Building Graphs from Other Graphs

Dr.Jayantha Lanel

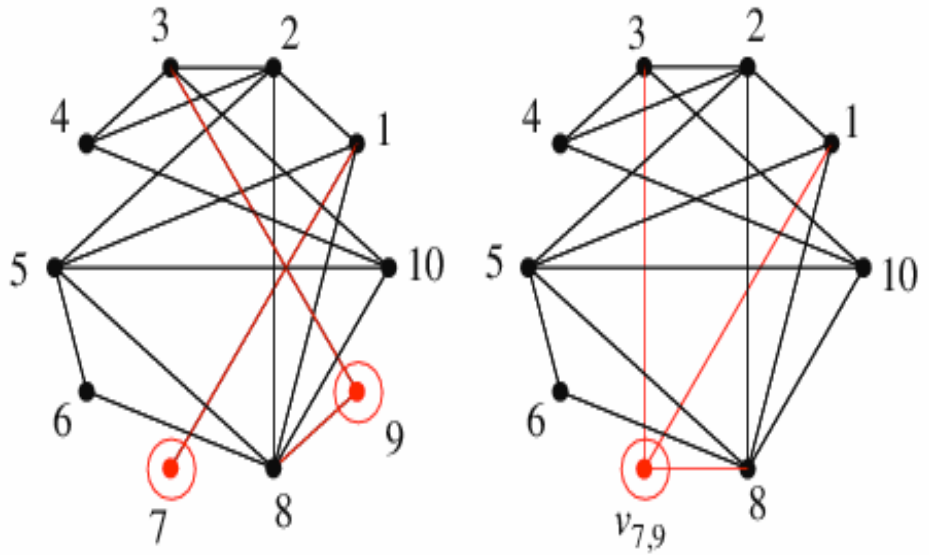
University of Sri Jayawardanapura

February 10, 2020

Outline

Contracting vertices

Contracting a pair of vertices, v_1 and v_2, replaces them by one vertex v such that v is adjacent to anything v_1 or v_2 had been. It does not matter whether v_1 and v_2 are connected by an edge; if they are, then the edge disappears when v_1 and v_2 are contracted.



Contract Command in **Maple**

Contract

The *contract* command contracts the specified edge of a graph. By default, all the loops and multiple edges are removed. By setting multi=true, the loops and multiple edges are preserved and the output is a weighted graph.
To contract multiple edges in a graph, use the foldl command.

Maple command : *contract*

Inducing and Permuting Subgraphs

Induced Subgraphs

An *induced subgraphs* of a graph G is a subset of the vertices of G together with any edges whose endpoints are both in this subset. Deleting a vertex from a graph is identical to inducing a subgraph of the remaining $n - 1$ vertices.

Permuting Subgraph

This is not induced a subgraph, but permutes the (vertices) embedding of the graph according to the given permutation.

Maple command : *InducedSubgraph*, *PermuteVertices*

Graph Union and Graph Join

Graph Union

The *graph union* operation takes two or more graphs and returns a graph that is formed by taking the union of the vertices and the edges of the graphs.

Remark: Maple does not support graph union in that sense but with restrictions.

Graph Join

The *join* of two graphs is their union, with the addition of all edges and vertices, spanning the different graph.

Maple command : *GraphUnion*, *GraphJoin*

Products of Graphs

The Product

The *product* $G_1 \times G_2$ of two graphs has a vertex set define by cartisian product of the vertex sets of G_1 and G_2. There is an edge between (u_1, v_1) and (u_2, v_2) if $u_1 = u_2$ and v_1 is adjacent to v_2 in G_2 or $v_1 = v_2$ and u_1 is adjacent to u_2 in G_1.

Maple command : *CartesianProduct*

Line Graphs

Line Graph $L(G)$

The *line graph* $L(G)$ of a graph G has a vertex of $L(G)$ associated with each edge of G and an edge of $L(G)$ if and only if two edges of G share a common vertex.

Line graphs are a special type of intersection graph, where each vertex represents a set of size 2 and each edge connects two sets with a nonempty intersection.

Maple command : *LineGraph*

THE END