Decomposition of Graphs: Graph Basics

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Graph Algorithms
Data Structures and Algorithms

Learning Objectives

- Provide examples of the types of objects modelled by graphs.
- Understand the formal definition of a graph.
- Draw and read pictures of graphs.

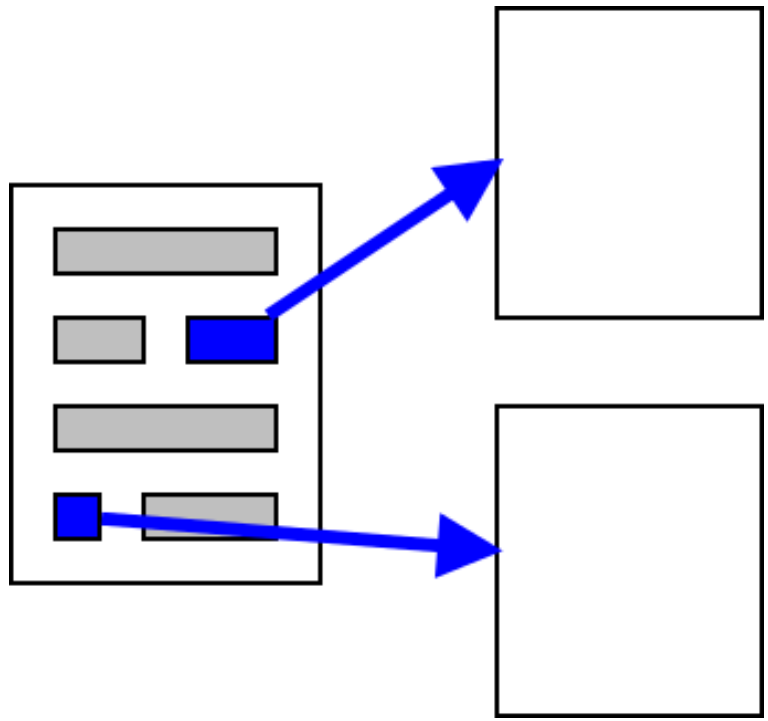
Outline

Graphs

- Represents connections between objects.
- Describe many important phenomena.

Internet

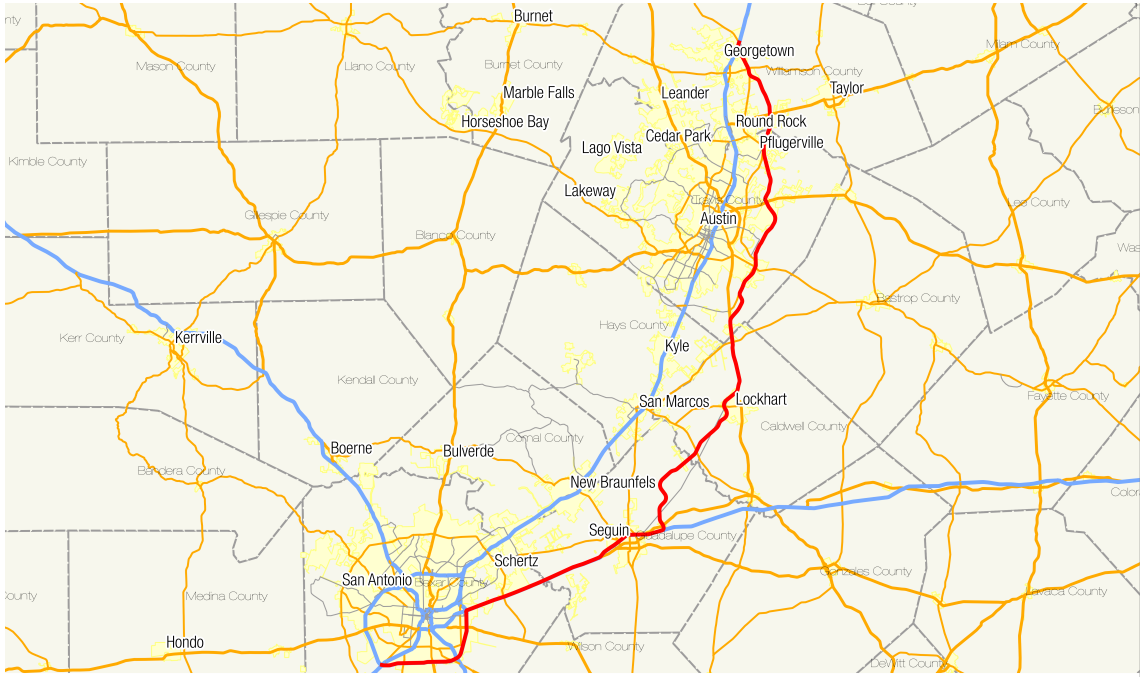
Webpages connected by links.



This is important for Google's page rank.

Maps

Intersections connected by roads.

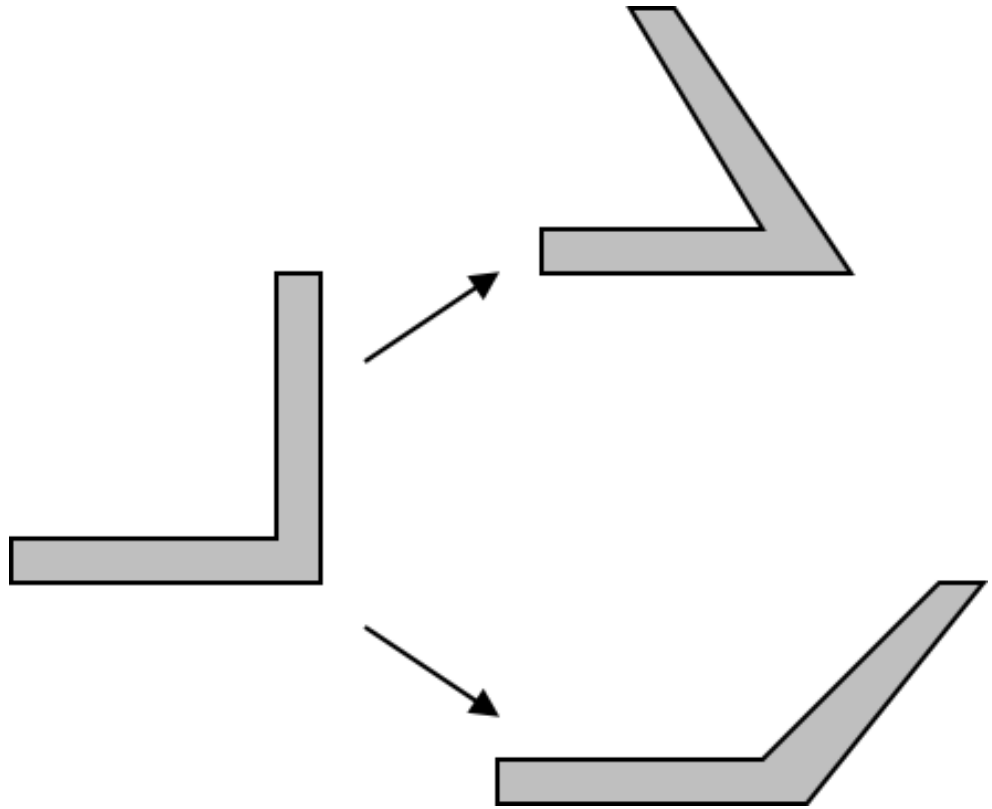


Social Networks

People connected by friendships.

Configuration Spaces

Possible configurations connected by motions.



Outline

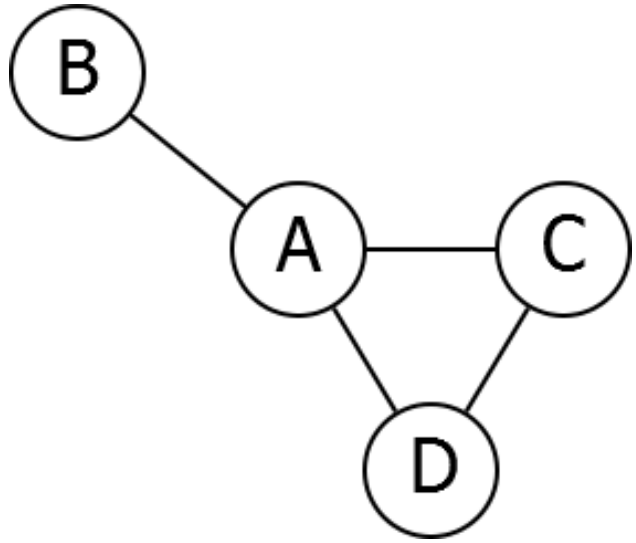
Formal Definition

Definition

An (undirected) Graph is a collection V of vertices, and a collection E of edges each of which connects a pair of vertices.

Drawing Graphs

Vertices: Points. Edges: Lines.

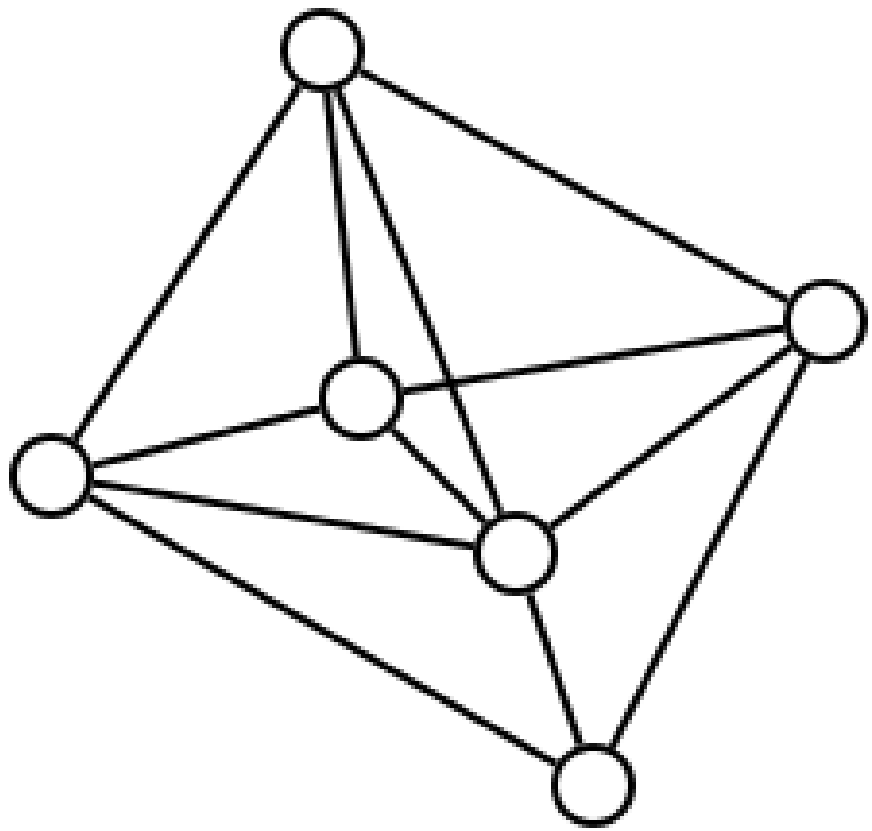


Vertices: A, B, C, D

Edges: (A, B), (A, C), (A, D), (C, D)

Problem

How many edges are in the graph given below?



Answer

12.

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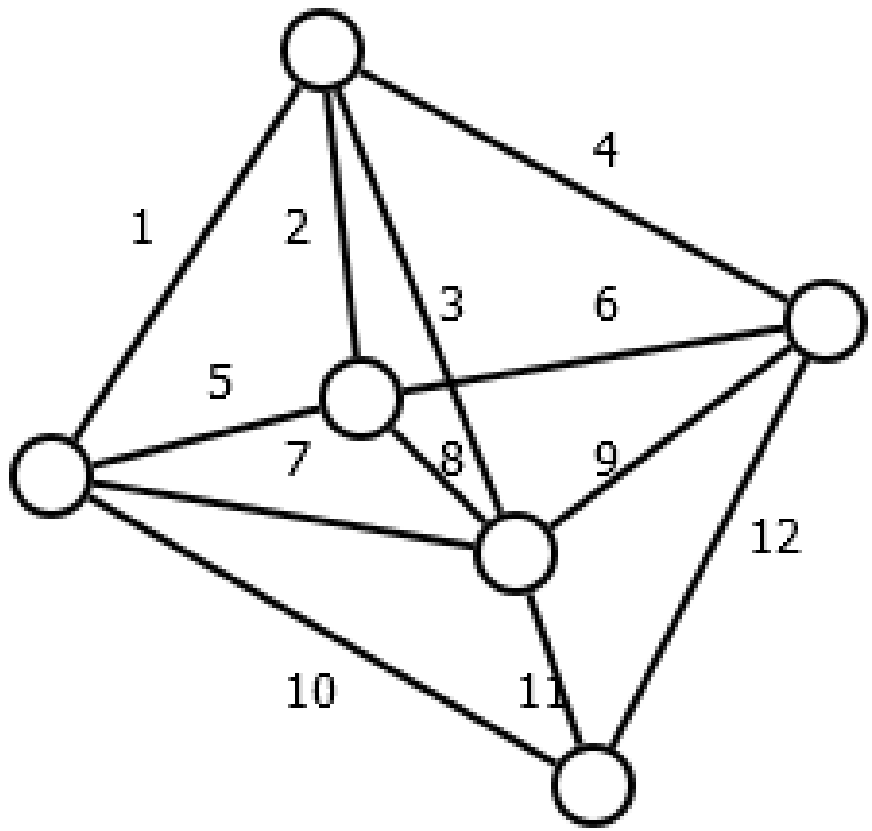
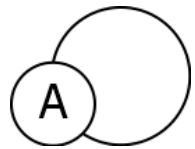


Loops and Multiple Edges

Loops connect a vertex to itself.



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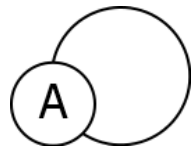
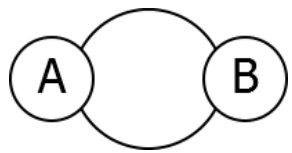


Multiple edges between same vertices.



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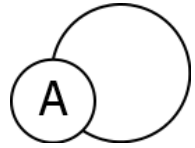

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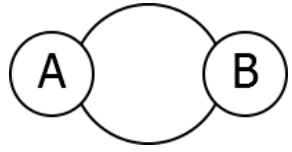

If a graph has neither, it is simple.

Next Time

- Computer representation of graphs.
- Runtimes for graph algorithms.