Chapter - 8

Graph Theorem :

Find the solution to the system of congruece $x \equiv 2 \pmod 3$

$x \equiv 1 \pmod 4$

$x \equiv 3 \pmod 5$

$M = m_1 \times m_2 \times m_3$

$\cancel{Y =} \quad \frac{M}{m_1}, \frac{M}{m_2}, \frac{M}{m_3}$

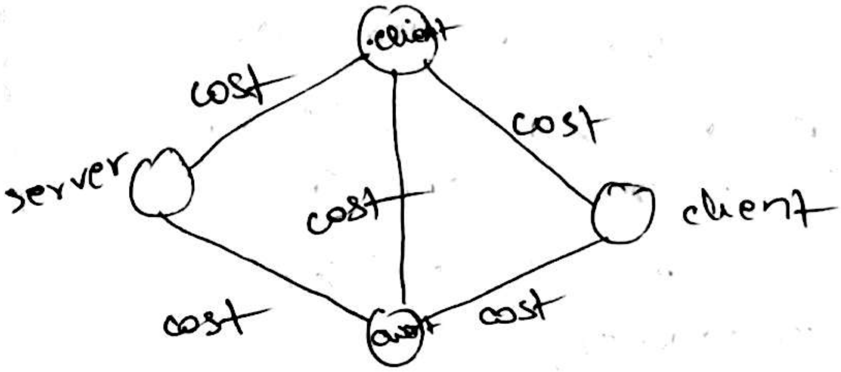
$Sol^n = M_1 a_1 y_1 + M_2 a_2 y_2 + M_3 a_3 y_3$

Graph: A graph $G = (V, E)$ consists of V, a nonemply set of vertices ~~set~~ (or nodes) and E a set of edges Each edge has either one or two vertices associated with it, called end points.

infinite graph: The vertices V of a graph G may be infinite A graph with an infinite vertex set is called an infinite graph.

\# finite graph: A graph with a finite vertex set is called a finite graph.

Computer Network.



\# Simple Graph: A graph in which each edge connects two different vertices is called simple graph.

\# Multi~~ple~~ graph: Graphs that may have multiple edges connecting the same vertices are called multi~~ple~~ graph.

\# Pseudographs: Graphs may ~~have~~ include loops and possibly multiple edge connecting the same pair of vertices, are sometimes called Pseudograph.

graph Models

Q. no

1—4
5—7
8—11
11—16
17—19

Graph Terminology

Pendent

Handshaking Theorem :

Bipartite

$G_1 \cup G_2$

$V = V_1 \cup V_2$

$E = E_1 \cup E_2$

$G(V, E)$

10.11.14

11 — D

$12 \cdot 30 -$ 4+G

Cot: 12 — B → ~~8:00 - 9:40~~ → C.T. ~~+ Extra class~~

⇒ Introduction to graph theory

Lab quiz : 13 — D, 13 — E → C.T.

Theorem 1: The handshaking theorem

Let $G = (V, E)$ be an undirected graph wit

e edges. Then,

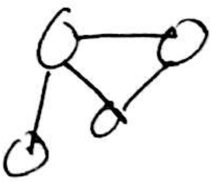
$$2e = \sum_{\in V} \deg(\,)$$

$2 \times 3 = 6$

$3 + 1 + 1 + 1 = 6$

Theorem 2: An undirected graph has an even number of vertices of odd degree.

$$2e = \sum_{\in V_1} \deg_t(\,) + \sum_{e V_2} \deg_t(\,)$$



even = $n \times$ odd + even - even $\times$ odd + even = even

Graph Theory

Chapter 8

Defn:

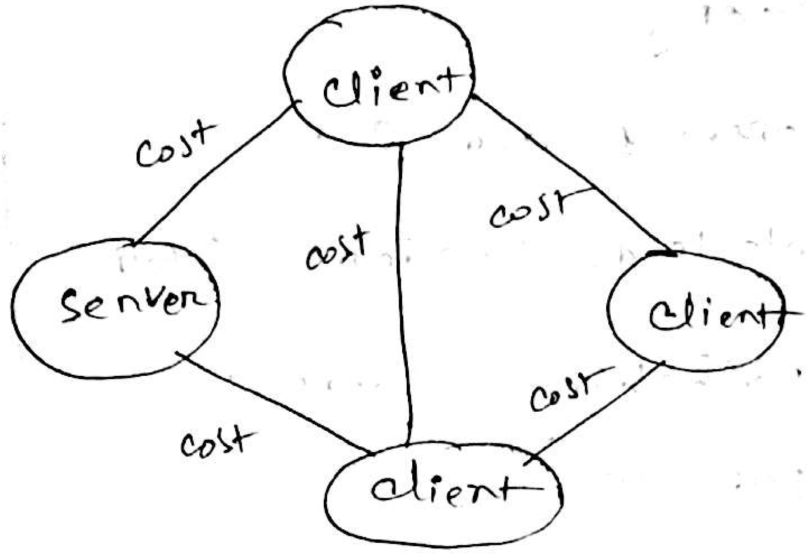
Graph: A graph $G=(V,E)$ consists of V, a non empty set of vertices ~~set~~ (or nodes) and E a set of edges. Each edges has either one or two vertices associated with it, called end points.

V = vertex E = Edge

infinie graph: The vertices V of a graph G may be infinite. A graph with an infinite vertex set is called an infinite graph.

finite graph: A graph with a finite vertex set is called a finite graph.

Computer Network:



Simple graph: A graph in which each edge connects two different vertices is called simple graph.

Multigraph graph: Graphs that may have multiple edges connecting the same vertices are called multi graph.

Pseudographs: Graphs may ~~have~~ include loops and possibly multiple edge connecting the same pair of vertices, are sometimes called pseudograph

Graph theory: Graps models → exmple † theory.

Theorem 1 and 2:

Isolated, Pendent বের কর

✓ Handshaking Theorem:

Bipartite

$G_1 \cup G_2$

$V = V_1 \cup V_2$

$E = E_1 \cup E_2$

$G(V, E)$

```
int gcd (int x, int y) {
    int temp, n;
    temp = x % y;
    if (temp != 0)
    { n = gcd (y, temp);
      return n; }
    if (temp == 0)
      return y; }
```

10.11.14

11-D

Coto: 12-B → ~~8.00-9.40~~ 12.30- → C.T. 4th ~~+ Extra class~~

⇒ Introduction to graph theory

Lab quiz : 13-D, 13-E → C.T.

Theorem 1: The handshaking theorem

Let $G=(V,E)$ be an undirected graph with e edges. Then,

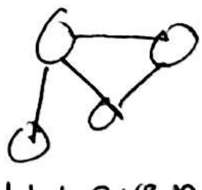
$$2e = \sum_{\in V} \deg(\ )$$

$2 \times 3 = 6$

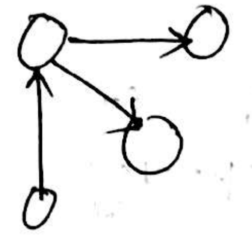
$3+1+1+1=6$

Theorem 2: An undirected graph has an even number of vertices of odd degree.

$$2e = \sum_{\in V_1} \deg_t() + \sum_{\in V_2} \deg_t()$$

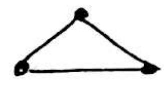


even = $n \times$ odd + even - even $\times$ odd + even = even



Indegree = 1
Out degree = 2

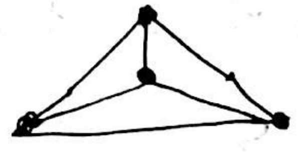
Complete Graph : The complete graph on n vertices, denoted by K_n, is the simple graph that ~~ca~~ contains exactly one edge between each pair of distinct vertices.



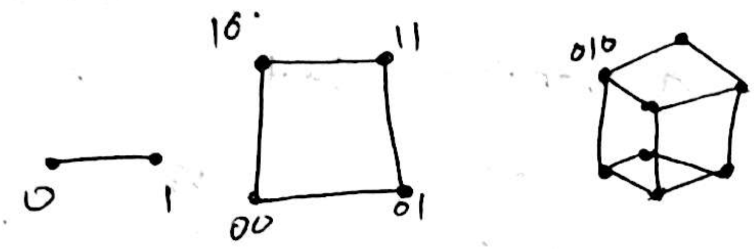
cycle : The cycle C_n, $n \geq 3$ consists of n vertices, $v_1, v_2, v_3, \ldots\ldots V_n$ and edges $\{v_1, v_2\}$, $\{v_2, v_3\}, \ldots \{v_{n-1}, v_n\}$ and $\{v_n, v_1\}$.

C_3 = 

wheel :



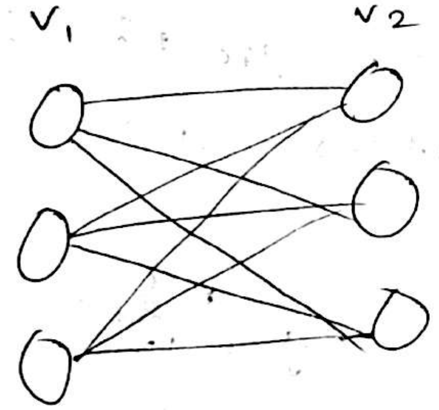
n - Cube graph:

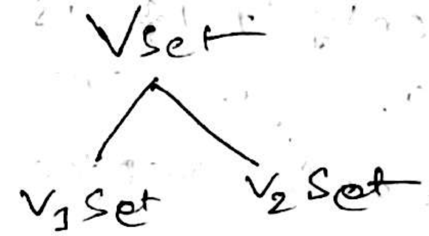


11.11.14

11 - E

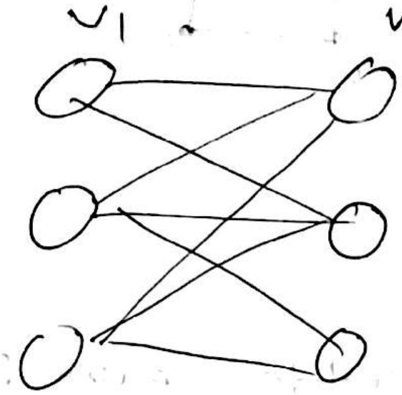
Bipartite Graph :



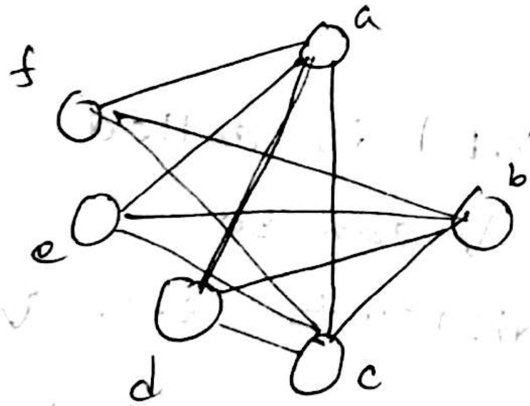


Def^n: A simple graph $G(V, E)$ is called bipartite if its vertex V can be partitioned into two disjoints sets V_1 and V_2 such that every edges in the graph connects a vertex V_1 and a vertex in V_2 (so that no edge in G connects either two vertices in

V_1 on two vertices in V_2) when this condition holds, we call the pair (V_1, V_2) a bipartition of a vertex set ~~of~~ V of G



<u>Theorem</u>: A simple graph is biparetite if and only if it is possible to assign one of two different colors of each vertex of the graph so that no two adjacent vertices are assigned the same color.



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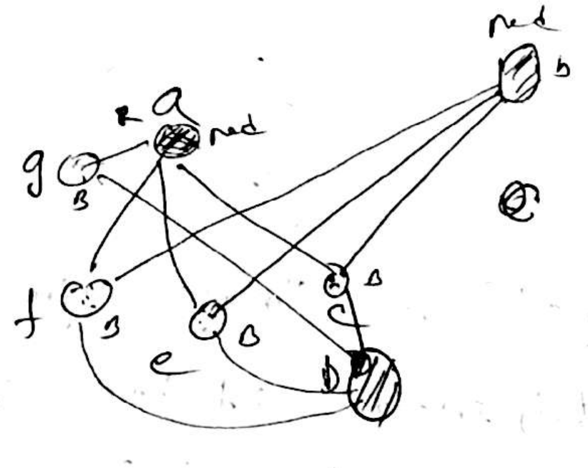
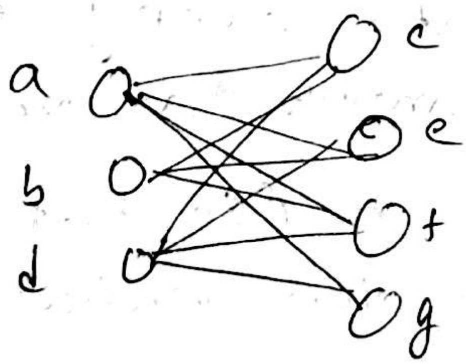
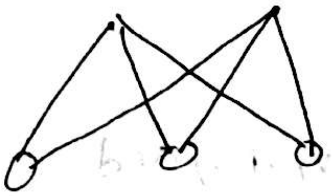


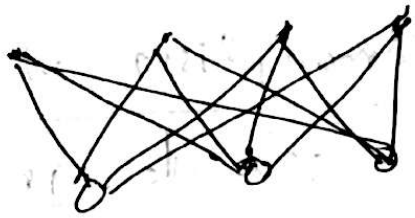
Bipartite



Complete Bipartite Graph:



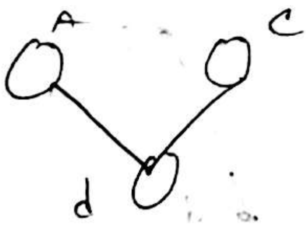
$K_{2,3}$



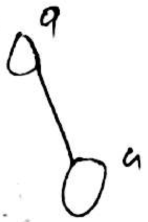
$K_{4,3}$

New graph from old graph:

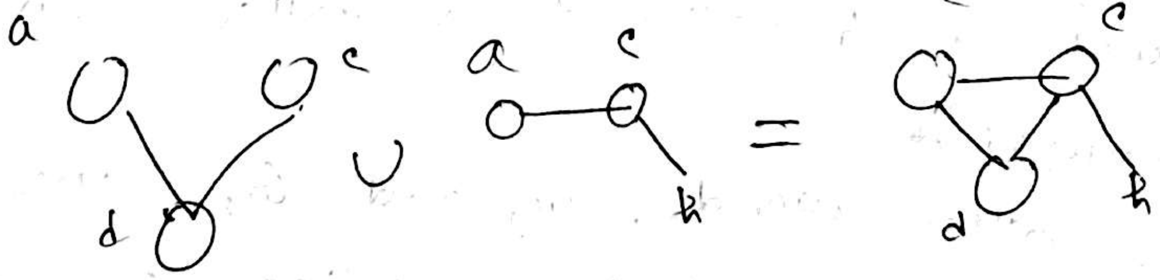
<u>Def^n</u>: A subgraph of a graph $G=(V,E)$ is a graph $H=(W,F)$ where $W \subseteq V$ and $F \subseteq E$. A subgraph H of G is a proper subgraph of G if $H \neq G$



G



H

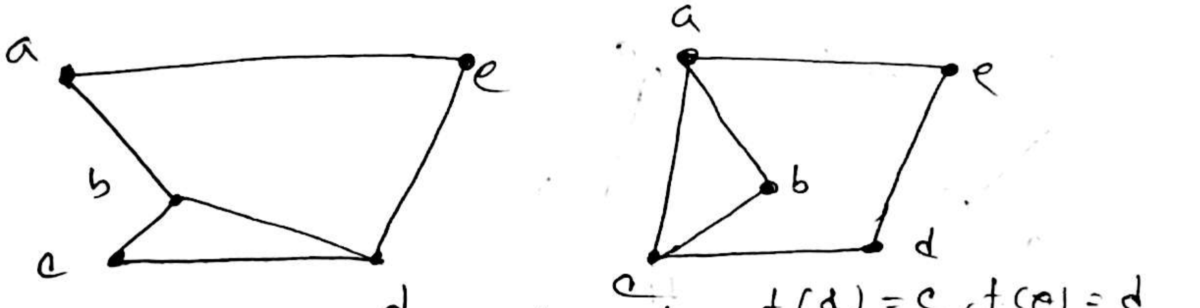


12.11.14

12-A

Isomorphism of graph:

The simple graph of $G_1(V_1, E_1)$ and $G_2(V_2, E_2)$ are isomorphic if there is a bijection (an one to one and onto function) f from V_1 to V_2 with the property that a and b are adjacent in G_1 if and only if $f(a)$ and $f(b)$ are adjacent in G_2, for all a and b in V_1



$f(a) = e$, $f(b) = a$, $f(c) = b$, $f(d) = c$, $f(e) = d$

→ Such a function f is called an isomorphism

→ In other words, G_1 and G_2 are isomorphic if their vertices can be ordered in such a way that they adjacent matrices M_{G_1} and M_{G_2} are identical.

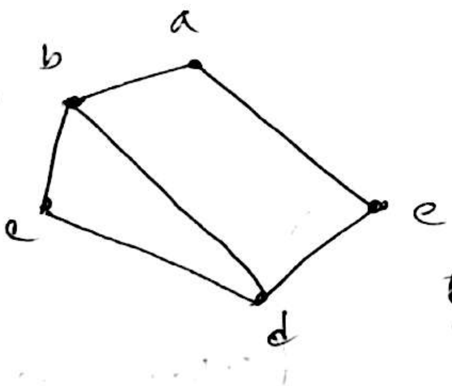
☐ ~~For this~~ we can check invariants that is properties that two isomorphic sample graphs must both have.

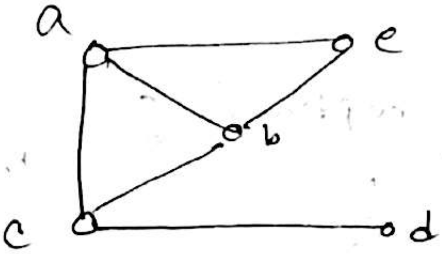
For example, they must have

✓ The same number of vertices

✓ The same number of edges.

✓ The same degree of vertices

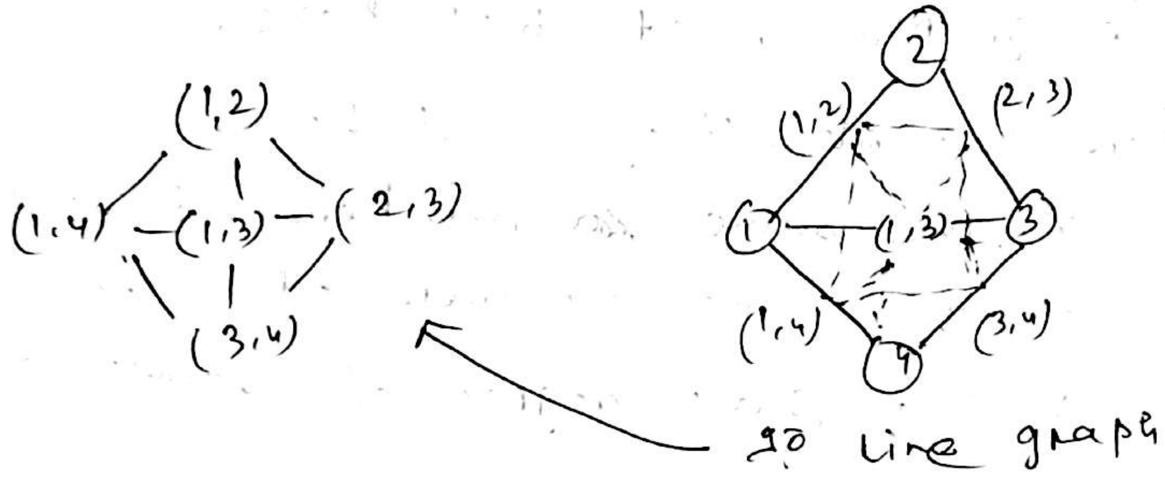




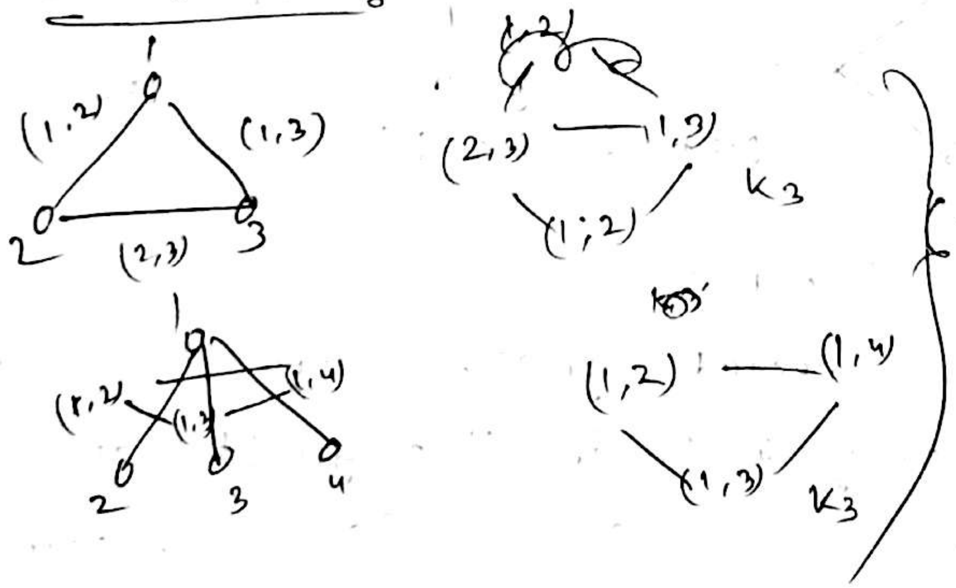
Not Isomorphic

☐ Whitney theorem:

Two connected graphs are isomorphic if and only if their line graph are isomorphic with a single exception: K_3, the complete graph on three vertices, and the complete bipartite graph $K_{1,3}$, which are not isomorphic but both have K_3 as their line graph.



exceptional :



They are not isomorphic

CT তে আসবে না,
Connectivity ⇒ self study

Euler path and hamilton path:

একটি যে Node থেকে শুরু একটি Node
শেষ ও থেকে যদি সব ~~node~~ edge visit ~~হয়~~
হয় তবে সেই path কে বলে Euler path.

আবার যদি ঐ Node এই ফিরে আসা হয়
তবে তাকে বলে Euler cycle.

Hamilton path: সব Node visit ⇑ একবারে মাত্র

এই সব Theory.