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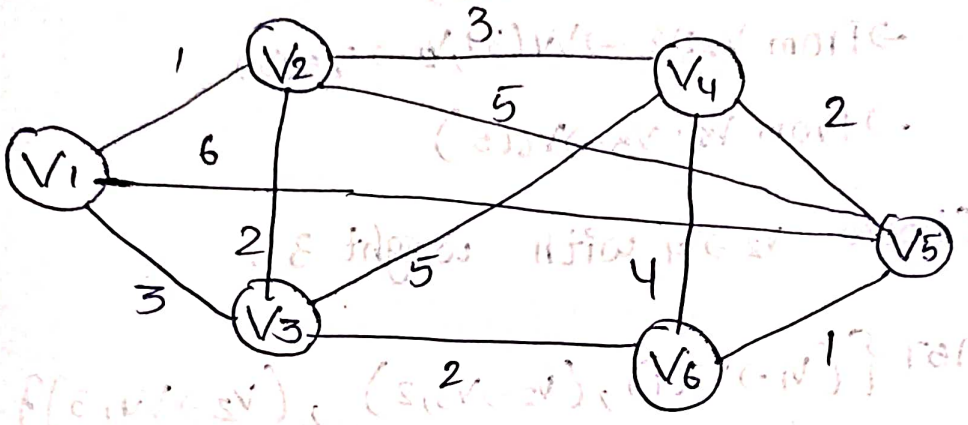
Design and Analysis of Algorithms:
ALM-2:

Q) Construct Minimal spanning Tree for a given graph.



Sol) According to Prim's algorithm:

step-1:- Start with vertex V_1

* Visited set $\{V_1\}$
* Edges to consider $V_1 \to V_2(1)$, $V_1 \to V_3(3)$, $V_1 \to V_6(6)$

*Choose $V_1 \to V_2$ with weight 1

MST $\{(V_1 \to V_2, 1)\}$

step-2:- Add V_2 to MST

*Visited set (V_1, V_2)

*Edges to consider

From V_1: $V_1 \to V_3(3)$, $V_1 \to V_6(6)$

From V_2: $V_2 \to V_3(2)$, $V_2 \to V_4(3)$, $V_2 \to V_5(5)$

Choose $V_2 \to V_3$ with weight 2.

MST: $\{(v_1 \to v_2, 1), (v_2 \to v_3, 2)\}$

Step-3:- Add v_3 to MST

* Visited set $\{v_1, v_2, v_3\}$
* Edges to consider
  - → From v_1: $v_1 \to v_6(6)$
  - → From v_2: $v_2 \to v_4(3)$, $v_2 \to v_5(5)$
  - → From v_3: $v_3 \to v_6(5)$

Choose $v_2 \to v_4$ with weight 3.

MST $\{(v_1 \to v_2(1), (v_2 \to v_3, 2), (v_2 \to v_4, 3)\}$

Step-4:- Add v_4 to MST.

* Visited set: $\{v_1, v_2, v_3, v_4\}$
* Edges to consider
  - → From v_1: $v_1 \to v_6(6)$
  - → From v_2: $v_2 \to v_5(5)$
  - → From v_3: $v_3 \to v_6(5)$
  - → From v_4: $v_4 \to v_5(2)$
    $v_4 \to v_6(4)$

Choose $v_4 \to v_5$ with weight 2.

MST $\{(v_1 \to v_2(1)), (v_2 \to v_3, 2), (v_2 \to v_4, 3)$
$(v_4 \to v_5, 2)\}$

Step-5: Add V_5 to MST

* Visited set : $\{V_1, V_2, V_5, V_4, V_3\}$
* Edges to Consider

From V_1: $V_1 \rightarrow V_6(6)$
From V_3: $V_3 \rightarrow V_6(5)$
From V_4: $V_4 \rightarrow V_6(4)$

Choose $V_4 \rightarrow V_6$ with weight 4.

MST : $\{(V_1 \rightarrow V_2, 1), (V_2 \rightarrow V_3, 2), (V_2 \rightarrow V_4, 3)$
$(V_4 \rightarrow V_5, 2), (V_4 \rightarrow V_6, 4)$

Step-6: All vertices are included

* Visited set $\{V_1, V_2, V_3, V_4, V_5, V_6\}$
* stop.

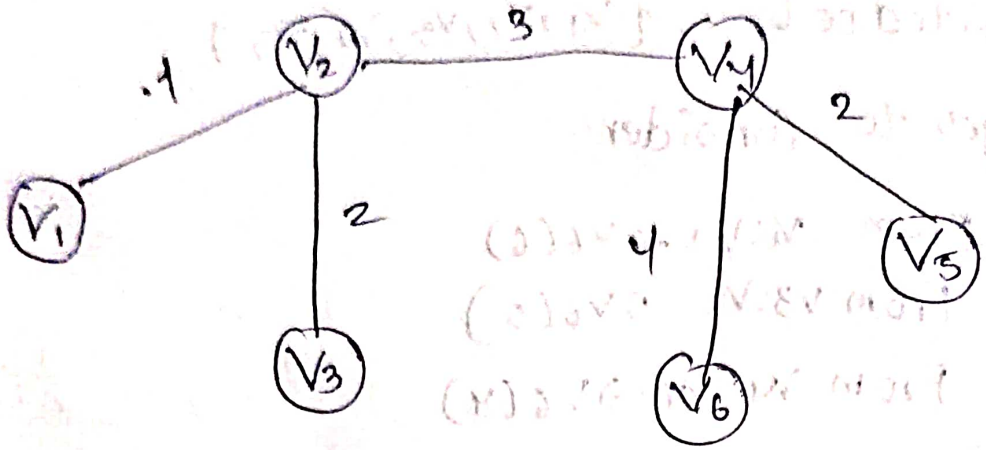
Final MST:

Edges:

$\rightarrow V_1 \rightarrow V_2(1)$
$\rightarrow V_2 \rightarrow V_3(2)$
$\rightarrow V_2 \rightarrow V_4(3)$
$\rightarrow V_4 \rightarrow V_5(2)$
$\rightarrow V_4 \rightarrow V_6(4)$

Total weight: $1+2+3+2+4 = 12$.

This is the Minimal Spanning Tree using Prim's algorithm for the given graph.


1
3
2
2
4
V_1
V_2
V_3
V_4
V_5
V_6