

GRAPH MODELLING

Graphs are discrete structures that consist of vertices and edges that connect these vertices. There are different kinds of graphs depending on whether they have directions, whether multiple edges can connect the same pair of vertices, whether loops are allowed and whether these graphs are weighted. Problems in every conceivable discipline can be solved using graph models.

A graph $G = (V, E)$ consists of V , a non-empty set of vertices (or nodes) and E a set of edges. Each edge has either one or two vertices associated with it, called its endpoints. An edge is said to connect its endpoints.

Graphs are extensively used to model social structures based on different kinds of relationships between people or groups of people. These social structures and the graphs that represent them are known as **social networks**. In these graph models, organizations or individuals are represented by vertices and the relationships between them are represented by edges.

The following graph is a small social network graph of type **Acquaintanceship or friendship graph G**. Friendship graphs are used to represent whether two people know each other, or whether they are friends. Each person in a particular group of people is represented by a vertex, and an undirected edge is used connect two people when these people know each other. When we are only concerned with acquaintanceship or whether they are friends, no multiple edges or loops are used. In the friendship graph below, we can say that **Caleb and Brick** know each other, or they are friends because there is an undirected edge between them. We can also say that **Spencer and Katz**, **Spencer and Amana**, **Katz and Amana** all know each other because there are undirected edges connecting each of them. We also see that from this group of people, Ragnar knows exactly one person because there is only one edge incident with him, and Spencer is the most famous person from this group because he has the largest number of edges incident with him.

Tip/ There is an undirected edge between two people if these people know each other. The total number of edges incident with a vertex or a person in this case of friendship graph is equals to the degree of that vertex and is equals to the number total number of people this person knows in the group.

The degree of a vertex in an undirected graph is the number of edges incident with it, except that a loop at a vertex contributes twice to the degree of that vertex. The degree of a vertex v is denoted by $\deg(v)$.

For example, the degree of **Ragnar is 1**, the degree of **Spencer is 10**, the degree of **West is 3**, the degree of **Kent is 4**, etc.

The acquaintanceship graph of all the people in the world has over six billion vertices and probably more than one trillion edges.

Friendship Graph G

