (Connected Graphs)



Upon trying to solve this problem and using the solutions and hints portion in Chartrand [1], it was determined that the matrix is not actually the power of matrix . The solution, according the text and . This graph has the corresponding adjacency matrix,

Multiplying gives the correct matrix. Multiplying does not get the matrix given in the problem. Instead, the matrix is

I have verified that the would not be correct, as performing and in fact if this operation is performed, non-integer numbers are achieved.

Problem 25 (Distance in Graphs)



First reduce the problem algebraically

Thus, based on the triangle inequality in Chartrand [1] which states

*for all*

However, for the sake of further examination of the problem,

If we assume the case

All other cases if it obvious to see that if the path geodesic then,

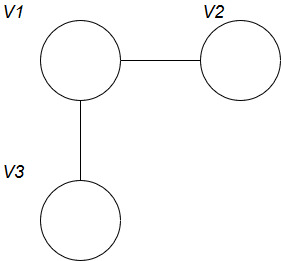
Otherwise,

Problem 31 (Distance in Graphs)



By definition of the radius and diameter of a graph, the following portion of the inequality,

Is obviously true, so the other inequality to show is,

Consider the following graph,

Therefore,

Thus, a graph *G* with the property exists .

Works cited

“Connected Graphs and Digraphs.” *Graphs & Digraphs*, by Gary Chartrand et al., CRC Press, 2016, pp. 25–55.