Dijkstra’s Algorithm

References

https://www.geeksforgeeks.org/dijkstras-shortest-path-algorithm-greedy-algo-7/

A minimum priority queue can be used to efficiently receive the vertex with least path distance.

```
function dijkstra(G, S)
    for each vertex V in G
        distance[V] <- infinite
        previous[V] <- NULL
        If V != S, add V to Priority Queue Q
    distance[S] <- 0

    while Q IS NOT EMPTY
        U <- Extract MIN from Q
        for each unvisited neighbour V of U
            tempDistance <- distance[U] + edge_weight(U, V)
            if tempDistance < distance[V]
                distance[V] <- tempDistance
                previous[V] <- U
    return distance[], previous[]
```

Reference: https://www.programiz.com/dsa/dijkstra-algorithm

Code for Dijkstra's Algorithm

```python
# Dijkstra's Algorithm in Python


import sys

# Providing the graph
vertices = [[0, 0, 1, 1, 0, 0, 0],
            [0, 0, 1, 0, 0, 1, 0],
            [1, 1, 0, 1, 1, 0, 0],
            [1, 0, 1, 0, 0, 0, 1],
            [0, 0, 1, 0, 0, 1, 0],
            [0, 1, 0, 0, 1, 0, 1],
            [0, 0, 0, 1, 0, 1, 0]]

edges = [[0, 0, 1, 2, 0, 0, 0],
         [0, 0, 2, 0, 0, 3, 0],
         [1, 2, 0, 1, 3, 0, 0],
         [2, 0, 1, 0, 0, 0, 1],
         [0, 0, 3, 0, 0, 2, 0],
         [0, 3, 0, 0, 2, 0, 1],
         [0, 0, 0, 1, 0, 1, 0]]

# Find which vertex is to be visited next
def to_be_visited():
    global visited_and_distance
    v = -10
    for index in range(num_of_vertices):
        if visited_and_distance[index][0] == 0 \
            and (v < 0 or visited_and_distance[index][1] <=
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vertices = [[0, 0, 1, 1, 0, 0, 0],
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            [0, 1, 0, 0, 1, 0, 1],
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         [0, 0, 3, 0, 0, 2, 0],
         [0, 3, 0, 0, 2, 0, 1],
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        if visited_and_distance[index][0] == 0 \
            and (v < 0 or visited_and_distance[index][1] <=
                 visited_and_distance[v][1]):
            v = index
    return v


num_of_vertices = len(vertices[0])

visited_and_distance = [[0, 0]]
for i in range(num_of_vertices-1):
    visited_and_distance.append([0, sys.maxsize])

for vertex in range(num_of_vertices):

    # Find next vertex to be visited
    to_visit = to_be_visited()
    for neighbor_index in range(num_of_vertices):

        # Updating new distances
        if vertices[to_visit][neighbor_index] == 1 and \
                visited_and_distance[neighbor_index][0] == 0:
            new_distance = visited_and_distance[to_visit][1] \
                + edges[to_visit][neighbor_index]
```

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    v = -10
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            and (v < 0 or visited_and_distance[index][1] <=
                 visited_and_distance[v][1]):
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for vertex in range(num_of_vertices):

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    for neighbor_index in range(num_of_vertices):

        # Updating new distances
        if vertices[to_visit][neighbor_index] == 1 and \
                visited_and_distance[neighbor_index][0] == 0:
            new_distance = visited_and_distance[to_visit][1] \
                + edges[to_visit][neighbor_index]
            if visited_and_distance[neighbor_index][1] > new_distance:
                visited_and_distance[neighbor_index][1] = new_distance

        visited_and_distance[to_visit][0] = 1
```

```
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