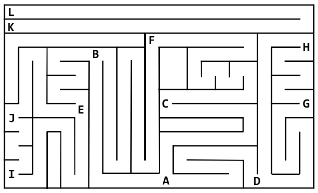
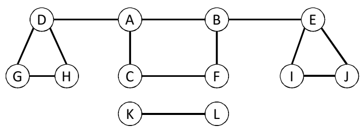
https://www.cs.upc.edu/~jordicf/Teaching/AP2/pptx/10_Graphs_Connectivity.pptx

## Reachability: exploring a maze



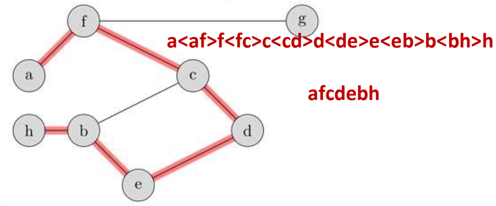




Which vertices of the graph are reachable from a given vertex?



## 2.3 Connectivity

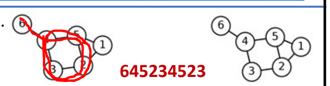
**Definition 2.8:** *Consider a graph G. A* $(\mathbf{v_0}, \mathbf{v_k})$*-**walk** in G is an alternating sequence* $[v_0, e_1, v_1, e_2 \ldots v_{k-1}, e_k, v_k]$ *of vertices and edges from G with* $e_i = \langle v_{i-1}, v_i \rangle$*. In a **closed walk**,* $v_0 = v_k$*. A **trail** is a walk in which all edges are distinct; a **path** is a trail in which also all vertices are distinct. A **cycle** is a closed trail in which all vertices except* $v_0$ *and* $v_k$ *are distinct.*



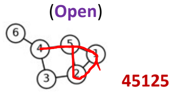

**Definition 2.9:** *Two distinct vertices u and v in graph G are **connected** if there exists a* $(u, v)$ *− path in G. G is **connected** if all pairs of distinct vertices are connected.*

https://math.stackexchange.com/questions/655589/what-is-difference-between-cycle-path-and-circuit-in-graph-theory

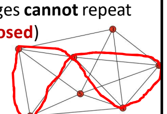
**Walk**: Vertices may repeat.
Edges may repeat
(Open or Closed)




**Trail** : Vertices may repeat.
Edges **cannot** repeat
(Open)




**Circuit**: Vertices may repeat.
Edges cannot repeat
(Closed)



https://wiki.sagemath.org/interact/graph_theory

**Path**: Vertices **cannot** repeat.
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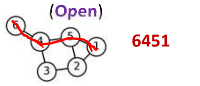
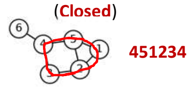
(Open)




**Cycle**: Vertices **cannot** repeat.
Edges **cannot** repeat
(Closed)




https://en.wikipedia.org/wiki/File:6n-graf.svg

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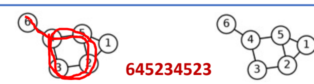


**Trail** : Vertices may repeat.
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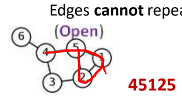
(Open)




**Circuit**: Vertices may repeat.
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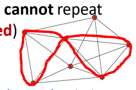
(Closed)



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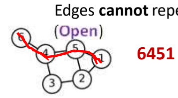


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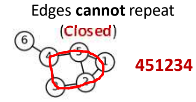


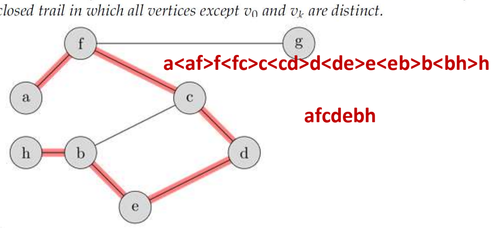

Path ⊂ Trail ⊂ Walk

Cycle ⊂ Circuit ⊂ Closed Walk

https://en.wikipedia.org/wiki/File:6n-graf.svg

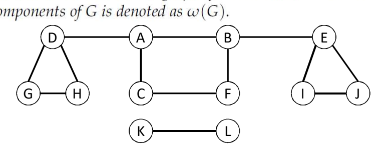
## 2.3 Connectivity

**Definition 2.8:** *Consider a graph G. A* $(\mathbf{v_0}, \mathbf{v_k})$*-**walk** in G is an alternating sequence* $[v_0, e_1, v_1, e_2 \ldots v_{k-1}, e_k, v_k]$ *of vertices and edges from G with* $e_i = \langle v_{i-1}, v_i \rangle$*. In a **closed walk**,* $v_0 = v_k$*. A **trail** is a walk in which all edges are distinct; a **path** is a trail in which also all vertices are distinct. A **cycle** is a closed trail in which all vertices except* $v_0$ *and* $v_k$ *are distinct.*




**Definition 2.9:** *Two distinct vertices u and v in graph G are **connected** if there exists a* $(u, v)$ *− path in G. G is **connected** if all pairs of distinct vertices are connected.*

**Definition 2.10:** *A subgraph H of G is called a **component** of G if H is connected and not contained in a connected subgraph of G with more vertices or edges. The number of components of G is denoted as* $\omega(G)$*.*




**Definition 2.11:** *For a graph G let* $V^* \subset V(G)$ *and* $E^* \subset E(G)$*.* $V^*$ *is called a **vertex cut** if* $\omega(G - V^*) > \omega(G)$*. If* $V^*$ *consists of a single vertex v, then v is called a **cut vertex**. Likewise, if* $\omega(G - E^*) > \omega(G)$ *then* $E^*$ *is called an **edge cut**. If* $E^*$ *consists of only a single edge e, then e is known as a **cut edge**.*