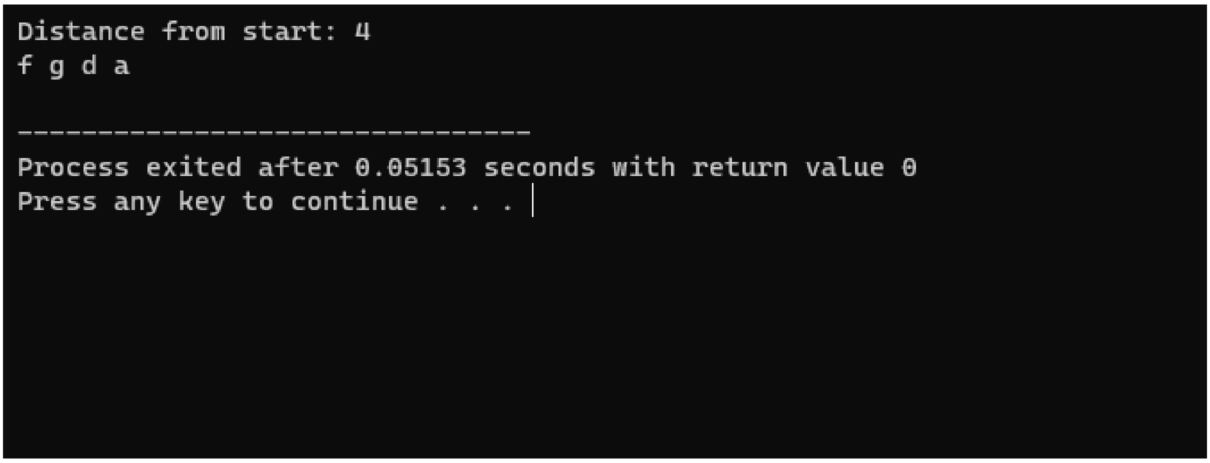
```
#include <iostream>

#include <vector>

using namespace std;

void DijkstrasTest();

int main() {

DijkstrasTest();

return 0;

}

class Node;

class Edge;

void Dijkstras();

vector<Node*>* AdjacentRemainingNodes(Node* node);

Node* ExtractSmallest(vector<Node*>& nodes);

int Distance(Node* node1, Node* node2);

bool Contains(vector<Node*>& nodes, Node* node);

void PrintShortestRouteTo(Node* destination);

vector<Node*> nodes;

vector<Edge*> edges;

class Node {

public:

Node(char id): id(id), previous(NULL), distanceFromStart(INT_MAX) {

nodes.push_back(this);

}

public:

char id;

Node* previous;

int distanceFromStart;
```

```
};

class Edge {

public:

Edge(Node* node1, Node* node2, int distance)


: node1(node1), node2(node2), distance(distance) {

edges.push_back(this);

}

bool Connects(Node* node1, Node* node2) {

return (

(node1 == this->node1 && node2 == this->node2) ||

(node1 == this->node2 && node2 == this->node1));

}

public:

Node* node1;

Node* node2;

int distance;

};


void DijkstrasTest() {

Node* a = new Node('a');

Node* b = new Node('b');

Node* c = new Node('c');

Node* d = new Node('d');

Node* e = new Node('e');

Node* f = new Node('f');

Node* g = new Node('g');
```

```
Edge* e1 = new Edge(a, c, 1);
Edge* e2 = new Edge(a, d, 2);
Edge* e3 = new Edge(b, c, 2);
Edge* e4 = new Edge(c, d, 1);
Edge* e5 = new Edge(b, f, 3);
Edge* e6 = new Edge(c, e, 3);
Edge* e7 = new Edge(e, f, 2);
Edge* e8 = new Edge(d, g, 1);
Edge* e9 = new Edge(g, f, 1);
a->distanceFromStart = 0;
Dijkstras();
PrintShortestRouteTo(f);
}
void Dijkstras() {
while (nodes.size() > 0) {
Node* smallest = ExtractSmallest(nodes);
vector<Node*>* adjacentNodes =
AdjacentRemainingNodes(smallest);
const int size = adjacentNodes->size();
for (int i = 0; i < size; ++i) {
Node* adjacent = adjacentNodes->at(i);
int distance = Distance(smallest, adjacent) +
smallest->distanceFromStart;
if (distance < adjacent->distanceFromStart) {

adjacent->distanceFromStart = distance;
adjacent->previous = smallest;
}

}

delete adjacentNodes;

}

}

Node* ExtractSmallest(vector<Node*>& nodes) {

int size = nodes.size();

if (size == 0) return NULL;

int smallestPosition = 0;

Node* smallest = nodes.at(0);

for (int i = 1; i < size; ++i) {

Node* current = nodes.at(i);

if (current->distanceFromStart <

smallest->distanceFromStart) {


smallest = current;

smallestPosition = i;

}


}

nodes.erase(nodes.begin() + smallestPosition);

return smallest;

}

vector<Node*>* AdjacentRemainingNodes(Node* node) {

vector<Node*>* adjacentNodes = new vector<Node*>();

const int size = edges.size();

for (int i = 0; i < size; ++i) {
```

```
Edge* edge = edges.at(i);
Node* adjacent = NULL;
if (edge->node1 == node) {
adjacent = edge->node2;
} else if (edge->node2 == node) {
adjacent = edge->node1;
}
if (adjacent && Contains(nodes, adjacent)) {
adjacentNodes->push_back(adjacent);
}
}

return adjacentNodes;
}
int Distance(Node* node1, Node* node2) {
const int size = edges.size();
for (int i = 0; i < size; ++i) {
Edge* edge = edges.at(i);
if (edge->Connects(node1, node2)) {
return edge->distance;
}
}

return -1;
}

bool Contains(vector<Node*>& nodes, Node* node) {
```

```
const int size = nodes.size();
for (int i = 0; i < size; ++i) {
if (node == nodes.at(i)) {
return true;
}
}

return false;
}
void PrintShortestRouteTo(Node* destination) {
Node* previous = destination;
cout << "Distance from start: "
<< destination->distanceFromStart << endl;
while (previous) {
cout << previous->id << " ";
previous = previous->previous;
}
cout << endl;
}
vector<Edge*>* AdjacentEdges(vector<Edge*>& Edges, Node* node);
void RemoveEdge(vector<Edge*>& Edges, Edge* edge);
vector<Edge*>* AdjacentEdges(vector<Edge*>& edges, Node* node) {
vector<Edge*>* adjacentEdges = new vector<Edge*>();
const int size = edges.size();
for (int i = 0; i < size; ++i) {
Edge* edge = edges.at(i);
if (edge->node1 == node) {

cout << "adjacent: " << edge->node2->id << endl;

adjacentEdges->push_back(edge);


} else if (edge->node2 == node) {

cout << "adjacent: " << edge->node1->id << endl;

adjacentEdges->push_back(edge);

}

}

return adjacentEdges;

}

void RemoveEdge(vector<Edge*>& edges, Edge* edge) {

vector<Edge*>::iterator it;

for (it = edges.begin(); it < edges.end(); ++it) {

if (*it == edge) {

edges.erase(it);

return;

}

}

}
```



```
Distance from start: 4
f g d a

--------------------------------
Process exited after 0.05153 seconds with return value 0
Press any key to continue . . .
```