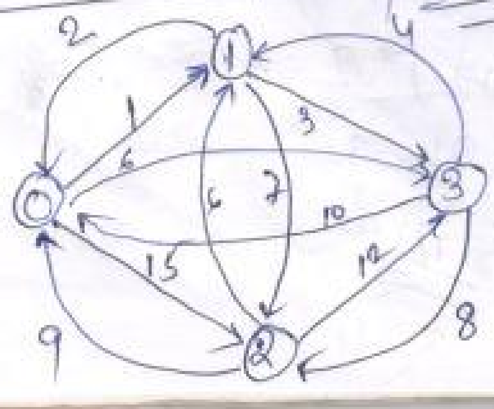
Travelling salesman problem (Held Karp Dyn...
algorithm)

1. $C(\{1\},1) = 0$
2. for $s = 2$ to n
3. for all subsets $S \subseteq \{1,2,\ldots,n\}$ of size s and ...
4. $C(S,1) = \infty$
5. for all $j \in S, j \neq 1$:
6. $C(S,j) = \min\{C(S-\{j\}, i) + d_{ij} : i \in S, i \neq \ldots$
7. return $\min_j C(\{1,\ldots,n\}, j) + d_{j1}$

Time Complexity $O(n^2 \cdot 2^n)$



	0	1	2	3
0	0	1	15	6
1	2	0	7	3
2	9	6	0	12
3	10	4	8	0

→ Generate all subset except ~~starting~~ vertex.

$\{\phi\}, \{1\}, \{2\}, \{3\}, \{1,2\}, \{1,3\}$
$\{2,3\}, \{1,2,3\}$

Now, we want to traverse all the vertex, except the starting vertex and vertexes in the subset using these subset.

→ Let's proceed, traverse all the vertex using subset $\{\phi\}$ except ~~vertex~~ starting vertex.

$\{1, \{\phi\}\} = cost[0,1] + cost[0,0] = 1+0 = 1^{(\phi)}$

$\{2, \{\phi\}\} = cost[0,2] + cost[0,0] = 15+0 = 15^{(\phi)}$

$\{3, \{\phi\}\} = cost[0,3] + cost[0,0] = 6+0 = 6^{(\phi)}$

→ Now traverse all the vertex using subset $\{1\}$ except the starting vertex i.e 0 and vertex in subset itself i.e 1.

$\{2, \{1\}\} = cost[1,2] + cost[1, \{\phi\}] = 7+1 = 8^{(1)}$

$\{3, \{1\}\} = cost[1,3] + cost[1, \phi] = 3+1 = 4^{(1)}$

→ Let's we reach vertex 2 from vertex 1. Now we have reach 1 from starting vertex i.e 0 via remaining subset i.e $\{\phi\}$ so technically it is the sum of $cost[1,2] + cost[1, \{\phi\}]$
cost of reaching 1 with remaining subset

Similarity

$\{1,\{2\}\} = cost[2,1] + cost[2,\{\phi\}] = 6+15 = 21^{(2)}$

$\{3,\{2\}\} = cost[2,3] + cost[2,\{\phi\}] = 12+15 = 27^{(2)}$

$\{1,\{3\}\} = cost[3,1] + cost[3,\{\phi\}] = 4+6 = 10^{(3)}$

$\{2,\{3\}\} = cost[3,2] + cost[3,\{\phi\}] = 8+6 = 14^{(3)}$

$$\{1,\{2,3\}\} = \min\begin{cases} cost[2,1] + cost[2,\{3\}] = 6+14 \\ cost[3,1] + cost[3,\{2\}] = 4+27 \end{cases}$$

$= 20^{(2)}$

$$\{2,\{1,3\}\} = \min\begin{cases} cost[1,2] + cost[1,\{3\}] = 7+10 = 17 \\ cost[3,2] + cost[3,\{1\}] = 8+4 = 12 \end{cases}$$

$= 12^{(3)}$

$$\{3,\{1,2\}\} = \min\begin{cases} cost[1,3] + cost[1,\{2\}] = 7+21 \\ cost[2,3] + cost[2,\{1\}] = 12+8 \end{cases}$$

$= 20^{(2)}$

$$\{0,\{1,2,3\}\} = \min\begin{cases} cost[1,0] + cost[1,\{2,3\}] = 2+20 \\ cost[2,0] + cost[2,\{1,3\}] = 9+12 \\ cost[3,1] + cost[3,\{1,2\}] = 10+20 \end{cases}$$

$= 21^{(2)}$

So we reach vertex 0 from 2. Now we have to find how did we reach 2 via subset {1, 3}.
i.e {2, {1,3}}, so in the solution we see that we reach 2 from verte 3 (0←2←3←{1}). So now we have to find how did we reach 3 via subset {1}
so we found that we reach 3 from 1. So the order of traversal is

0 ← 2 ← 3 ← 1 ← 0

The Bellman-ford algorithm

→ Dijistra algorithm works only on non-negative weight where as Bellman-ford can work with -ve weight.

→ Incase of -ve cycle Bellman-ford algorithm ~~can~~ fails but it can detect the if there is -ve cycle in the graph.

→ Dijistra algorithm is Greedy approach wh[ere] Bellman-ford is Dynamic approach.

→ worst case time complexity of Dijistra is (vlogv) where as for Bellman ford it is O(n[...])

Q why Dijistra can not handle -ve weight?