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Unit : 4 : Greedy Algorithm

* Explain Greedy Algorithm with its characteristics.

=> Greedy Algorithm is used to select things which is best at that moment.

Greedy Algorithm some time not gives Optimal solution.

Greedy Algorithm is a technique to select the thing which is best at a moment.

This method is basically used to determine the feasible solution that may or may not be optimal.

Greedy Algorithm can take decision on the basis of the currently available information.

Some time Greed algorithm does not worry about the future decision.

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Greedy Algorithm is used to find the shortest path in graph.

-> Characteristics of Greedy Algorithm:

1 Simple Algorithm

2 Faster to Execute

3 Efficiency

4 Less computing resource.

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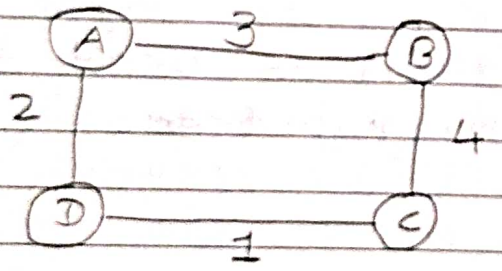
* Explain Minimum Spanning Tree with example.

=> A Spanning Tree of a connected graph G contains all the nodes and has the edges which connects all the nodes.

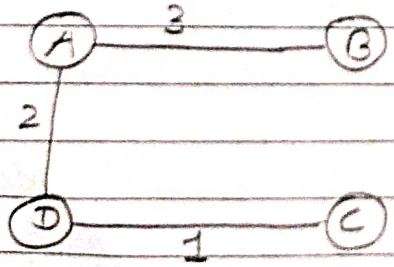
In Spanning Tree, there are no cycle in the graph.

A Minimum Spanning tree is founed when the edges are picked to minimize the total cost.

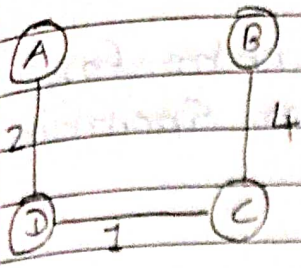
Ex.



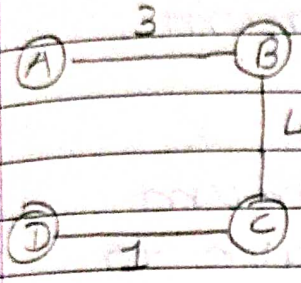
Possible Spanning Tree:



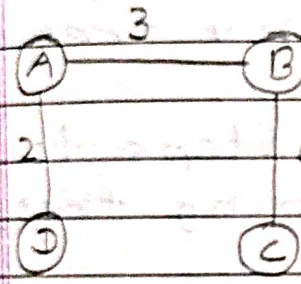
Cost = 3 + 2 + 1
= 6



Cost = 4+2+1
= 7



Cost = 4+3+1
= 8



Cost = 4+3+2
= 9

Among the Four Possible Tree, We get Minimum Spanning Tree with cost = 6.

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* Explain Prim's Algorithm for Finding the Minimum Spanning Tree.

=> Using Prim's Algorithm, we can find the minimum Spanning Tree.

For Finding the Minimum Spanning Tree, we have to Remove All the Parallel edges and Self loops of any tree.

This are the Basic Steps to Find Minimum Spanning tree.

Steps :

1 Create Edges list of the Given Graph.

2 Create skeleton for Spanning Tree.

3 Select Minimum edges From the edges list.

4 After that select one end Point from the minimum edges

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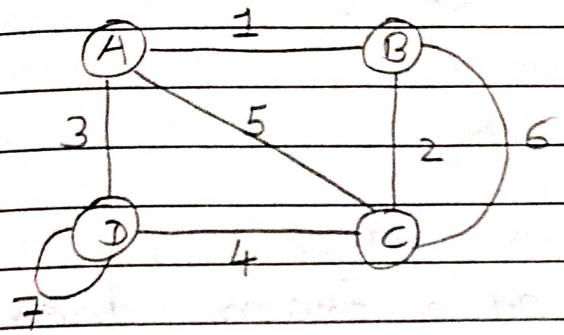
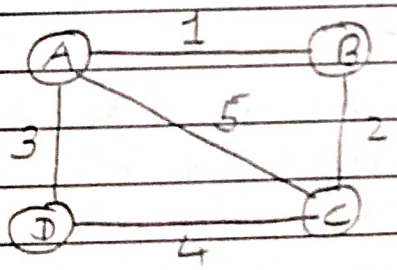
5 Repeat the steps untill n-1 edges are added.

Ex.



For Find the Minimum Spanning tree, we have to remove self loop and Parallel edges from the graph.



Create edges list From the Graph.

Edge	Weight
AB	1
BC	2
CD	4
DA	3
AC	5

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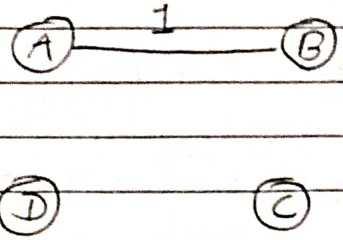
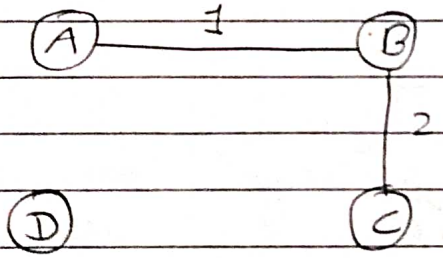
Create Skeleton For Graph and Select the minimum weight edges.



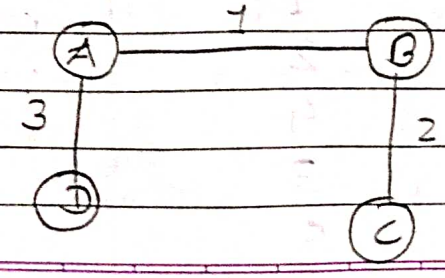
Select the edge from edges list with A and B endpoint with minimum weight.

Here, BC (2) and DA (3).
So, take BC edges.



Select the edge from edges list with A, D and C endpoint.

Here, DA (3), DC (4).
So, take DA edges.



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Here, We get Minimum Spanning Tree with cost = 6.

* Explain Kruskal's Algorithm for Finding the Minimum Spanning Tree.

=> Using Kruskal's Algorithm, we can find the minimum Spanning Tree.

For Finding the minimum Spanning Tree, we have to Remove All the Parallel edges and self loops of any trees.

This are the Basic steps for Finding the Minimum Spanning tree.

Steps:

1 Create the edges list of the Given Graph.

2 Create skeleton for Spanning tree and short the edges list according to its weight.

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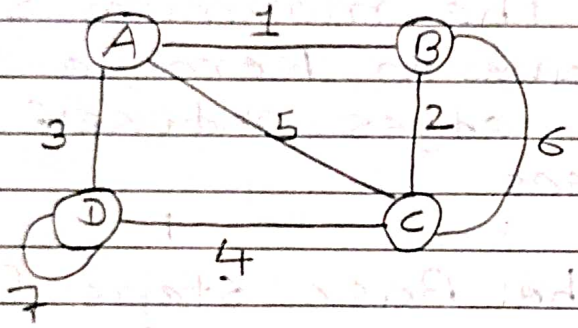
3 Take the edge at the top of the edge list and Remove from the table.

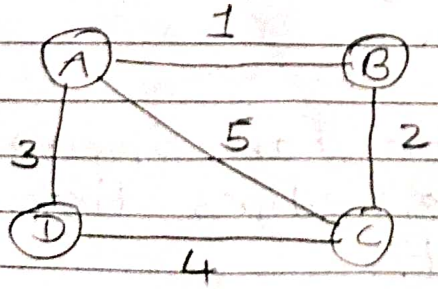
4 Select the second edge from the edge list but it is not create cycle.

5 Repeat the steps until n-1 edges are added.

Ex.



For Finding the, Minimum Spanning tree, we have to remove self loop and Parallel edges from the graph.



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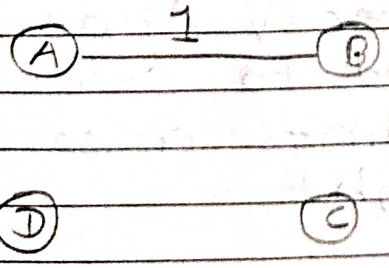
Create edges list from the Graph.

Edge	Weight
AB	1
BC	2
CD	4
DA	3
AC	5

Sort the edges list, according to its weight.

Edge	Weight
AB	1
BC	2
DA	3
BC	4
AC	5

Create a skeleton for tree and take First edge and Remove From the list.



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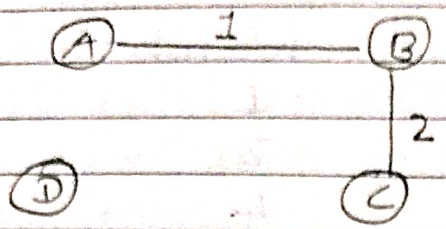
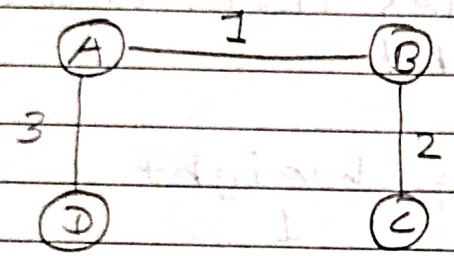
Select second edge from the edges list.



Select third edge from the edges list.



Here, We get Minimum Spanning tree with cost = 6.

* Explain Fractional knapsack Problem with example.

=> Fractional Knapsack Problem is follow Greedy Apporach which is used to select n different things accordaing to its weight.

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This are the basic step to perform Fractional knapsack Problem.

Steps :-

1 Calculate the Density of every item.

2 Short the item according to its density.

3 Take Total Weight and Total Profit = 0.

check for every item

Weight(Item) + Total Weight <= W

than Select this item.

4 else Follow this step,

X[i] = W - item Weight

Profit = Profit + (X[i]/W[i] * V[i])

i = item number.

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Ex. Total Weight W = 16 Kg

Item	Weight(w)	Value
1	6	6
2	10	2
3	3	1
4	5	8
5	1	3

=> Here, Given Total Weight W = 16 Kg Which means we have to select only 16 kg Item.

According to Fractional Knapsack Problem,

- Step - 1 : Find the value of each Item or density.

Item	W	V	Density
1	6	6	1
2	10	2	0.20
3	3	1	0.33
4	5	8	1.60
5	1	3	~~1.66~~ 3

- Step-2 : Sort the Item, according to its Density.

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Item	W	V	Density
5	1	3	3
4	5	8	1.60
1	6	6	1
3	3	1	0.33
2	10	2	0.20

- Step - 3 : Pick the First Item in the table and check

Item + Total Weight ≤ Weight

1 + 0 ≤ 16

Condition is follow so, take this item.

Item	W	V	Total Weight	Total Profit
-	-	-	0	0
5	1	3	1	3

- Step : 4 : Take Second Item with Total Weight - 1

∴ 5 + 1 ≤ 16, Condition is follow

Item	W	V	Total Weight	Total Profit
-	-	-	0	0
5	1	3	1	3
4	5	8	6	11

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- Step 5 : Take Third Item with Weight 6

∴ 6 + 6 ≤ 16, ∴ Condition is follow.

Item	W	V	Total Weight	Total Profit
-	-	-	0	0
5	1	3	1	3
4	5	8	6	11
1	6	6	12	17

- Step 6 : take Fourth Item with weight 12

∴ 3 + 12 ≤ 16, ∴ Condition is follow.

Item	W	V	Total Weight	Total Profit
-	-	-	0	0
5	1	3	1	3
4	5	8	6	11
1	6	6	12	17
3	3	1	15	18

- Step 7 : take Last item with weight 15

∴ 15 + 10 ≰ 16, ∴ Condition is not follow.

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Find, X[2] = 16 - 15 = 1

Profit = 18 + (0.20 * 2)
= 18.4

Item	W	V	Total Weight	Total Profit
-	-	-	0	0
5	1	3	1	3
4	5	8	6	11
1	6	6	12	17
3	3	1	15	18
2	10	2	16	18.4

* Explain Coin Change Problem with example.

=> Coin Change Problem is used Greedy approach which is used to gives certain amount of change.

In Coin Change Problem, we have to always select maximum value of coin.

Algorithm for Coin Change Problem :

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1 Sort the coin value in descendin Order.

2 IF Current-Value <= Reamaing Value
than
total Coin = total Coin + Current-Value Coin

3 else Increment

4 Reapeat the step until Reamaing value = 0

Ex. Available coin 20, 10, 5, 1 and we have to make ₹3 Value.

=> Sorted Coin value in descending Order -> 20, 10, 5, 1

take 20 < Make value
20 < ₹3, So take 20 and Reamaing value ₹3 - 20 = 23

~~total Coin = 20~~

take 20 < Reamaing value

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∴ 20 ≤ 23, So take 20 coin
Remaing value = 23 - 20
= 3

take 20 ≤ 3, Condition is False
So, Increment value.

take, 10 ≤ 3, Again condition is
Falsee, So, Increment value.

take, 5 ≤ 3, Again condition is
False, So, Increment value.

take, 1 ≤ 3, Condition is true
So take 1 coin and
Reamaing value = 3 - 1 = 2

Again take, 1 ≤ 2, So take 1
Coin and Reamaing
value = 2 - 1 = 1

Again take, 1 ≤ 1, So take 1
coin and Reamaing value = 1 - 1 = 0

So, Total
Coin = [20, 20, 1, 1, 1]

Total Coin = 1 + 1 + 1 + 1 + 1
= 5 Coin