

Networks

Vertex (plural Vertices)

An object, represented with a dot.

Edge

A connection between two vertices represented with a line or an arrow.

Loop

An edge that connect from an vertex to itself.

Graph

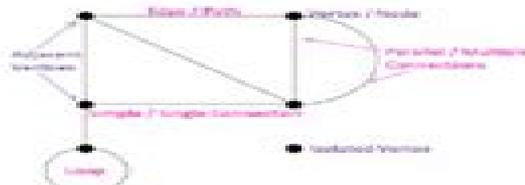
A collection of vertices that are connected (or not) to each other using edges in some specific way.

The Degree of a Vertex

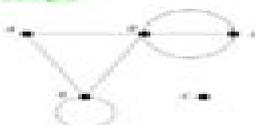
The number of edges connected to a vertex.

A loop counts as two edges for the degree.

Vertices are classified as even or odd if their degree is an even number or odd number.



Example



Degrees

Deg(A) = 2
 Deg(B) = 2
 Deg(C) = 4
 Deg(D) = 2
 Deg(E) = 1

Handshaking Lemma

Every edge is counted by the degree of two vertices.
 Sum of vertex degrees = 2 x number of edges.

A loop counts as one edge in the number of edges.

Direction on Graphs

Undirected Graph

A graph where the edge between two vertices acts in both directions.



Directed Graph / Digraph

A graph where specific direction is indicated for every edge. Some vertices may not be reachable from other vertices.



Undirected Graphs

Types of Networks



Graph Type	Number of Edges with n vertices
Complete	$\frac{n(n-1)}{2}$
Connected	$n-1$

Types of graphs

Simple graph – No loops or duplicate edges.

Isolated vertex – A graph has an isolated vertex if there is a vertex that is not connected to another vertex by an edge.

Degenerate graph – Degenerate graphs have all vertices isolated. Therefore, there are no edges in the graph at all.

Connected graph – Each vertex is either directly or indirectly connected to every other vertex.

Bridge – A bridge is an edge that when removed makes the graph unconnected.

Subgraph – Are graphs that are part of larger graphs.

Equivalent (isomorphic) graph – Look different but have the same information

Complete graph – Every vertex has a direct connection to every other vertex.

Bipartite Graph – A bipartite graph is a graph whose set of vertices can be split into two subsets X and Y in such a way that each edge of the graph joins a vertex in X and a vertex in Y.

Isomorphic graphs – Two graphs have: ① same numbers of edges and vertices; ② corresponding vertices have the same degree and the edges connect the same vertices.

The Mathematics Of Networks

Padhraic Smyth



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