Uninformed Search Strategies

School of Electronic and Computer Engineering
Peking University

Wang Wenmin

Uniform-cost Search 一致代价搜索

Search Strategy 搜索策略

Expand lowest-cost unexpanded node.

扩展最低代价的未扩展节点。

Implementation 实现方法

Queue ordered by path cost, lowest first.

队列，按路径代价排序，最低优先。

Uniform-cost Search Algorithm 一致代价搜索算法

```
function UNIFORM-FIRST-SEARCH(problem) returns a solution, or failure
    node ← a node with STATE = problem.INITIAL-STATE, PATH-TEST = 0
    frontier ← a priority queue ordered by PATH-COST, with node as the only element
    explored ← an empty set
    loop do
        if EMPTY ? (frontier) then return failure
        node ← POP(frontier)          /* chooses the lowest-cost node in frontier */
        if problem.GOAL-TEST(node.STATE) then return SOLUTION(node)
        add node.STATE to explored
        for each action in problem.ACTIONS(node.STATE) do
            child ← CHILD-NODE(problem, node, action)
            if child.STATE is not in explored or frontier then
                frontier ← INSERT(child, frontier)
            else if  child.STATE is in frontier with higher PATH-COST then
                replace that frontier node with child
```

Example: From Sibiu to Bucharest 举例：从Sibiu到Bucharest

- From Sibiu to Bucharest, least-cost node, Rimnicu Vilcea, is expanded, next, adding Pitesti with cost 80 + 97 = 177.

  从Sibiu到Bucharest，扩展最低代价节点Rimnicu Vilcea，然后加上Pitesti的代价

- The least-cost node is now Fagaras, and adding goal node Bucharest with cost 99 + 211 = 310.

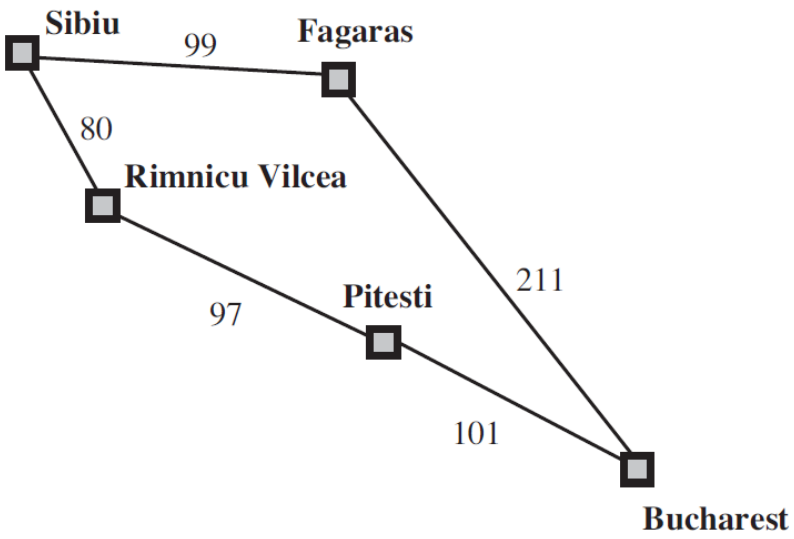
  现在最低代价节点为Fagaras，加上目标节点Bucharest的代价

- Choosing Pitesti and adding a second path to Bucharest with cost 177 + 101 = 278.

  选择Pitesti并加上第二条路径到Bucharest的代价

- This new path is better, so lowest path cost is 278.

  这条新路径较好，故最低路径代价为 278.



Properties of Uniform-cost Search —致代价搜索的特性

- Time complexity $O(b^{1+\lfloor C^*/\epsilon \rfloor})$

  时间复杂性

- Space complexity $O(b^{1+\lfloor C^*/\epsilon \rfloor})$

  空间复杂性

where

- b -- the branching factor

  分支因子

- C^* -- the cost of the optimal solution

  最优解的代价

- ϵ -- every action costs at least

  至少每个动作的代价

Thank you for your attention!