COMP0005 Algorithms

Graphs

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Undirected Simple Graph

An undirected simple graph G is a two-tuple

$$G = (V, E) \tag{1}$$

Where

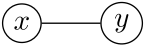
1. V is the set of vertices (or nodes, points)
2. E is the set of edges (or links) where each edge connects two vertices
   - Not allowing *self-loops*:

     $$E \subseteq \{(x, y) \mid (x, y) \in V^2 \wedge x \neq y\} \tag{2}$$

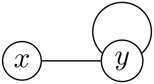
   - Allowing *self-loops*:

     $$E \subseteq \{(x, y) \mid (x, y) \in V^2\} \tag{3}$$

No *self-loops*



Allowing *self-loops*



Directed Simple Graph

A directed simple graph G is a *graph* in which *edges* have orientation

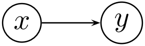
$$G = (V, A) \tag{4}$$

Where

1. V is the set of vertices (or nodes, points)
2. A is the set of directed edges where each edge connects two vertices with a direction

Directed Edge

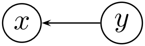
In a directed simple graph, each edge (x, y) connects *vertex* $x \to y$.



For the directed edge (x, y) from $x \to y$

- x is the tail of the edge
- y is the head of the edge

The edge (y, x) is the inverted edge of (x, y)



Directed Edge

It is also possible for a *loop* (or *cycle*) to form between nodes