- Pa1 ext 1 day
- new examples Queue & stack as array.

<u>Exercise</u>

re-create List ADT from Pa1 based on an Array data structure (use array doubling.)

Graph Theory handout:

A Graph is a pair of sets

$$G = (V, E)$$

where

$V \neq \emptyset$ (vertices)

$E \subseteq V^{(2)} = \{2\text{-element subsets of } V\}$

Pic: $\{x, y\}$ 

undirected edge

xy

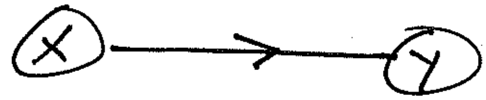
A Digraph is a pair of sets

$$G = (V, E)$$

where

$V \neq \emptyset$, $E \subseteq V \times V$

Pic: (x, y)

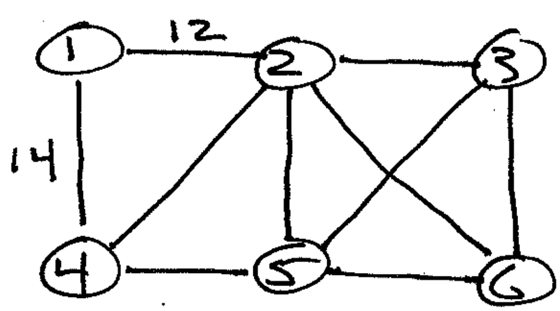


directed edge

origin terminus

Ex. $V = \{1, 2, 3, 4, 5, 6\}$

$E = \{12, 14, 23, 24, 25, 26, 35, 36, 45, 56\}$



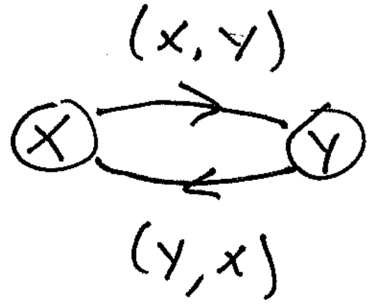
1 is adjacent to 2
ends
join
12 is incident to 1
12 is adjacent to 14

note: in a graph

and

are not allowed

<u>but</u> in a digraph:



are allowed.

• <u>Walk</u> from x to y is a sequence

$$x = v_0, v_1, v_2, \ldots, v_k = y \quad \left(\begin{matrix}\text{length} \\ = k\end{matrix}\right)$$

in which $\{v_{i-1}, v_i\} \in E(G)$ $(1 \le i \le k)$

a walk is closed if $x = y$.

- trail is a walk in which no edge is repeated.

- Path is a trail in which no vertex is repeated (except possibly in case $x=y$.)

- length (walk, trail, path) is the # of edge traversals

- a walk trail or path is trivial if length $=0$.

- a non-trivial closed path is called a cycle.

We say y is <u>reachable</u> from x iff G contains an x-y <u>Path</u>.

<u>Defn</u>

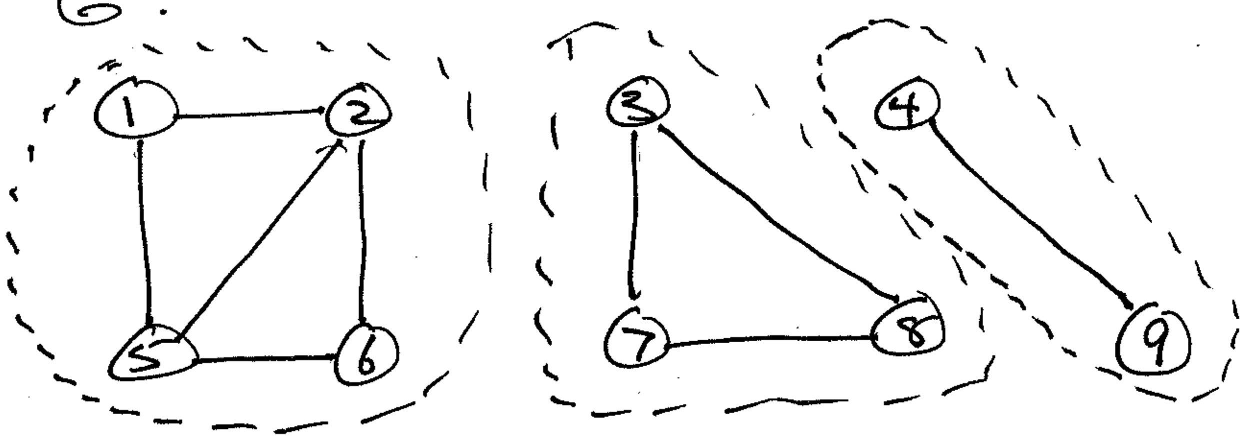
a graph G is called <u>connected</u> iff for all $x, y \in V(G)$: x is reachable from y, and y is reachable from x.

<u>Defn</u> a subgraph H of G is called a <u>connected component</u> of G iff

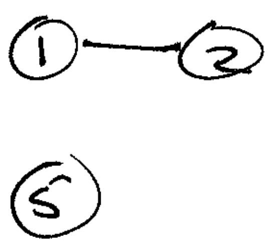
(1) H is connected, and

(2) H is maximal w.r.t. (1).

<u>Ex.</u> G:

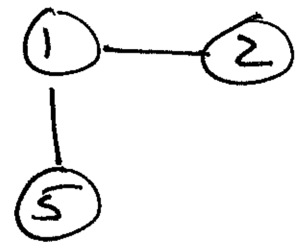


- subgraph ({1, 2, 5}, {12})



<u>Disconnected</u>

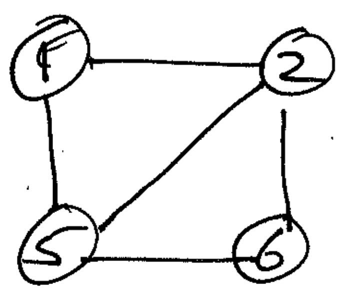
- subgraph $(\{1,2,5\}, \{12, 15\})$



<u>connected</u>

not a conn. comp.

- subgraph $(\{1,2,5,6\}, \{12, 15, 25, 26, 56\})$



connected maximal

The <u>distance</u> from x to y

$$\delta(x,y) = \begin{cases} \text{len. of a shortest } x\text{-}y \text{ Path, if } y \text{ reachable from } x \\ \infty \text{ if } y \text{ not reachable from } x \end{cases}$$