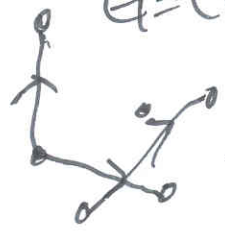


Def. 2 digraph
directed graph



$G=(V,E)$

$u,v \in V$
→ ordered pair



$(u,v) \neq (v,u), (u,u)$

Def. 1. ugraph

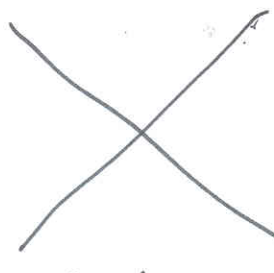
→ 2-element set



$\{u,v\} = \{v,u\}$

$\{u,u\} = \{u\}$

Pseudograph



1 or 2-elements set

$\{u,v\}$



$\{u\}$

self-loop.

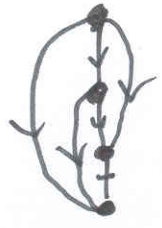
* Antisymmetric

if $(aRb \wedge bRa) \Rightarrow a=b$ aRa allowed

Asymmetric

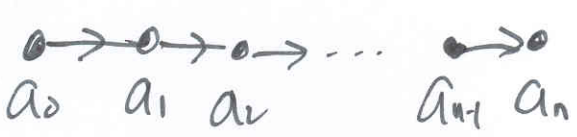
if $aRb \Rightarrow b \not R a$. aRa n.

Transitive



R^+ ? Transitive closure

Path



$n+1$ vertices

n edge

$(a_i, a_{i-1}) \in E, 0 \leq i < n$

length n

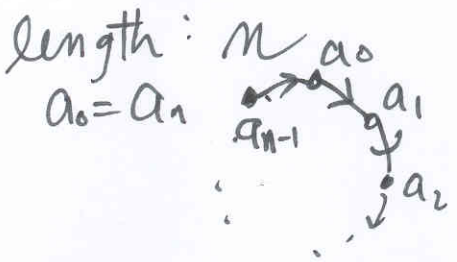
$a_0, a_1, a_2, \dots, a_n$

Seq. vertices (0)

$(a_0, a_1), (a_1, a_2), \dots, (a_{n-1}, a_n)$

n of edges (X)

Cycle



length: n
 $a_0 = a_n$

n vertices

n edges

length $n-1$

$a E^* b$: length ≥ 0
 $a E^+ b$: length ≥ 1

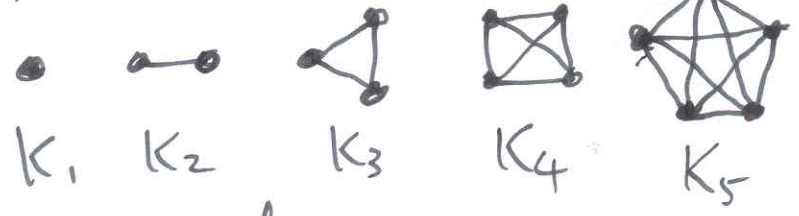


$$E^* = \bigcup_{i \in \mathbb{N}_0} E^i$$

$$E^0 = \{(a, a) \mid a \in V\}$$

$$E^+ = \bigcup_{i \in \mathbb{N}_1} E^i$$

Complete graph K_n

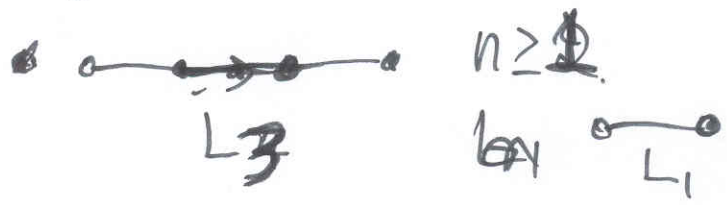


$K_n = ?$

Empty graph



Line



Cycle