

# AI Lab - Lesson 2

## Informed Search

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# Start Your Working Environment

Start the previously installed (Session 1) conda environment *ai-lab*

## Listing 1: Update Environment

```
cd AI-Lab  
git stash (NB: remember to backup the previous lessons before this step!)  
git pull  
git stash pop  
conda activate ai-lab  
jupyter notebook
```

## Listing 2: Open Lesson

To open the tutorial navigate with your browser to:  
`lesson_2/lesson_2_problem.ipynb`

# Uniform-Cost Search Example

At the beginning of *lesson\_2/lesson\_2\_problem.ipynb* you can find an implementation of the last uninformed search algorithm you have seen in class, the Uniform-Cost Search (UCS). The pseudocode is in the next slide.

# Uniform-Cost Search (UCS)

**Input:** *problem*

**Output:** *solution*

```
1: node  $\leftarrow$  a node with STATE = problem.INITIAL-STATE, PATH-COST = 0
2: frontier  $\leftarrow$  PRIORITY-QUEUE ordered by PATH-COST, with node as the only element
3: explored  $\leftarrow \emptyset$ 
4: loop
5:   if IS-EMPTY(frontier) then return FAILURE
6:   node  $\leftarrow$  REMOVE(frontier) ▷ Remove node with highest priority
7:   if problem.GOAL-TEST(node.STATE) then return SOLUTION(node)
8:   explored  $\leftarrow$  explored  $\cup$  node.STATE
9:   for each action in problem.ACTIONS(node.STATE) do
10:    child  $\leftarrow$  CHILD-NODE(problem, node, action) ▷ Increase path cost over parent
11:    if child.STATE not in explored or frontier then
12:      frontier  $\leftarrow$  INSERT(child, frontier)
13:    else
14:      if child.STATE is in frontier with higher path – cost then
15:        replace that frontier node with child
```

Note: this is a **graph search** version

# Assignments

- Your assignments for this session are at:  
*lesson\_2/lesson\_2\_problem.ipynb*. You will be required to implement some informed search algorithms
- The pseudocodes are variations of the Uniform-Cost Search (UCS) where the *priority queue* is ordered by  $h$  and  $f = g + h$  respectively