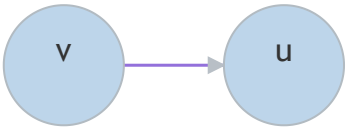
Graph theory

Glossary

- **Graph G (V, E)**:
  - **V**: vertices set
  - **E**: edges set
- **Degree**: number of vertices
- **Walk**: series of connected vertices
- **Path**: walk without repeated vertices
- **Closed walk**: walk where $v_0 = v_n$
- **Cycle**: closed walk without repeating vertices
- **Euler path**: visit each edge once
- **Hamilton path**: visit each vertex once
- **Directed graph**: edges are ordered pairs
- **Ancestor**: v, **Successor**: u in



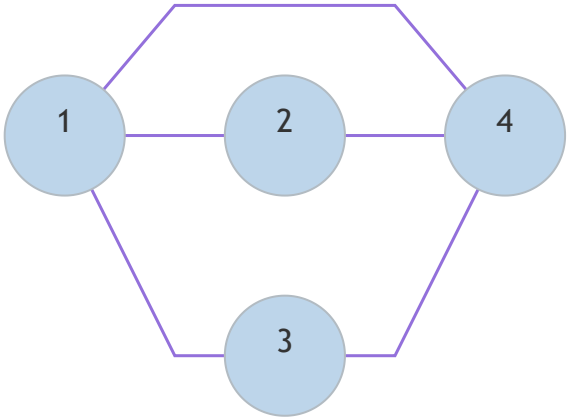
- **$\deg_{in}(v)$**: number of incoming edges into v
- **$\deg_{out}(v)$**: number of outgoing edges into v

Graph Representation

Adjacency matrix

matrix where $A_{uv} = \begin{cases} 1 & \text{if} (u,v) \in E \\ 0 & \text{otherwise} \end{cases}$

Graph:



Matrix:

$$\begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{pmatrix}$$

Adjacency list

Array of linked lists, where Adj[u] contains a list containing all the neighbors of u.

Graph: Same as above

List: