CS & IT ENGINEERING

DISCRETE MATHS
Graph theory

Lecture No. 05

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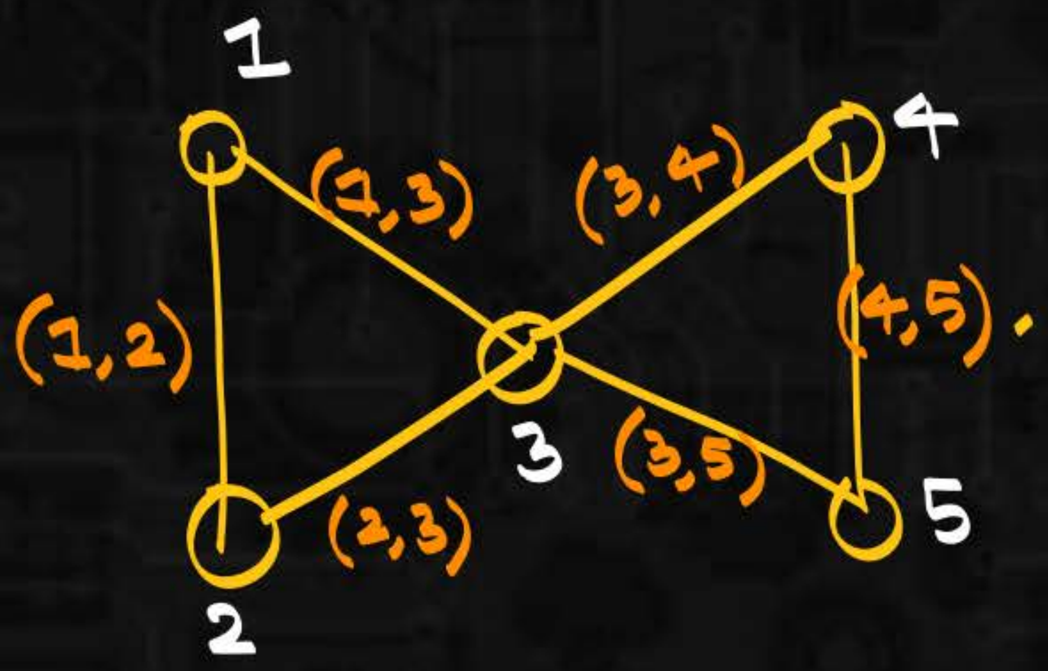
TOPICS

01 Inequality thm

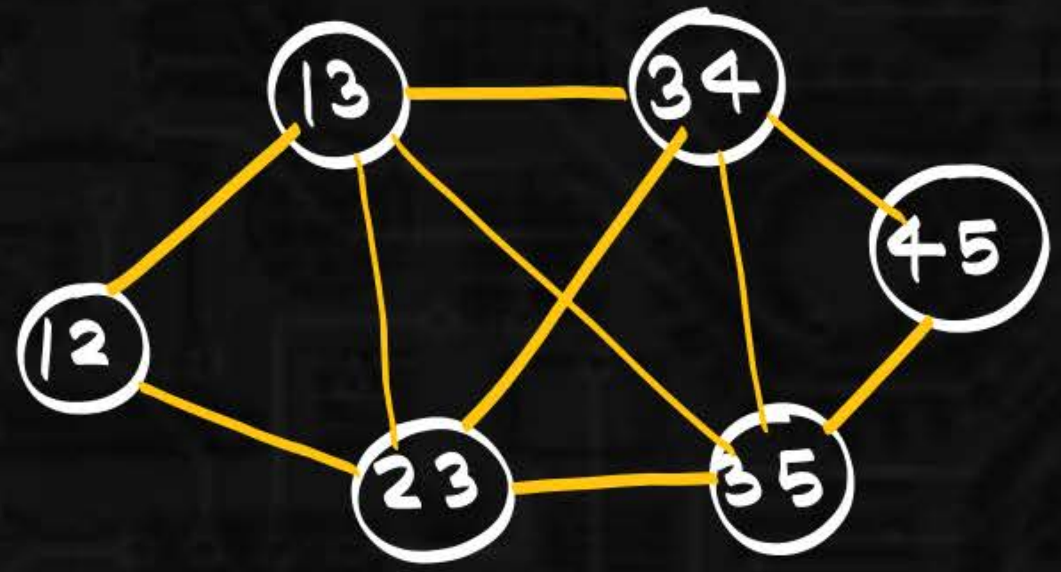
02 Types of graphs

03 Degree sequence

Line Graph (L(G))



G=(V,E)

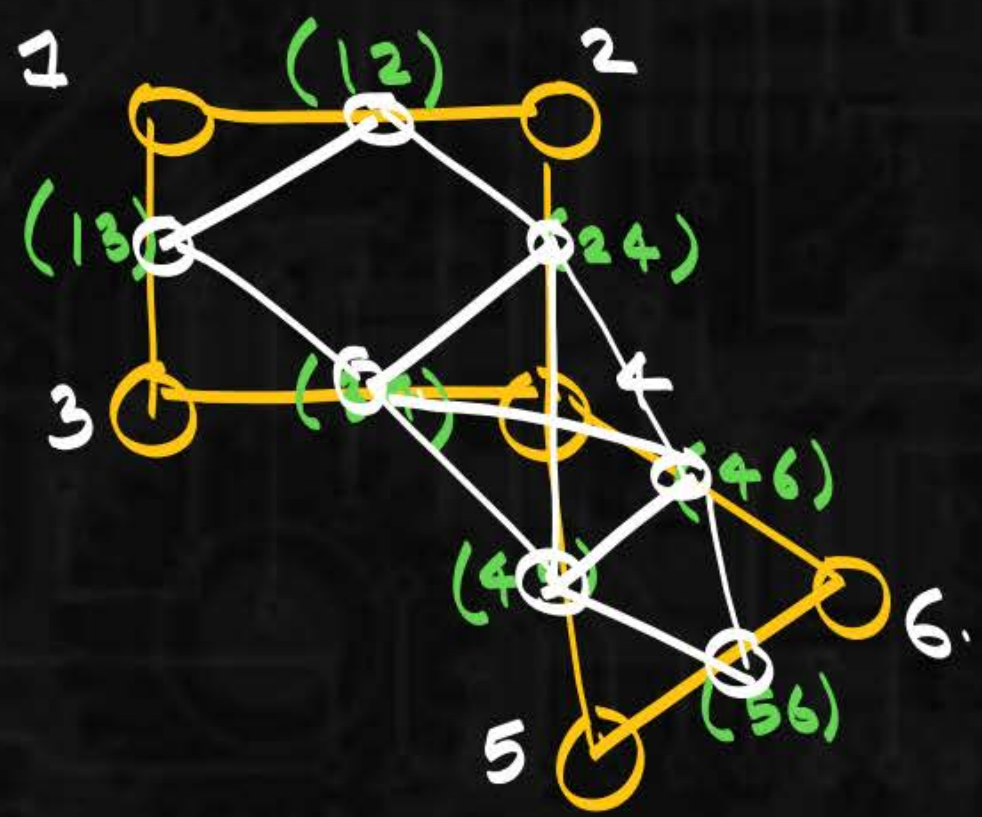


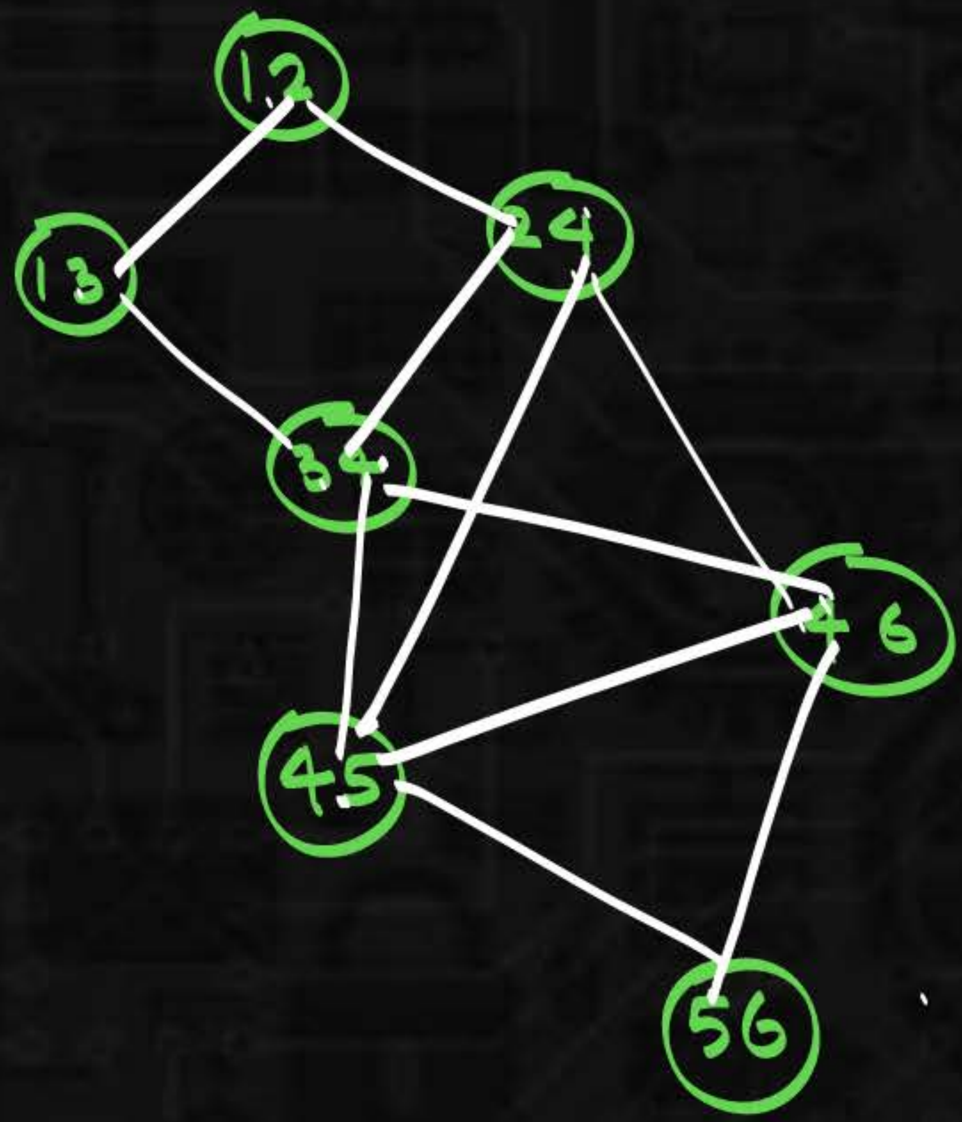
L(G).

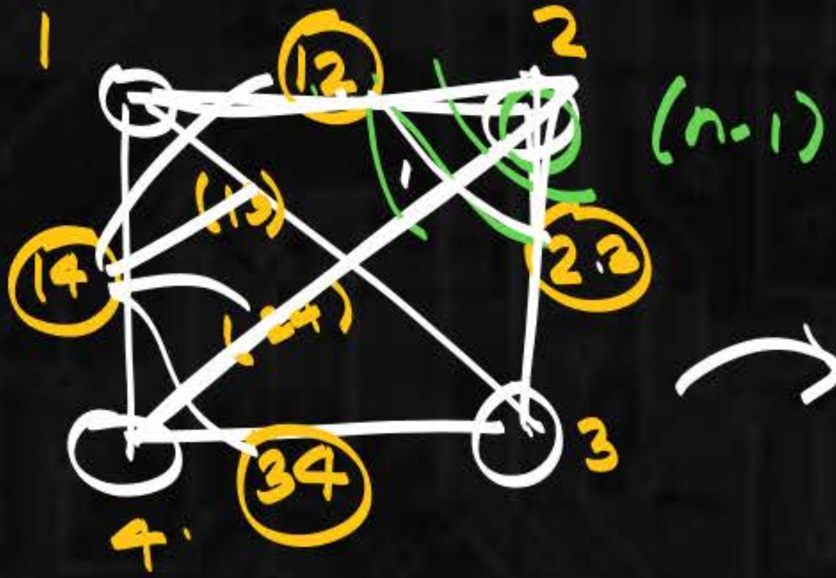
- → name the vertices in G.
- → name the edges based on end vertices

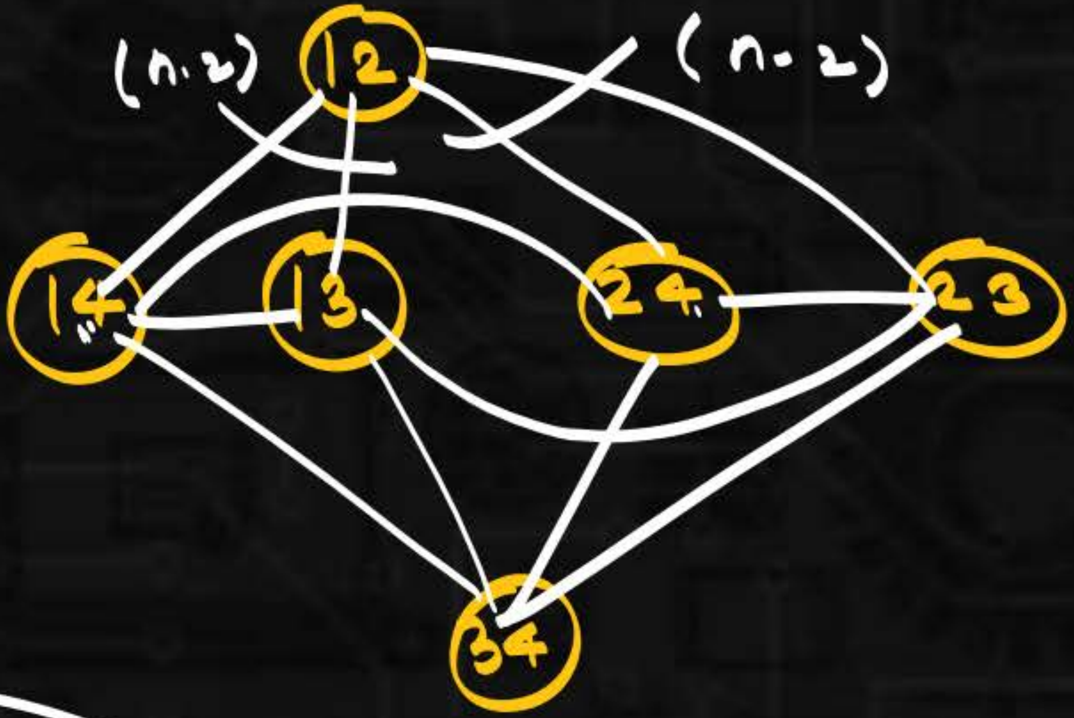
→ edge in G will become vertex in L(G)

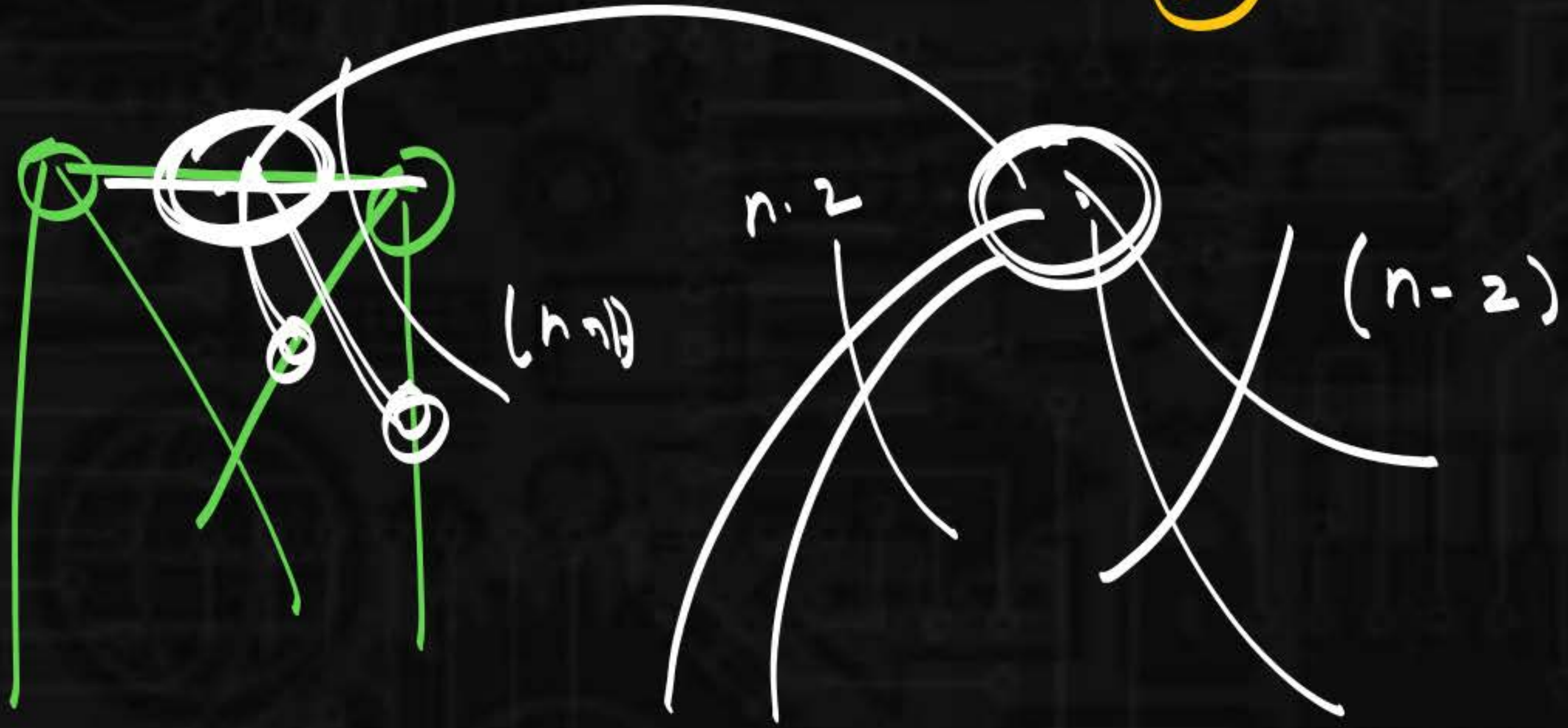
→ common end points connect it


1
(12)
2
(13)
(24)
3
4
(46)
(45)
6
5
(56)


12
13
24
34
46
45
56

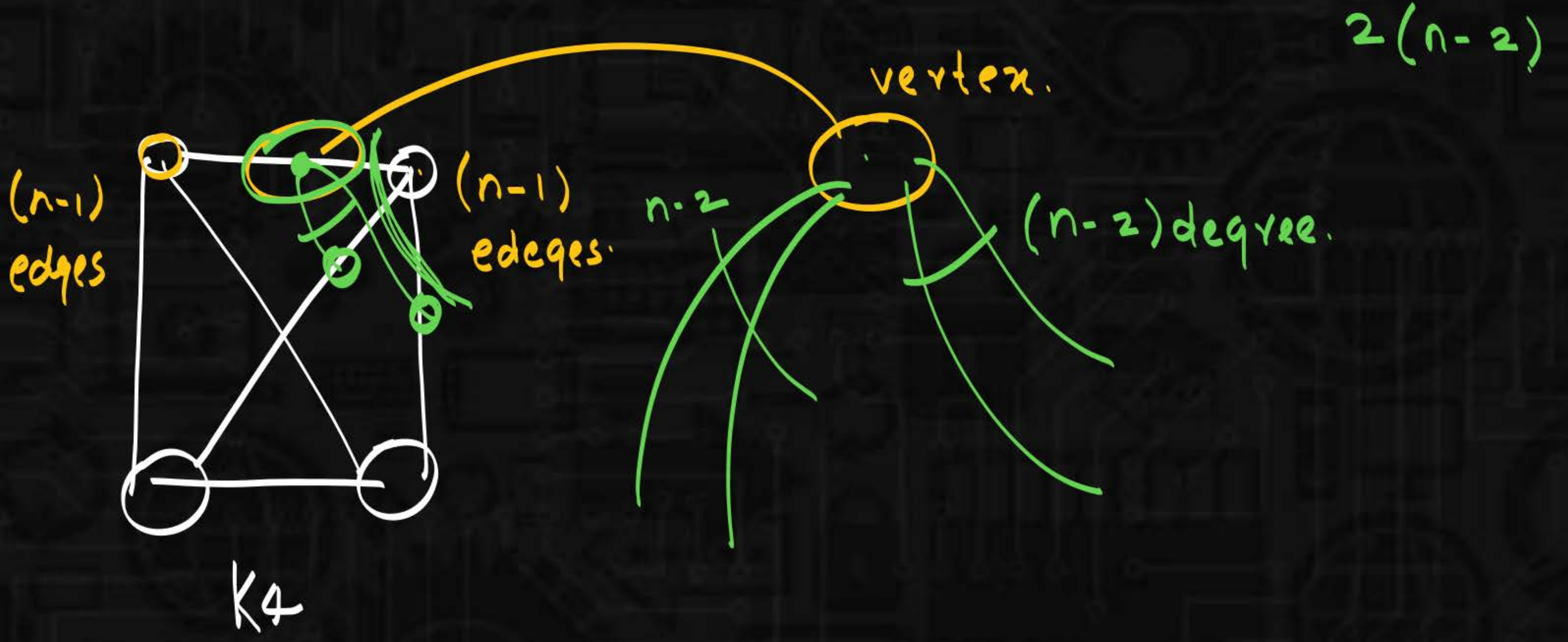

1
12
2
(n-1)
14
(13)
23
(24)
34
3
4


(n-2)
12
(n-2)
14
13
24
23
34


n-2
(n-2)

** $K_n \to$ complete Graph. Degree of each vertex is $(n-1)$.

Degree of $L(K_n) = 2(n-2)$.



→ Graph vertices are represented as n-bit signal.

two vertices are connected with each other, when there bit difference is changes by 1-bit, what will be total edges in the Graph ?

$n = 2$

2-bit signal.

Total vertices $= 2^2 = 4$.

00
01
10
11

$n = 3$

3-bit signal

Total vertices $= 2^3$

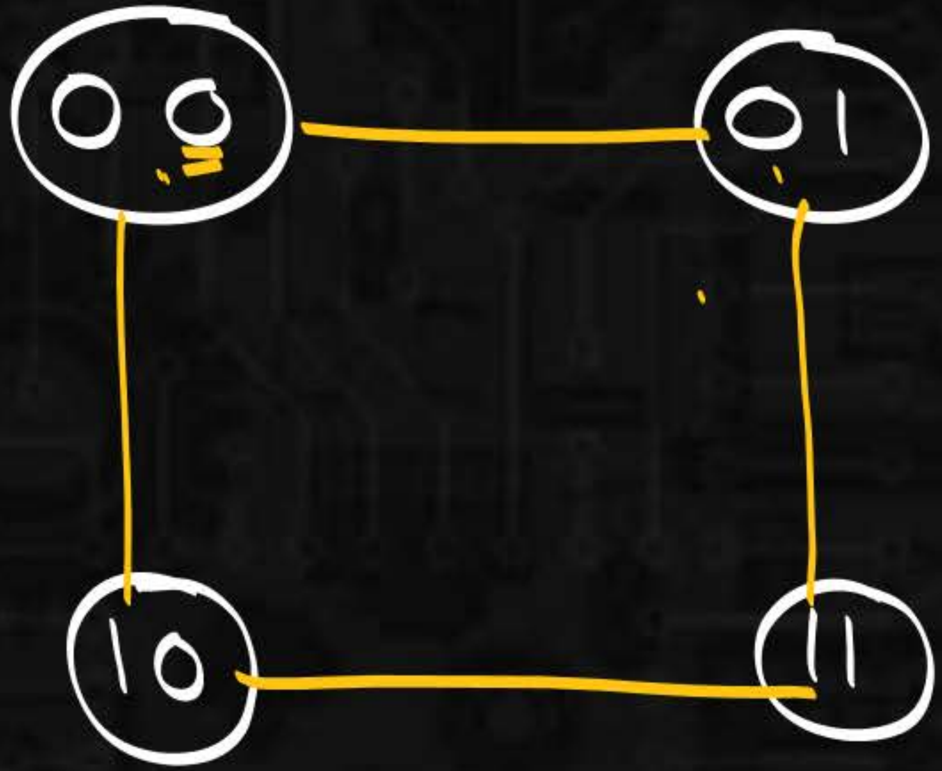
000 v_1
001
010
011
100
101
110
111

n-bit signal.

Total vertices $= 2^n$.

$n = 2$ bit

Total vertices $= 2^2 = 4$.

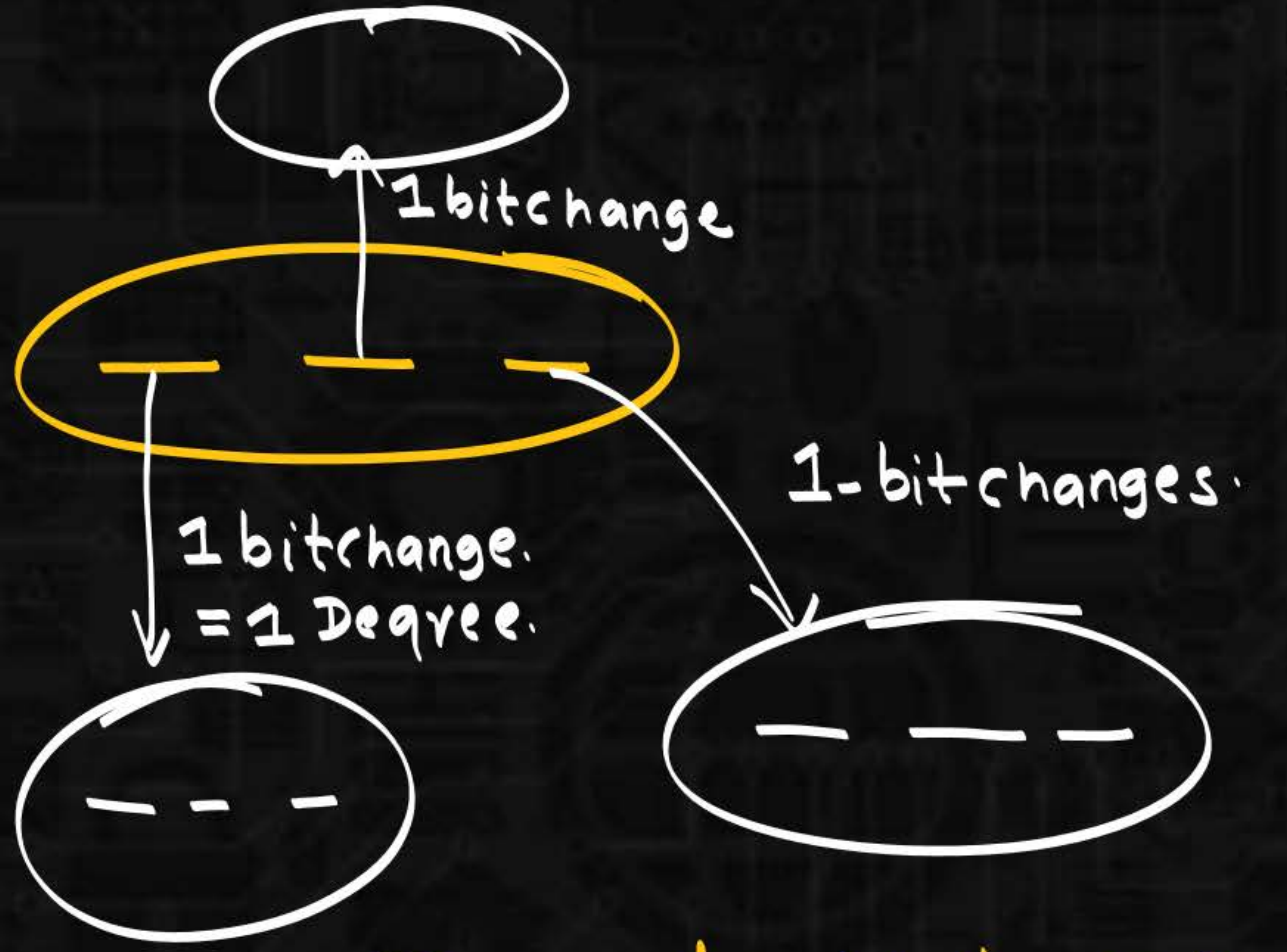


→ Degree of each vertex is 2.

$n = 3$

Total vertices $= 2^3 = 8$.

000
001
010
011
100
101
110
111



Degree of each vertex is 3.

n-bit signal.

Total vertices = 2^n.

Degree of each vertex is n.

$$\sum d(v_i) = 2e.$$

$$\boxed{e = n \cdot 2^{n-1}.}$$

$$2^n \times n = 2e.$$

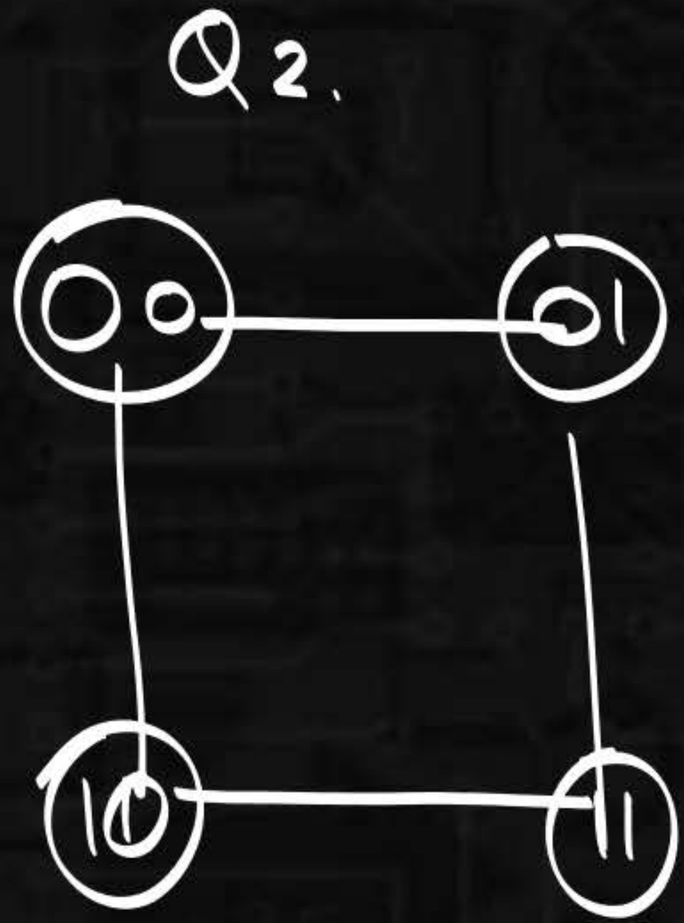
$$\frac{2^n \times n}{2} = e.$$

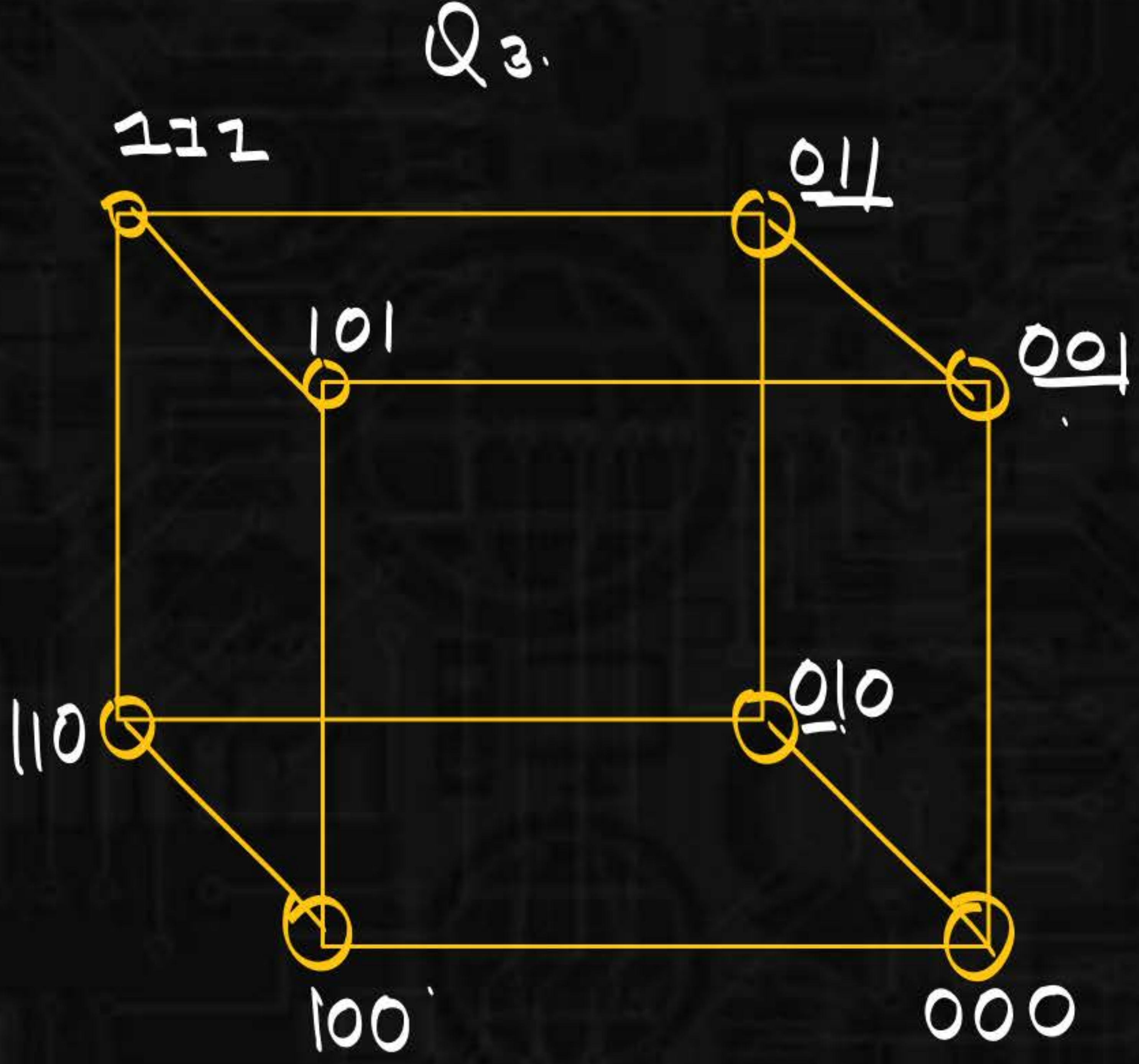
Hypercube (Q_n) $(n \geq 1)$ Total vertices ($V = 2^n$)

→ does not contains odd length cycle → Bipartite Graph.

↳ n-bit signal

Regular Graph.





Total vertices $V = 2^n$

$e(G) = n \cdot 2^{n-1}$

$e(G) + e(\bar{G}) = \dfrac{V(V-1)}{2}$

$n \cdot 2^{n-1} + e(\bar{G}) = \dfrac{2^n(2^n-1)}{2}$

$$\boxed{e(\bar{G}) = \frac{2^n(2^n-1)}{2} - n \cdot 2^{n-1}}$$

Total vertices $= V$

$V = 2^n$

K_V $V-1, V-1, V-1, \ldots \ldots V-1$

$G \rightarrow n, n, n, \ldots \ldots n$

$\bar{G}$, $V-1-n, V-1-n, V-1-n \ldots \ldots$

$2^n-1-n, 2^n-1-n, 2^n-1-n \ldots \ldots$

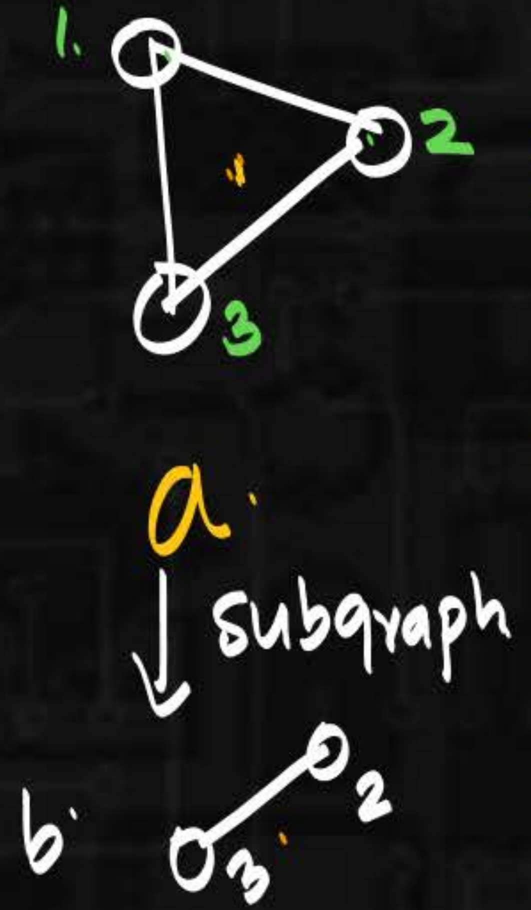
Subgraph ($\subset$)

$\rightarrow a \subset G$.

when all vertices & edges of a must be in G.

$\rightarrow$ edges end vertices in a must be same in G.

Graph $G = (V, E)$

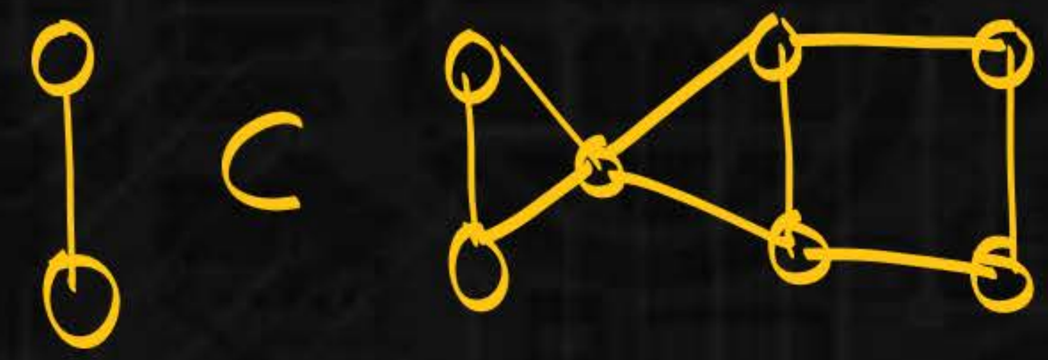


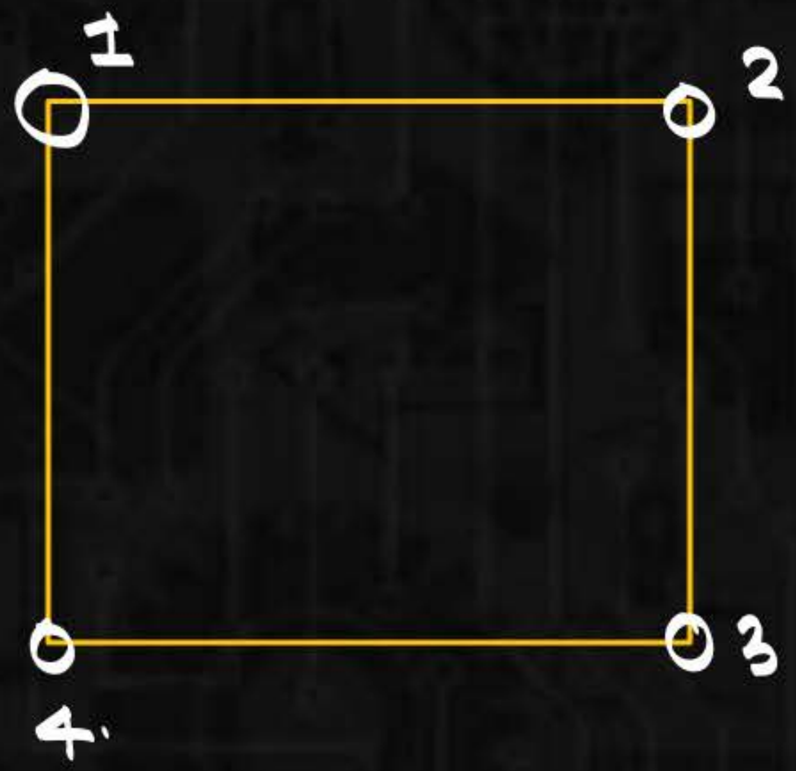
1. Every edge of G is subgraph of G.
2. Every vertex of G is subgraph of G.
3. Every Graph is subgraph of itself.
4. $b \subset a \subset G \rightarrow b \subset G$.

Subgraph of a subgraph of a Graph is Subgraph of a Graph.

a.

G.

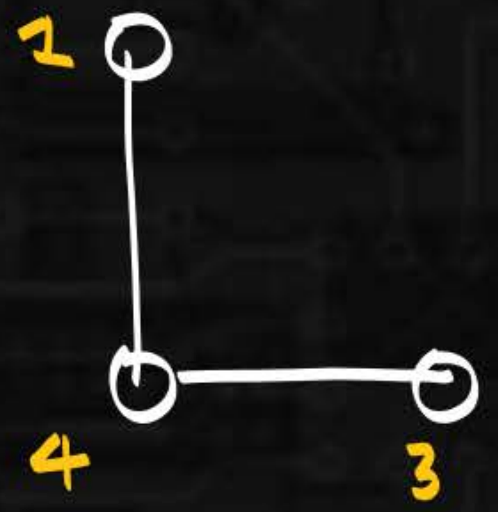




edge-disjoint subgraph :

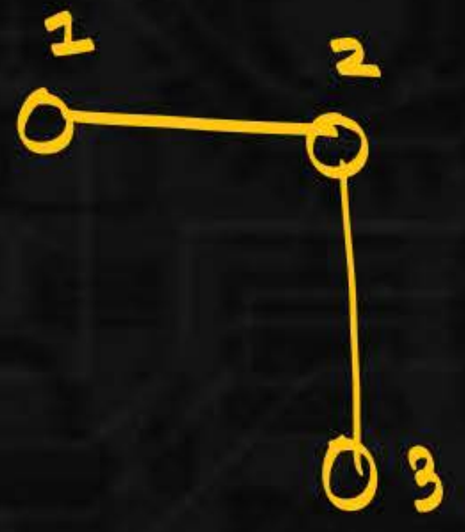
G_1, G_2 are subgraphs of G.
Such that, G_1, G_2 will not have any common edges.

They may have common vertex.



G_1

$E_1 = \{14, 43\}$



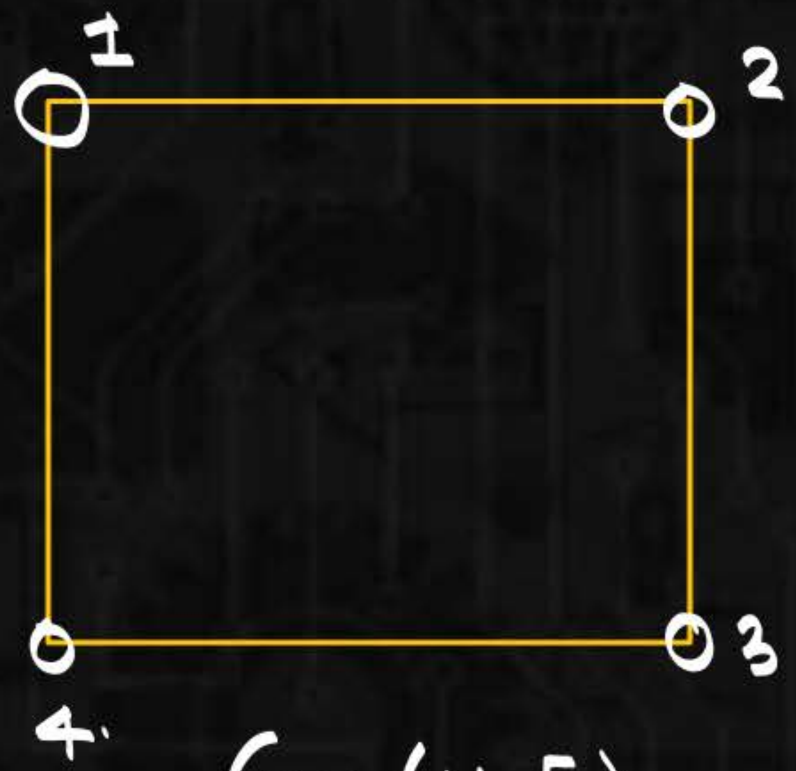
G_2

$E_2 = \{12, 23\}$

vertex-disjoint subgraph :

G_1, G_2 are subgraphs of G.
such that, G_1, G_2 will not have any common vertex

if no common vertex.
no point of having common edge.



$G = (V, E)$

G_1

$V_1 = \{1, 2\}$

G_2

$V_2 = \{3, 4\}$


THANK YOU GW
SOLDIERS !