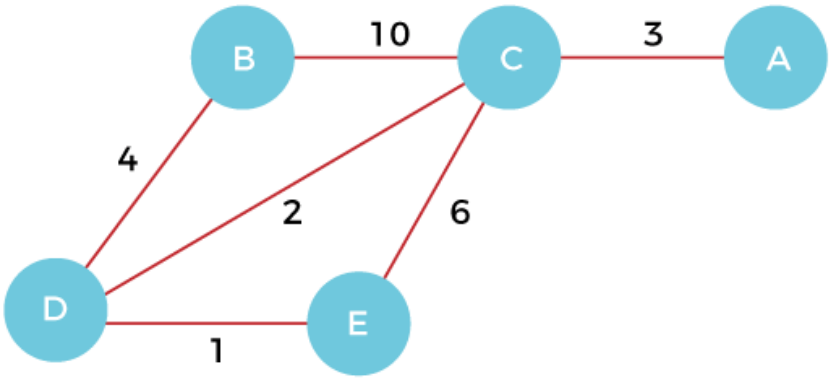
Program: BSCS (Even)
Subject: Design & Analysis of Algorithms
Instructor: Mustafa Ali Bamboat

Quiz – 4
04-Dec-2024
30 minutes

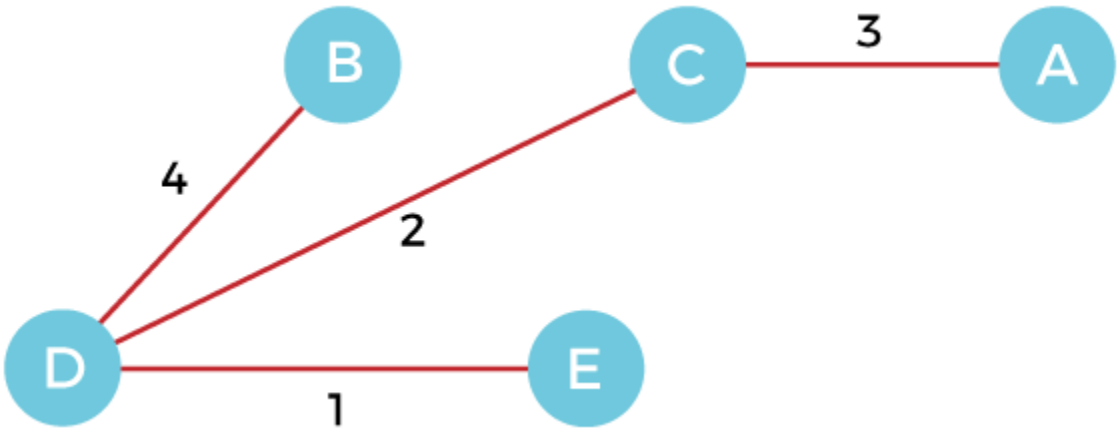
Attempt questions.

Q1. The following is the weighted undirected graph, you are required to find the possible minimum spanning tree, using a greedy approach, where the vertex B is the arbitrary start vertex.

[5 Marks]

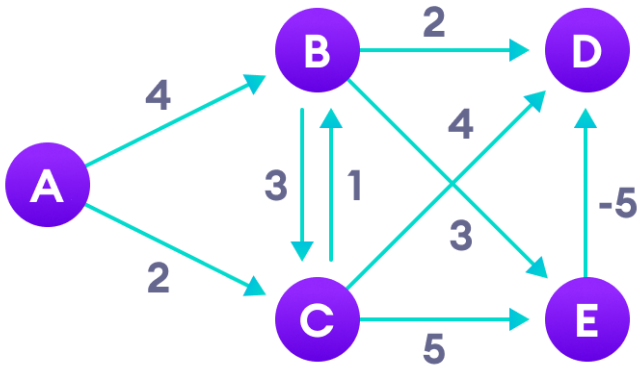


Answer:



Q2. Find the shortest paths from a single source vertex to all other vertices, using the dynamic programming strategy capable of handling graphs with negative edge weights, consider vertex A as a source vertex.

[5 Marks]



Answer:

Formula:

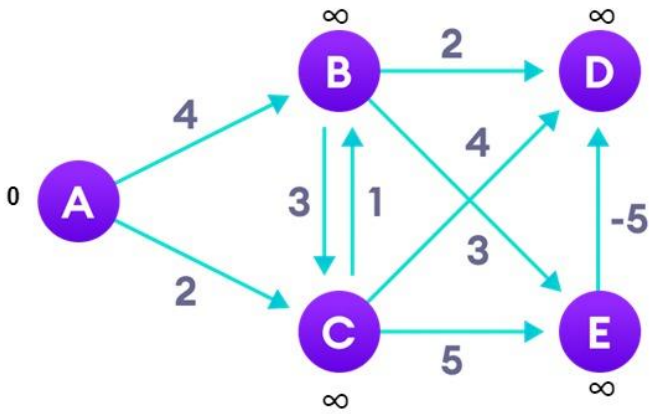
$$if\,(d[u] + c(u,v) < d[v]$$
$$d[v] = d[u] + c(u,v)$$

Step-1: create $edgesList$

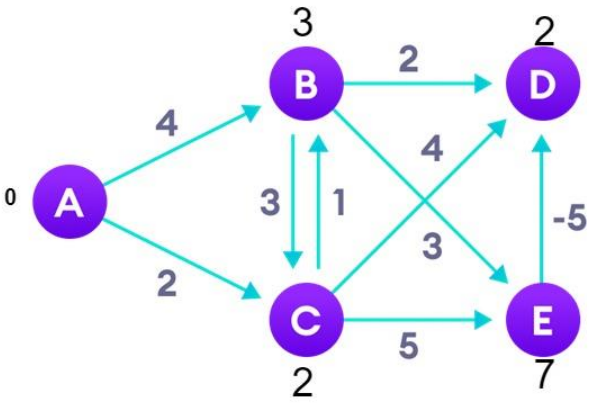
$edgesList = (\mathrm{A,B}), (\mathrm{A,C}), (\mathrm{B,C}), (\mathrm{B,D}),(\mathrm{B,E}), (\mathrm{C,B}), (\mathrm{C,D}), (\mathrm{C,E}), (\mathrm{E,D})$

Relax each edges for $|V| - 1 = 5 - 1 = 4$

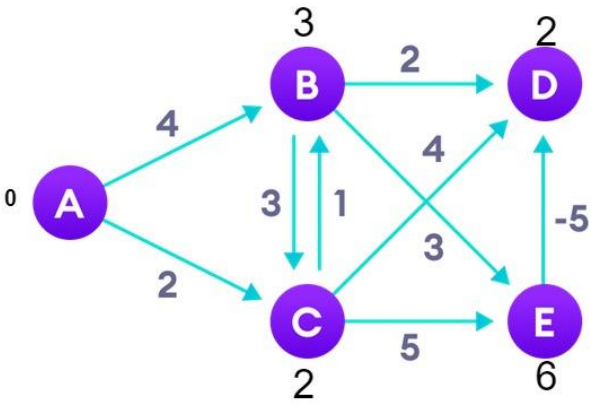
Initially mark each vertex as infinity except the source vertex.



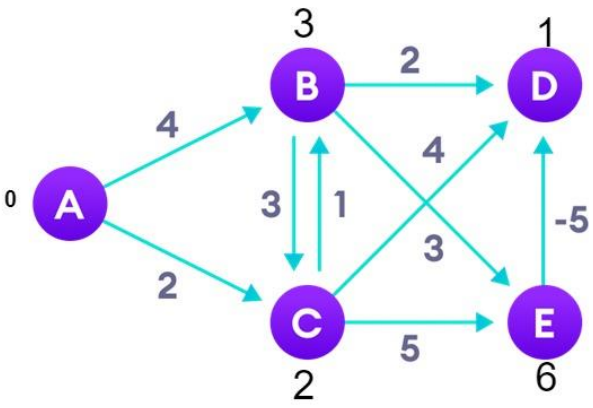
1st Loop

(A,B)	$if(0+4<\infty)$ $d[B]=4$	
(A,C)	$if(0+2<\infty)$ $d[C]=2$	
(B,C)	$if(4+3<2)false$	
(B,D)	$if(4+2<\infty)$ $d[D]=6$	
(B,E)	$if(4+3<\infty)$ $d[E]=7$	
(C,B)	$if(2+1<4)$ $d[B]=3$	
(C,D)	$if(2+4<6)$ false	
(C,E)	$if(2+5<7)$false	
(E,D)	$if(7-5<6)$ $d[D]=2$	

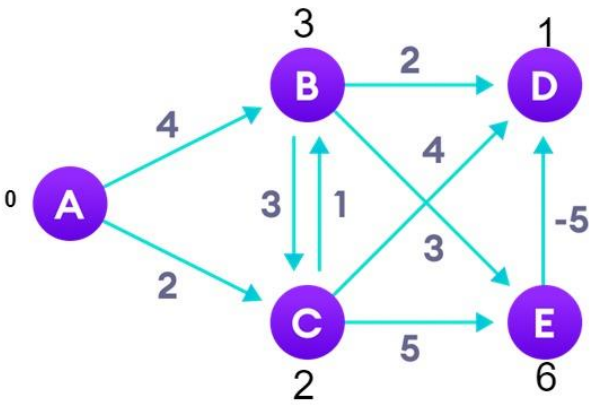
2nd Loop

(A,B)	$if(0+4<3)false$	
(A,C)	$if(0+2<2)false$	
(B,C)	$if(3+3<2)false$	
(B,D)	$if(3+2<2)false$	
(B,E)	$if(3+3<7)$ $d[E]=6$	
(C,B)	$if(2+1<3)false$	
(C,D)	$if(2+4<2)$ false	
(C,E)	$if(2+5<7)$false	
(E,D)	$if(7-5<2)false$	

3rd Loop

(A,B)	$if(0+4<3)false$	
(A,C)	$if(0+2<2)false$	
(B,C)	$if(3+3<2)false$	
(B,D)	$if(3+2<2)false$	
(B,E)	$if(3+3<6)false$	
(C,B)	$if(2+1<3)false$	
(C,D)	$if(2+4<2)$ false	
(C,E)	$if(2+5<6)$false	
(E,D)	$if(6-5<2)$ $d[D]=1$	

4th Loop

(A,B)	$if(0+4<3)false$	
(A,C)	$if(0+2<2)false$	
(B,C)	$if(3+3<2)false$	
(B,D)	$if(3+2<2)false$	
(B,E)	$if(3+3<6)false$	
(C,B)	$if(2+1<3)false$	
(C,D)	$if(2+4<2)$ false	
(C,E)	$if(2+5<6)$false	
(E,D)	$if(6-5<1)$ false	

Hence the shortest path is

$$A \rightarrow C \rightarrow D = 0+2+1=3$$