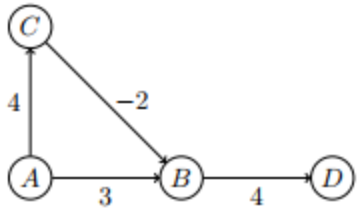
Directed graph with negative-weight edges Dijkstra's algorithm:

To find the shortest path from A to B and from A to D using Dijkstra's algorithm.

Run Dijkstra's algorithm on the graph below, using vertex A as the source.




| step | S | dist[A] | dist[B] | dist[C] | dist[D] |
|---|---|---|---|---|---|
| 1 | $\{A\}$ | 0 | 3 | 4 | $\infty$ |
| 2 | $\{A, B\}$ | 0 | 3 | 4 | 7 |
| 3 | $\{A, B, C\}$ | 0 | 3 | 4 | 7 |
| 4 | $\{A, B, C, D\}$ | 0 | 3 | 4 | 7 |

From the above table, we found that the shortest path from A to B is 7 but the actual shortest path from A to B is 2 and same is happened for path from A to D is 7 but actual shortest path from A to D is 6.

Henceforth, Dijkstra's algorithm gives incorrect result when there is negative weight.

Consider any graph with a negative cycle.

RELAX is called a finite number of times but the distance to any vertex on the cycle is $-\infty$, so DIJKSTRA's algorithm cannot possibly be correct here.

The proof of theorem 24.6 doesn't go through because we can no longer guarantee that $\delta(s, y) \leq \delta(s, u)$.