創新AI碩一

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Key Point：

1. Update Estimates  
   If the calculated distance of a vertex is less than the known distance, update the shortest distance.
2. Choose Next Vertex  
   The town we explore will always be the unexplored town with the smallest estimates.  
   In other words, the next town we explore should be among all of the unexplored towns, the one we know we can get to the quickest.

思考方向：

1. 試著找出所有One-To-All Shortest Path
2. 再從中選出到Eforie的最短路徑
3. A

|  |  |  |  |
| --- | --- | --- | --- |
| **Vertex** | **Shortest Distance From Arad** | **Previous Vertex** | **Path** |
| Arad | 0 | X | A |

Consider the start vertex, Arad.

Distance to Arad from Arad = 0.

Distance to all other vertices from Arad are unknown, therefore ∞ (infinity).

1. A→Z

|  |  |  |  |
| --- | --- | --- | --- |
| **Vertex** | **Shortest Distance From Arad** | **Previous Vertex** | **Path** |
| Arad | 0 | X | A |
| Zerind | 75 | A | A→Z |
| Sibiu | 140 | A | A→S |
| Timisoara | 118 | A | A→T |

Zerind: min(∞,75) = 75

Sibiu: min(∞,140) = 140

Timisoara: min(∞,118) = 118

Visit the unvisited vertex with the smallest known distance from the start vertex, Arad.  
This time around, it is Zerind.

1. A→Z→O

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| --- | --- | --- | --- |
| **Vertex** | **Shortest Distance From Arad** | **Previous Vertex** | **Path** |
| Arad | 0 | X | A |
| Zerind | 75 | A | A→Z |
| Sibiu | 140 | A | A→S |
| Timisoara | 118 | A | A→T |
| Oradea | 146 | Z | A→Z→O |

Oradea: min(∞,146) = 146

1. A→S

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| **Vertex** | **Shortest Distance From Arad** | **Previous Vertex** | **Path** |
| Arad | 0 | X | A |
| Zerind | 75 | A | A→Z |
| Sibiu | 140 | A | A→S |
| Timisoara | 118 | A | A→T |
| Oradea | 146 | Z | A→Z→O |
| Neamt | 246 | O | A→Z→O→N |

Sibiu: min(140, 297) = 140, We do not need to update the distance to Sibiu.

Neamt: min(∞, 246) = 246

Visit the unvisited vertex with the smallest known distance. This time around, it is Sibiu.

1. A→S→R

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| **Vertex** | **Shortest Distance From Arad** | **Previous Vertex** | **Path** |
| Arad | 0 | X | A |
| Zerind | 75 | A | A→Z |
| Sibiu | 140 | A | A→S |
| Timisoara | 118 | A | A→T |
| Oradea | 146 | Z | A→Z→O |
| Neamt | 246 | O | A→Z→O→N |
| Fagaras | 239 | S | A→S→F |
| Rimnicu Vilcea | 220 | S | A→S→R |

Fagaras: min(∞, 239) = 239

Rimnicu Vilcea: min(∞, 220) = 220

Visit the unvisited vertex with the smallest known distance. This time around, it is Rimnicu Vilcea.

1. A→S→R→P

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| --- | --- | --- | --- |
| **Vertex** | **Shortest Distance From Arad** | **Previous Vertex** | **Path** |
| Arad | 0 | X | A |
| Zerind | 75 | A | A→Z |
| Sibiu | 140 | A | A→S |
| Timisoara | 118 | A | A→T |
| Oradea | 146 | Z | A→Z→O |
| Neamt | 246 | O | A→Z→O→N |
| Fagaras | 239 | S | A→S→F |
| Rimnicu Vilcea | 220 | S | A→S→R |
| Pitesti | 317 | R | A→S→R→P |
| Craiova | 366 | R | A→S→R→C |

Pitesti: min(∞, 317) = 317

Craiova: min(∞, 366) = 366

Visit the unvisited vertex with the smallest known distance. This time around, it is Pitesti.

1. A→S→R→C

|  |  |  |  |
| --- | --- | --- | --- |
| **Vertex** | **Shortest Distance From Arad** | **Previous Vertex** | **Path** |
| Arad | 0 | X | A |
| Zerind | 75 | A | A→Z |
| Sibiu | 140 | A | A→S |
| Timisoara | 118 | A | A→T |
| Oradea | 146 | Z | A→Z→O |
| Neamt | 246 | O | A→Z→O→N |
| Fagaras | 239 | S | A→S→F |
| Rimnicu Vilcea | 220 | S | A→S→R |
| Pitesti | 317 | R | A→S→R→P |
| Craiova | 366 | R | A→S→R→C |
| Bucharest | 418 | P | A→S→R→P→B |

Bucharest: min(∞, 418) = 418

Craiova: min(366, 455) = 366, We do not need to update the distance to Craiova.

Visit the unvisited vertex with the smallest known distance. This time around, it is Craiova.

※ 省略Fagars，因為距離目標Eforie更遠。

1. A→S→R→C→G

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| --- | --- | --- | --- |
| **Vertex** | **Shortest Distance From Arad** | **Previous Vertex** | **Path** |
| Arad | 0 | X | A |
| Zerind | 75 | A | A→Z |
| Sibiu | 140 | A | A→S |
| Timisoara | 118 | A | A→T |
| Oradea | 146 | Z | A→Z→O |
| Neamt | 246 | O | A→Z→O→N |
| Fagaras | 239 | S | A→S→F |
| Rimnicu Vilcea | 220 | S | A→S→R |
| Pitesti | 317 | R | A→S→R→P |
| Craiova | 366 | R | A→S→R→C |
| Bucharest | 418 | P | A→S→R→P→B |
| Giurgiu | 716 | C | A→S→R→C→G |

Giurgiu: min(∞, 716) = 716

1. A→S→R→P→B

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| --- | --- | --- | --- |
| **Vertex** | **Shortest Distance From Arad** | **Previous Vertex** | **Path** |
| Arad | 0 | X | A |
| Zerind | 75 | A | A→Z |
| Sibiu | 140 | A | A→S |
| Timisoara | 118 | A | A→T |
| Oradea | 146 | Z | A→Z→O |
| Neamt | 246 | O | A→Z→O→N |
| Fagaras | 239 | S | A→S→F |
| Rimnicu Vilcea | 220 | S | A→S→R |
| Pitesti | 317 | R | A→S→R→P |
| Craiova | 366 | R | A→S→R→C |
| Bucharest | 418 | P | A→S→R→P→B |
| Giurgiu | 716 | C | A→S→R→C→G |
| Eforie | 1116 | G | A→S→R→C→G→E |

Eforie: min(∞, 1116) = 1116

Bucharest: min(418, 806) = 418, We do not need to update the distance to Bucharest.

Visit the unvisited vertex with the smallest known distance. This time around, it is Bucharest.

1. A→S→R→P→B→U→H→E

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| --- | --- | --- | --- |
| **Vertex** | **Shortest Distance From Arad** | **Previous Vertex** | **Path** |
| Arad | 0 | X | A |
| Zerind | 75 | A | A→Z |
| Sibiu | 140 | A | A→S |
| Timisoara | 118 | A | A→T |
| Oradea | 146 | Z | A→Z→O |
| Neamt | 246 | O | A→Z→O→N |
| Fagaras | 239 | S | A→S→F |
| Rimnicu Vilcea | 220 | S | A→S→R |
| Pitesti | 317 | R | A→S→R→P |
| Craiova | 366 | R | A→S→R→C |
| Bucharest | 418 | P | A→S→R→P→B |
| Giurgiu | 716 | C | A→S→R→C→G |
| Eforie | 687 | G | A→S→R→P→B→U→H→E |
| Urziceni | 503 | B | A→S→R→P→B→U |
| Hirsova | 601 | U | A→S→R→P→B→U→H |

Eforie: min(1116, 687) = 687

※ 省略Ureziceni→Vaslui，因為距離目標Eforie更遠。

we are done.

The Shortest path to Eforie is A→S→R→P→B→U→H→E.

Total Distance is 687KM.