DIJKSTRA'S SINGLE SOURCE SHORTEST PATH ALGORITHM

1 Uses BFS

2 Creates a tree comprising of connected vertices and minimizes the cost of a vertex from the source vertex.

Pre-Conditions:

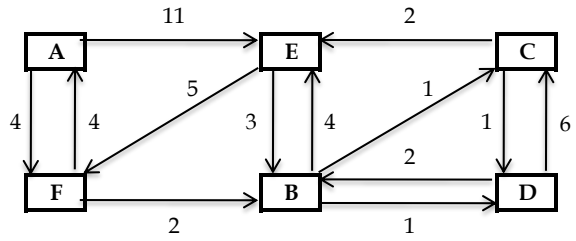
1 Edge cost should be non-negative.

2 Weighted directed graph

Required Data Structures:

1 A Queue [an array Visited[] to keep track of already visited vertices].
Also a minHeap or Fibonacci Heap may also be used.

2 Two 1-D arrays of size = |V|. Array Length[] will store distance of the vertex from source.
Array Parent[] will indicate the parent vertex of the current vertex.

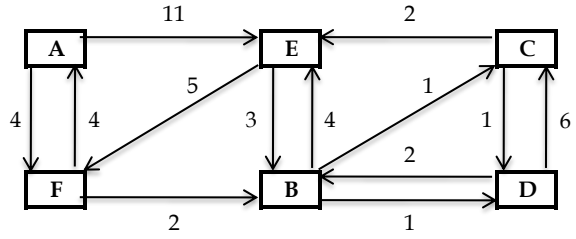


	A	B	C	D	E	F
A	0	NF	NF	NF	11	4
B	NF	0	1	1	4	NF
C	NF	NF	0	1	2	NF
D	NF	2	6	0	NF	NF
E	NF	3	NF	NF	0	5
F	4	2	NF	NF	NF	0

Adjacency Matrix

NF := Infinity

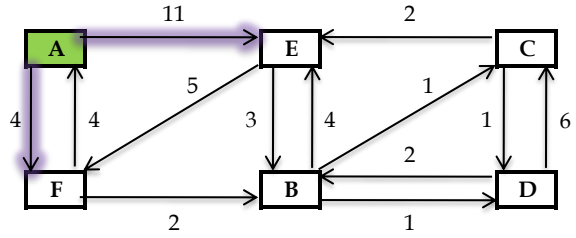
Initial State



	A	B	C	D	E	F
VISITED[]	F	F	F	F	F	F
PARENT[]	-	-	-	-	-	-
LENGTH[]	0	NF	NF	NF	NF	NF

minDistV : **A** among non-visited vertices

Iteration-01: Call Dijkstra(G[][|V|], A)



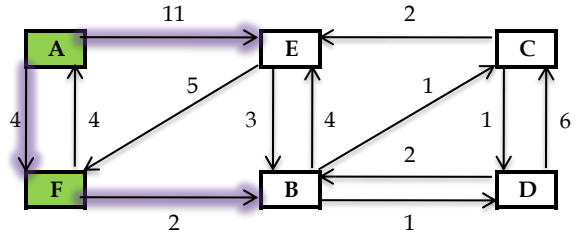
SRC:= **A**

	A	B	C	D	E	F
A	0	NF	NF	NF	11	4

	A	B	C	D	E	F
VISITED[]	T	F	F	F	F	F
PARENT[]	-	-	-	-	A	A
LENGTH[]	0	NF	NF	NF	11	4

minDistV : **F** among non-visited vertices

Iteration-02: Call Dijkstra(G[][|V|], F)



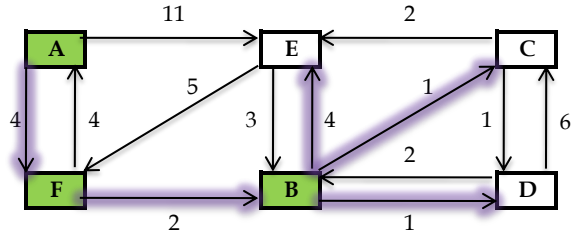
SRC:= **F**

	A	B	C	D	E	F
F	4	2	NF	NF	NF	0

	A	B	C	D	E	F
VISITED[]	T	F	F	F	F	T
PARENT[]	-	F	-	-	A	A
LENGTH[]	0	6	NF	NF	11	4

minDistV : **B** among non-visited vertices

Iteration-03: Call Dijkstra(G[][|V|], B)

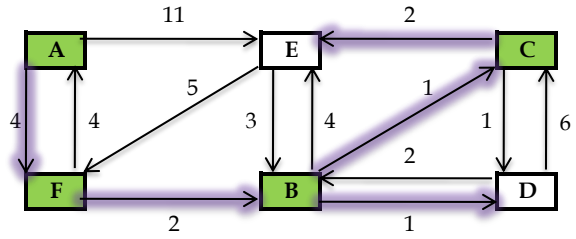


SRC:= **B**

	A	B	C	D	E	F
B	NF	0	1	1	4	NF
VISITED[]	T	T	F	F	F	T
PARENT[]	-	F	B	B	B	A
LENGTH[]	0	6	7	7	10	4

minDistV : **C** among non-visited vertices

Iteration-04: Call Dijkstra(G[][|V|], C)

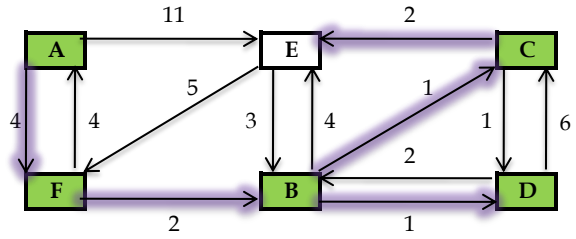


SRC:= **C**

	A	B	C	D	E	F
C	NF	NF	0	1	2	NF
VISITED[]	T	T	T	F	F	T
PARENT[]	-	F	B	B	C	A
LENGTH[]	0	6	7	7	9	4

minDistV : **D** among non-visited vertices

Iteration-05: Call Dijkstra(G[][|V|], D)



SRC:= **D**

	A	B	C	D	E	F
D	NF	2	6	0	NF	NF
VISITED[]	T	T	T	T	F	T
PARENT[]	-	F	B	B	C	A
LENGTH[]	0	6	7	7	9	4

Dijkstra's SSSP Terminates on Processing atmost |V| - 1 vertices.
Thus, the shortest path origiating at [source] vertex A

	Cost	Path
A -> B	**6**	A -> F -> B
A -> C	**7**	A -> F -> B -> C
A -> D	**7**	A -> F -> B -> D
A -> E	**9**	A -> F -> B -> C -> E
A -> F	**4**	A -> F

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AY - 2019-20