Graphs

Goldsmiths Computing

Motivation

Many, many problems can be expressed in terms of graphs.

Definition

A graph is a set of vertices (nodes) which are linked by zero or more edges from nodes to nodes, each of which can have a weight.

Operations

vertices	return the collection of vertices {v} in the graph
edges	return the collection of edges {(u,v)} in the graph
addVertex[v]	add vertex v to the graph
addEdge[e]	add edge e to the graph
neighbours[v]	return the collection of vertices directly reachable from v
weight[u,v]	return the weight of the edge between u and v
constructor(V, E)	make a new graph with with given vertex and edge collection

Edge operations

from	return the source vertex of this edge
to	return the destination vertex of this edge
weight	return the weight of this edge

Representations

adjacency matrix a matrix of edge information linking vertices

adjacency list an array of vertices, each vertex contaning edges from that vertex

edge list a list of edges in the graph, along with a set of vertices

Other definitions

Directed

A directed graph has edges that are one-directional: an edge from u to v does not imply an edge from v to u.

Undirected

An undirected graph has two-directional edges: an edge from u to v with weight w implies an edge from v to u with weight w.

Tree

A tree (in the context of graphs) is an undirected graph where any two vertices are joined by exactly one path.

Directed acyclic

A directed acyclic graph or DAG is a directed graph where no sequence of edges returns to its starting point.

Work

1. Reading:
    - CLRS, chapter 22
    - Drozdek, section 8.1
    - DPV, section 3.1