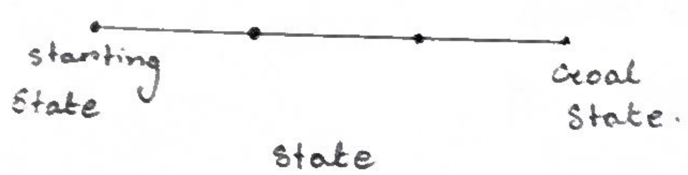
Final Graphs and Search problems in AI :

$\boxed{\text{week - 2}}$

- This lecture is all about search prob and Graphs.

Task.



If, there is a **huge task** we generally **break** that into **smaller tasks**
↳ **Intermidiate** States ↓
For these we **need search**.

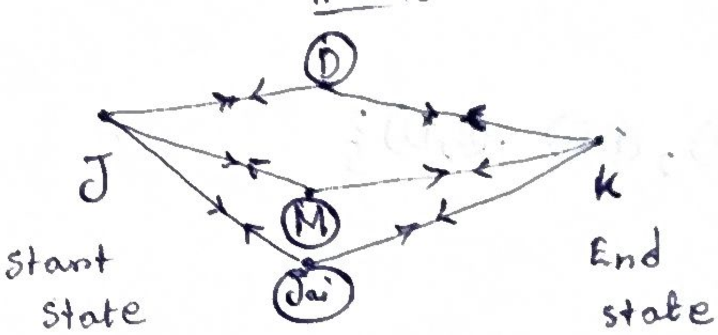
Eg :

Jodhpur to kolkata

Task

Air ticket
land/Train ticket
Combination

$\boxed{\text{Air}}$.



Simplified air route Graphically. Network

$V = \{J, D, M, Jai, k\}$

$E = \{\{J, D\}, \{J, M\}, \{J, Jai\}, \{D, k\}, \{M, k\}, \{Jai, k\}\}$

D- Delhi
M- Mumbai
Jai - Jaipur

Graph : Odered pair of V and E

$V \rightarrow$ set of Nodes / Vertices

$E \rightarrow$ **Edge set**.

$\therefore$ $E \subseteq V \times V$; E is subset of $V \times V$

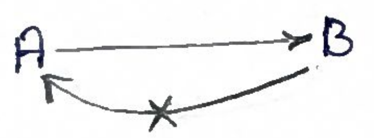
$\boxed{G = (V, E)}$

Types of graph:

- Directed / Undirected
- Weighted / Unweighted
- Cyclic / Acyclic.

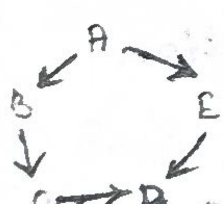
① Directed graph : One way dirn.

Eg: chemical Reaction.



$\rightarrow \{(A, B)\}$

$(A, B) \neq (B, A)$



$V = \{A, B, C, D, E\}$

$E = \{(A,B), (B,C), (C,D), (A,E), (E,D)\}$

② Undirected graph : Two way dir^n

Eg :

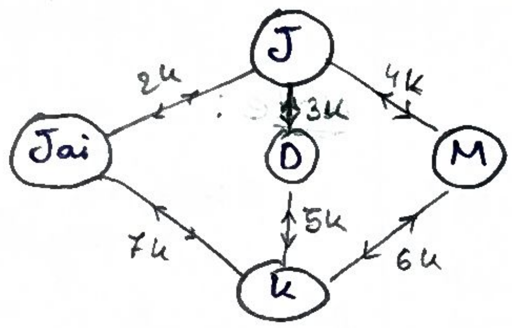
$\{\{A, B\}\}$

$\{A, B\} = \{B, A\}$

③ Weighted graph : Some more info given which helps in deciding more efficient rout.

Air fair

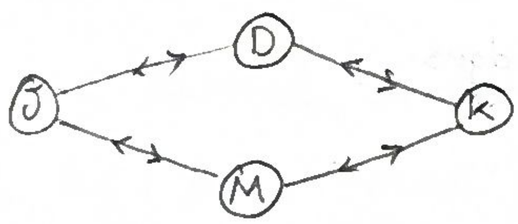
Eg: cost, time, etc.



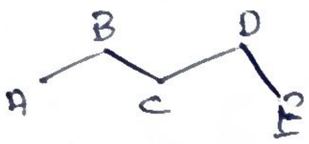
We can choose most cost effective Route.

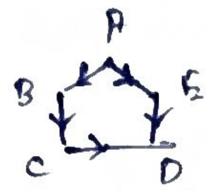
④ Unweighted graph : Only Basic graph is given with no extra info.

⑤ Cyclic Graph : Interconnection of the vector and if I start from a point I should end up there.

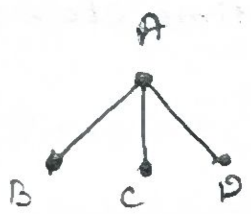


⑥ Acyclic Graph : The ~~graph~~ graph may or may not be connected but if I start from a point I won't end up there.





Neighbour/Adjucent of a Node :



N(A)
Adj(A) = { B, C, D }

In the previous eg :

Adj (J) = { D, M, Jai }

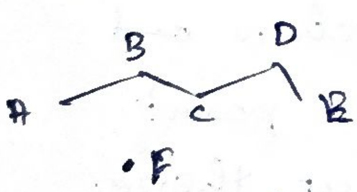
Note :

A —— B
Edge.

If A → B
st pt = A
end pt = B

else
A —— B == A ↔ B
end points = { A, B }.

Path :



⇒ A → B → C → D → E

Sequence of the Nodes and Edges.

A → E ⇒ No direct path.

A → F ⇒ No path.

Simple graph : Graph which has no cycles.

Connected graph : Any 2 nodes connected via path.

A → D connected graph

A → F disconnected graph.

disconnected graph: If 2 nodes not connected via path.

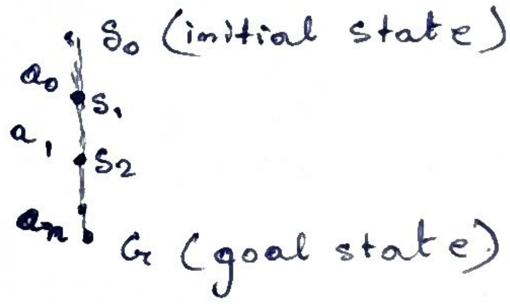
Degree of vertex : No of edges of a vertex.

$D(A) = 3$
$D(B) = 1$
$D(C) = 1$
$D(D) = 1$

Formulation of the Search problem :

Defined using tupple :

$$P = (S, A, S_0, G)$$



S : Set of all possible state.

A : Set of actions (or) operations

$S_0 \in S$: Initial state

$G \subseteq S$: Set of goal states

The objective is to find a sequence of actions $a_1, a_2 \ldots a_n$ such that :

$$a_n(\ldots(a_2(a_1(S_0)))\ldots) \in G$$

$A = \{air, Rail, Road\}$.

that's why actions, and not action.

Note: There can be many goal. state

What happens if there are multiple paths?

⇒ Minimization comes in.

in the J → K eg:

we would consider cost and time efficiency.

Applications :

- Google Maps ⟷ Route Finding
- Robot Motion planing → Robo vaccumes
- Game playing → Chess bot..
- Planning