

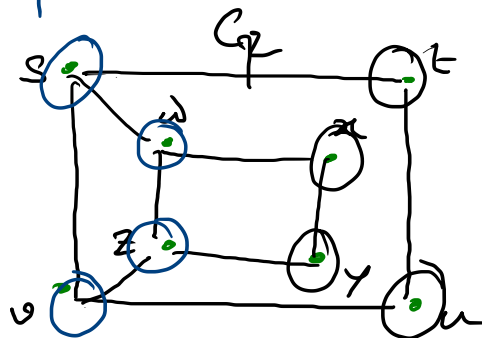
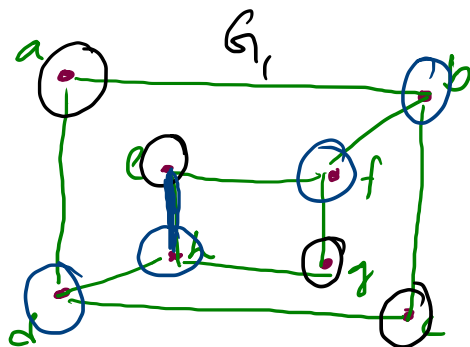
Isomorphism.

- ① Same # of elements despite different structure.
- ② A property preserved by isomorphism \rightarrow graph invariant.

③ Properties

1. Same no. of vertices.
 2. " " of edges.
 3. " " of vertices with same degree.
4. \rightarrow isomorphism function.

	G_1	G_2
# of V	8	8
# of E	10	10
# of V with same deg	$V^2 \rightarrow 4$ $V^3 \rightarrow 4$	$V^2 \rightarrow 4$ $V^3 \rightarrow 4$



$$f(G_1) \rightarrow G_2$$

A_{G_1}

	a	b	c	d	e	f	g	h
a	0	1	0	1	0	0	0	0
b	1	0	1	0	0	1	0	0
c	0	1	0	1	0	0	0	0
d	1	0	1	0	0	0	0	1
e	0	0	0	0	0	1	0	1
f	0	1	0	0	1	0	1	0
g	0	0	0	0	0	1	0	1
h	0	0	0	1	1	0	1	0

not preserved for

A_{G_2}

	s	t	u	v	w	x	y	z
s	0	1	0	1	1	0	0	0
t	1	0	1	0	0	0	0	0
u	0	1	0	1	0	0	0	0
v	1	0	1	0	0	0	0	1
w	1	0	0	0	0	1	0	1
x	0	0	0	0	1	0	1	0
y	0	0	0	0	0	1	0	1
z	0	0	0	1	1	0	1	0

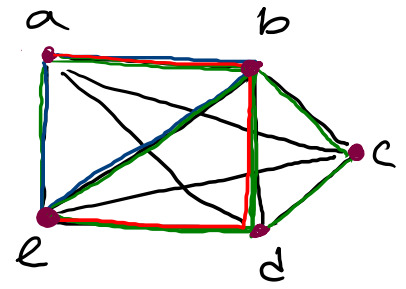
G_1, G_2 are not isomorphic.

10.4 Connectivity

① Path: $\dots \downarrow \dots \downarrow \dots \downarrow \dots$

② Simple path: \rightarrow a path with no repeating edges.

③ Circuits: \rightarrow



path \rightarrow $a-e$
 $a-b-d-e$
 $a-b-c-d-e$
 $a-b-d-e-b-d-e$

Circuit $\rightarrow a-b-e-a$

Simple path $\rightarrow a-b-c-d-e$

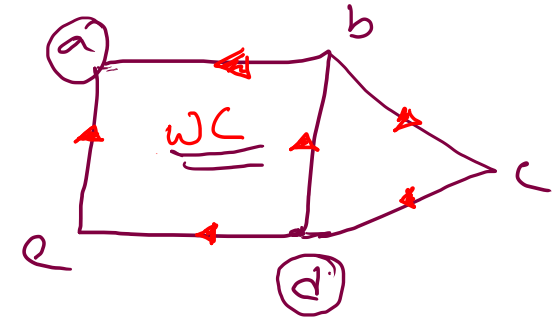
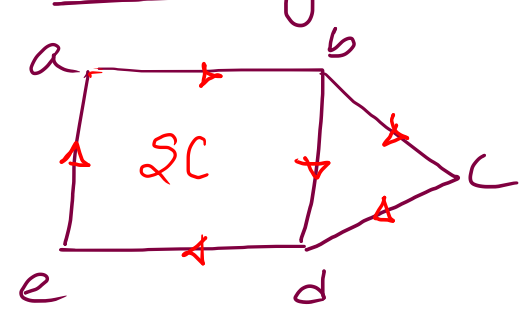
④ Connected Graph \rightarrow ctf.

⑤ Directed graphs

\rightarrow strongly connected.

\rightarrow weakly connected \rightarrow

$\left. \begin{matrix} \text{path}(a \rightarrow b) \\ \text{path}(b \rightarrow a) \end{matrix} \right\} a, b \in V$



10.5 Euler + Hamiltonian paths

⑧ * Euler \rightarrow "can repeat vertices. but not edges."

\rightarrow path \rightarrow Simple path with every edge of G .

\rightarrow ckt \rightarrow Simple ckt. " every edge of G .

\rightarrow every vertex must have even degree.

⑧ * Hamiltonian

\rightarrow passes through every vertex exactly once.

\rightarrow a graph with vertex of degree 1 does not have a HC