Basic definitions

Definition 1 *A* directed graph *(shortened:* digraph*) is a pair* $G = (V, E)$ *where* V *is any nonvoid finite set and* $E \subseteq V \times V$*.*

Note that E may be empty.

An element of V is called a *vertex* (pl. *vertices*). An element of E is called an *edge*.

The definition of a graph allow (almost) anything as the set of vertices (V). The vertices will be some objects from the modeled problem universe: towns, road intersections, people, activities, machine states, etc.

The edges may represent any relations between the real-world objects corresponding to vertices: the existence of a direct road, the existence of an indirect road (maybe passing through other towns), boss–subordinate relationships, prerequisites (an activity that depends on another), etc.

The following names and notations are used:

endpoints: If $e = (x, y) \in E$ is an edge, then x and y are called *endpoints* of e. x is called the *source* or *origin* of e, and y is called the *target* of e.

incidency: $x \in V$ is an endpoint of $e \in E$, then we say that e is incident to x. The set of edges incident to a vertex x will be written in this booklet as $I(x)$. If x is the target of e we will say that e is *inbound* to x; the set of inbound edges to a given vertex x will be denoted as $I^{\text{in}}(x)$. If x is the source of the edge e, we will say that e is *outbound* to vertex x; the set of outbound edges of a vertex x will be written as $I^{\text{out}}(x)$.

adjacency: $x \in V$ and $y \in V$ are *adjacent* if $(x, y) \in E$, that is, there is an edge between them;

neighbors: two adjacent vertices are called *neighbours* to each other.

degree: The number of edges starting (i.e. having as source) from vertex x is called the *out-degree* of x and written as $\deg^{\text{out}}(x)$. The number of edges ending (having as target) at a vertex x is called the *in-degree* of x and written as $\deg^{\text{in}}(x)$.