Artificial Intelligence Lab

Name : Sandip Kumar Maity
**Roll : ** 001911001032
Department : Information Technology (UG-3)
Semester : 5
Assignment 4.1: UCS and Iterative lengthening Search

Assignment Description :

Implement both the algorithms and apply them to instances of the graph given for the traveling in Romania problems. Compare the algorithm's performance between uniform-cost search and Iterative Lengthening search, and comment on your results.

Things to do:
1. Implement both the algorithms
2. Execute both the implementations on traveling in Romania problem.
3. Write a document based on your observations of outputs of point 2 and compare and comment on the output.

Uniform-Cost Search :

Uniform-Cost Search is a variant of Breadth First Search where expansion is done according to the cost of getting to the node instead of the depth of the node. So instead of using a normal queue, a priority queue is used.

Iterative Lengthening Search :

The idea is to use increasing limits on path cost to search for the path with the least cost. If a node is generated with a cost more than the limit it is immediately discarded. For any iteration, the cost limit is set to the least discarded cost in the last iteration.

Observations :

1. We explore all nodes in UCS as there is no cost limit, whereas in ILS nodes with a cost more than the cost limit are discarded.
2. We perform UCS only once on the given graph i.e. single search, whereas in ILS we repeatedly search the graph with increasing cost limit.

   In our example ILS performs multiple searches with the following limits:
   0, 75, 118, 140, 146, 220, 229, 239, 291, 299, 317, 366, 374, 418.

   For each iteration, ILS has to explore the nodes it has previously explored in previous iterations again. This impacts the time of execution a bit, as it has to re-explore starting part of the graph multiple times till it reaches the goal. Whereas UCS explores these nodes only once.
3. As UCS is a single search, it puts every node it generates into the priority queue even if it has a high cost. Due to this the average size of the priority queue is high (4.0 in our example). In ILS we use an increasing cost limit and so nodes with a cost higher than the limit are rejected and so the average size of the priority queue is relatively smaller and generally increases as the cost limit increases (ranges from 0 to 3.25 in our example). This means that ILS uses less memory on average for searching the least cost path.