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CSE - C Section.

Subject code : 19CSC311A

Subject : Graph Theory and Optimization.

Date - 11-06-2021

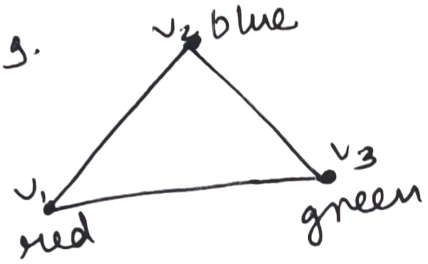
TT - 2

1.

a) Chromatic number

A graph which is coloured using the minimum of colours such a graph is called properly coloured graph. and the number of colours in a properly coloured graph is called chromatic number.

e.g.



3 - chromatic graph.

chromatic no. = 3

b) Tree

A graph G is said to be a tree if it is connected and has no cycle.

eg.

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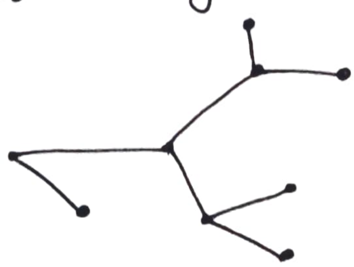


Name : Subhendu Maji Reg. no. : 18ETCS002121

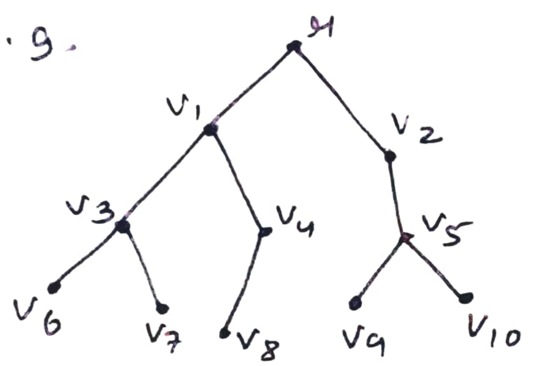
Q 1.

c) Internal vertices of a tree

In a rooted tree a vertex whose out-degree is 0 is called a Leaf.

a vertex which is not a leaf is called an internal vertex of the tree.

e.g.



In above graph,

except $v_6, v_7, v_8, v_9, v_{10}$, all other vertices are internal vertices.

because. $v_6, v_7, v_8, v_9, v_{10}$ are ~~leaf~~ leaves.

Internal vertices are $v_3, v_4, v_5, v_1, v_2, r$.

d) Spanning tree

let G be a connected graph

A subgraph T of G is called a spanning tree of G, if

(i) T is a tree, and

(ii) T contains all vertices of G.

e.g. a connected graph G can have more than one spanning tree.

let,

K_3 graph.

spanning tree of K_3 graph are—

(i) Spanning tree 1

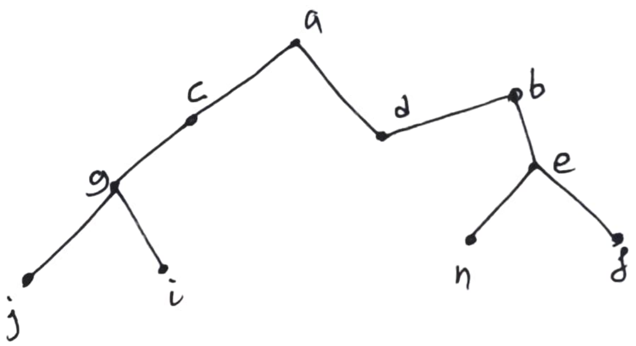
(ii) spanning tree 2.

(iii) Spanning tree 3.

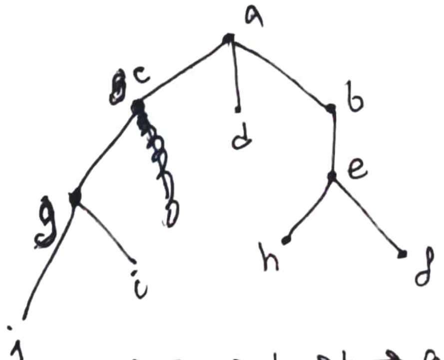
2.

DFS spanning tree.

a → c → g − j → (backtrace) → g → i → (backtrace) → g → (backtrack) → c → (backtrace) → a → d → b → e → (backtrace) → b → (backtrace) → d → (backtrace) → a .



BFS spanning tree.



a → c → d → b → g → e → j → i → h → f

Name: Subhendu Maji Reg. no. 18ETCS002121

(4)

5.

Courses are 681, 782, 792, 846, 857, 904, 909, 933

681 - 782, 792, 846, 857, 904, 909, 983.

782 - 681, 792, 857, 904, 909, 933

792 - 681, 782, 933

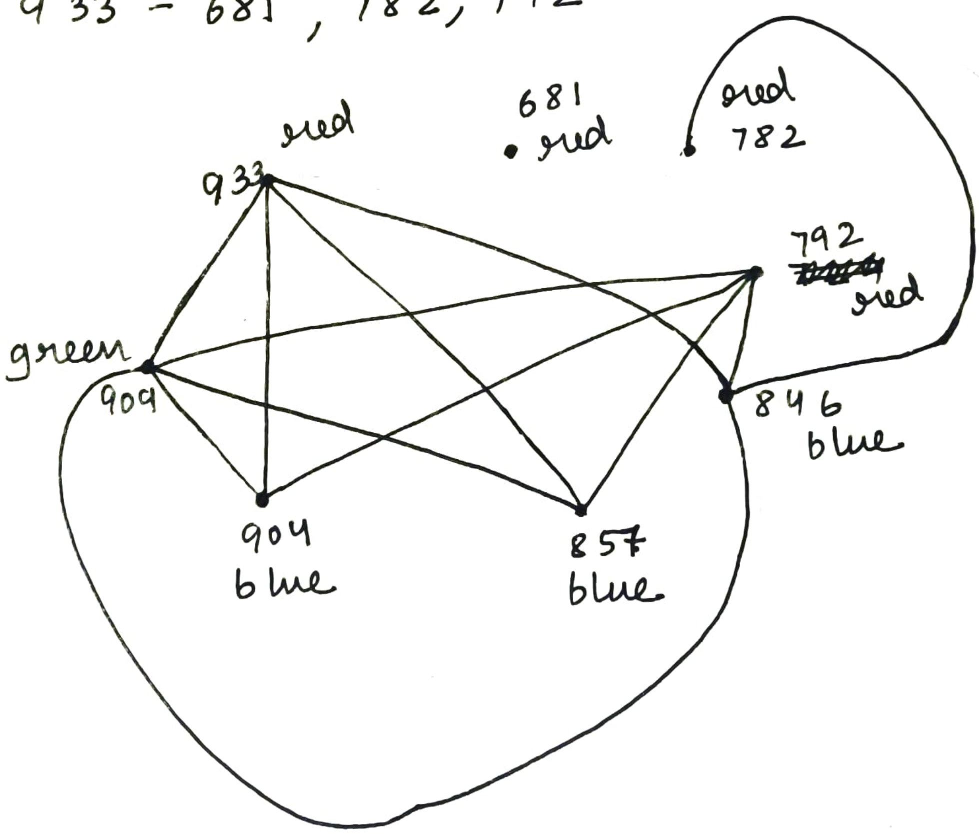
846 - 681, 857, 904,

857 - 681, 782, 846, 904

904 - 681, 782, 846, 857

909 - 681, 782

933 - 681, 782, 792



here, Red → 681, 782, 792, 933

Blue → 846, 857, 904

Green → 909

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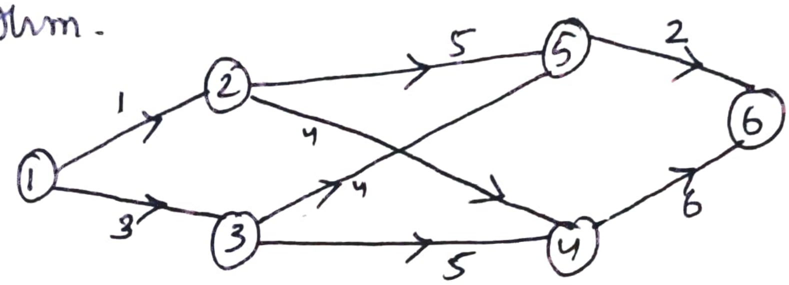
4.

To find the shortest path in the given weighted directed graph, we can use Dijkstra's algorithm.



given, the starting vertex is 1.

let us consider the initial ~~FA~~ distance from 1 to all the vertices

2	3	4	5	6	selected vertex
1	3	∞	∞	∞	2
1	3	5	6	∞	3
1	3	5	6	∞	4
1	3	5	6	11	5
1	3	5	6	8	6

on each selected value v, we check if the distance to the v + the cost to the next node is less than the distance taken to ~~the~~ reach the vertex directly from start node S.

if $d(u) > d(v) + c(v,u)$

then, update $d(u)$

∴, the shortest path from 1 are -

1 ⟶ 2 cost = 1

1 ⟶ 3 cost = 3

1 ⟶ 2 ⟶ 5 cost = 6

1 ⟶ 2 ⟶ 4 cost = 5

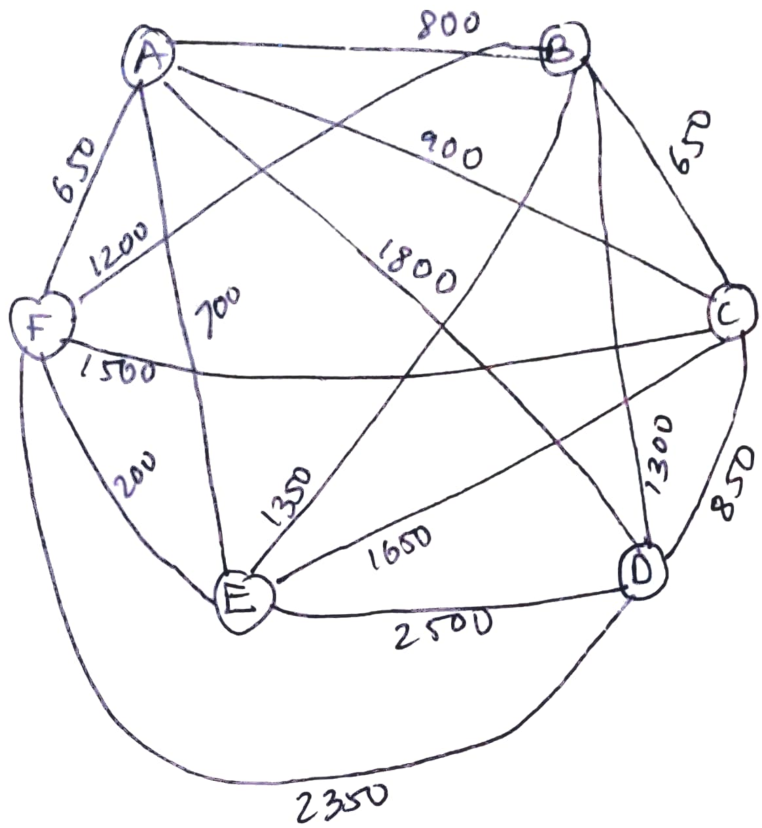
1 ⟶ 2 ⟶ 5 ⟶ 6 cost = 8

3. given, the distance b/w all the cities
It is a undirected graph.
To find shortest path covering all the cities

i.e minimum spanning tree.

we can us Prim's algorithm to find the min. span tree because this is a dense graph.

Name : Subhendu Maji Reg. no : 18ETCS002121



Start A,

AB → 800
AC → 900
AD → 1800
AE → 700
AF → 650

we choose A → F because it has minimum cost.

Start A F

FE = 200
AE = 700

we choose FE, because it has min cost

Start AFE

AB = 800
FB = 1200
EB = 1350

we choose, AB because it has min cost.

Name : Subhendu Maji Reg. 18ETCS002121

Start AFEB,

BC = 650
AC = 900
FC = 1500
EC = 1650

we choose, BC, because it has min cost

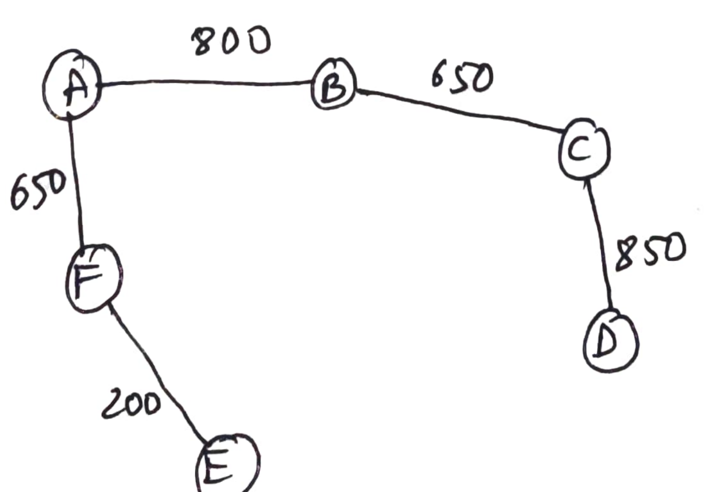
Start, AFEBC

AD = 1800
CD = 850
FD = 2350
ED = 2500
BD = 1350

we choose CD, because, it has min cost.

hence, cost of shortest path is

200 + 650 + 800 + 650 + 850 = 3150



is the required mini spanning tree.