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Date
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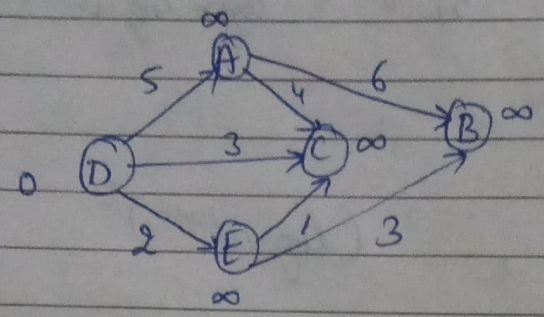
Question 4 →

(a) The graph is given as,



Step 1 – We put starting vertex, i.e. D as 0 and rest as ∞.

Step 2 – We use, $d(u) + c(u,v) \leq d(v)$, if true we update $d(v)$ by $d(u) + c(u,v)$

now, $d(D) + c(D,A) \leq d(A)$

$\rightarrow \quad 0 + 5 \leq \infty$

$\therefore \Rightarrow \boxed{d(A) = 5}$

//ly, $d(D) + c(D,C) \leq d(C)$

$0 + 3 \leq \infty$

$\Rightarrow \boxed{d(C) = 3}$

& $d(D) + c(D,E) \leq d(E)$

$0 + 2 \leq \infty$

$\rightarrow \therefore d(E) = 2$

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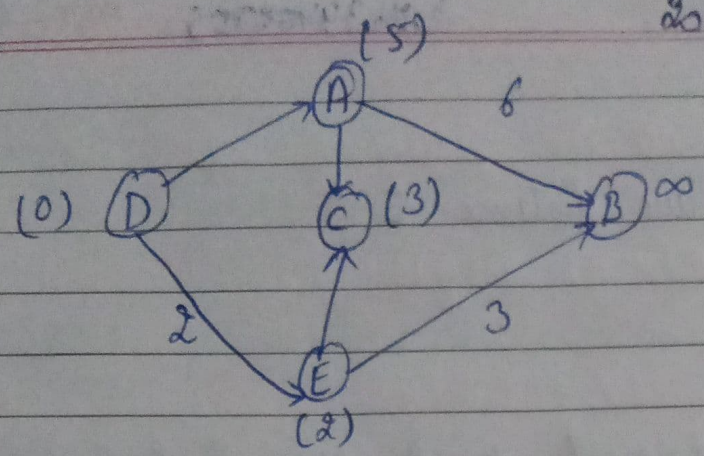

Step (3) now, find the minimum distance vertex, minimum of (5, 3, 2) is 2.

∴ next vertex E is given $\boxed{d(E) = 2}$

now, C and B are adjacent to E

$$d(E) + c(E,C) \leq d(C)$$

as, $2 + 1 \leq 3$, $\boxed{d(C) = 3}$

$$d(E) + c(E,B) \leq d(B)$$

$$2 + 3 \leq \infty$$

Hence, $d(B) = 2 + 3 = 5$

∴ $\boxed{d(B) = 5}$

Step 4, Pick minimum vertex from B and C and there is no edge from C

∴ no vertices are updated

Step 5, next, we do is ; pick minimum vertex from A

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and B both have distance 5

we Pick A

Step6, Vertices adajacent to A are B & C.

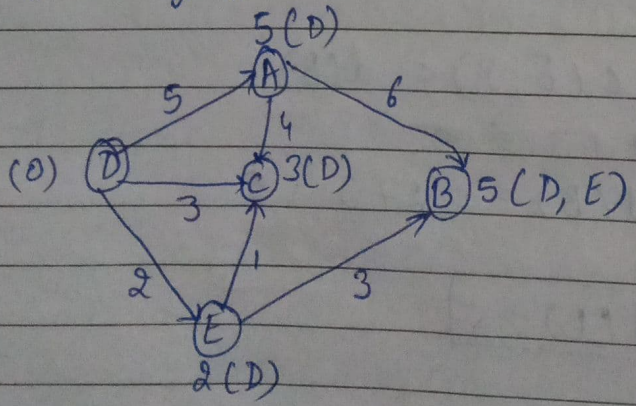
D → A → C , distance is 5+4=9 > distance of C

∴ C is not updated.

D → A → B distance is 5+6=11 > distance of B

∴ B is not updated

∴ final graph with shortest path is :



hence, D updated A, C, E, as 5, 3, 2
E updated B as 5

A & C updated none.

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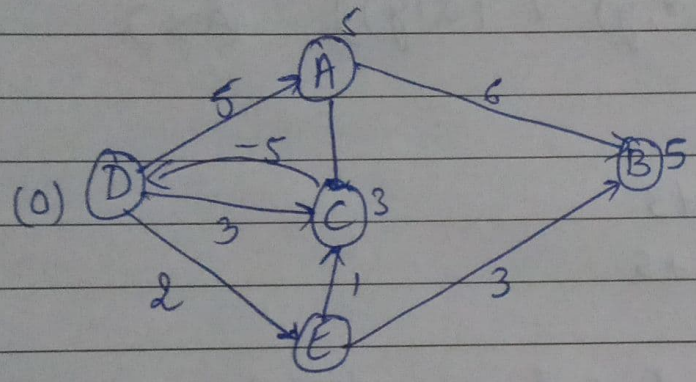
now, for CD = -5

Dijkstra Algorithm can handle graphs consisting of cycles, but negative weights will cause this algorithm to produce incorrect result.



Here, first A, C, E are updated to 5, 3, 2 ; then E is picked and B is updated to 5, Now when C is picked, it will update the D to 3-5=-2 and again D will update A, C & E

This procedure keeps repeating and will give incorrect result.

∴ Dijkstra will not work for CD = -5

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(b) To find - negate the following statement

$\forall x \exists y (P(x,y) \wedge Q(y))$

$\Rightarrow \neg[\forall x \exists y (P(x,y) \wedge Q(y))]$

$= \exists x \forall y (\neg(P(x,y) \wedge Q(y)))$

$= \exists x \forall y (\neg P(x,y) \vee \neg Q(y))$ (Ans)

(c) given, $f(x) = 5x + 3$

$g(x) = 3x + 5$

now, composition of f and g, $fog(x)$

$= f(g(x))$

$= f(3x+5)$

$= f(5(3x+5)+3)$

$= 15x + 25 + 3$

$= 15x + 28$

$\boxed{fog = 15x + 28}$

now, composition of g and f, $gof(x)$

$= g(f(x))$

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$g(5x+3)$

$= 3(5x+3)+5$

$= 15x+9+5 = 15x+14$

$\therefore g(f(x)) = 15x+14$

$\boxed{gof = 15x+14}$