

This file provides pseudo code for all the functions you need to implement.

- You need to implement the `drive(goalstates,inputs)` function.
- In `drive(goalstates,inputs)` function you can free to implement any search algorithm covered in class (explain your algorithm in solution pdf), Your algorithm should perform well on different scenarios.
- To provide you assistant in implementation this pdf provides pseudo code for Drive function, A* search and its helper functions [heuristic cost and path reconstruction],
- **Pseudo codes for all 4 functions [Drive, A*, heuristic cost and path reconstruction] are provided below, you can just convert them into python code to complete the assignment.**
- Submit the function code in pdf file. The code has to compile and run as part of the simulator without issues.

Algorithm 1 *drive(goalstates,inputs)*

- 1: extract start and goal states from environment
 - 2: **for** for all goal states **do**
 - 3: goalReached,path= *A_Star(start,goal)*
 - 4: Find best path from all paths received [1 path received for 1 goal]
 - 5: [Best path, would the shortest path in case of goal is reachable otherwise it would be the longest path, how far traveled before being blocked]
 - 6: Compute action sequence for best path
 - 7: retrun action sequence
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For more details (and pseudo code) of “A star search” go through the class slides and wiki page https://en.wikipedia.org/wiki/A*_search_algorithm

closedSet - The set of nodes already evaluated

openSet - The set of currently discovered nodes that are not evaluated yet.

cameFrom - which node it can most efficiently be reached from.

gScore - the cost of getting from the start node to that node.

fScore - cost of getting from the start node to the goal. by passing that node.

Algorithm 2 *A_Star(start, goal)*

```
1: closedSet = []
2: openSet = [start]
3: cameFrom = {}
4: gScore = {}
5: gScore[start] = 0
6: fScore = {}
7: fScore[start] = heuristic_cost_estimate(start, goal)
8: current = start
9: while openSet is not empty do
10:   current = the node in openSet having the lowest fScore value
11:   if current = goal then
12:     return Goal Reached, reconstruct_path(cameFrom, current)
13:   remove current from openSet and fScore
14:   add current to closedSet
15:   for all actions do
16:     neighbor = applyAction(current, action)
17:     if neighbor = current then
18:       path blocked, stop, evaluate next action
19:     tentative_gScore = gScore[current] + Distance from current to neighbor
20:     if neighbor not in openSet then
21:       Add neighbor in openSet
22:     else if tentative_gScore ≥ gScore[neighbor] then
23:       stop, evaluate next action
24:     cameFrom[neighbor] = current
25:     gScore[neighbor] = tentative_gScore
26:     fScore[neighbor] = gScore[neighbor] +
       heuristic_cost_estimate(neighbor, goal)
27: if current = goal then
28:   return Goal Reached, reconstruct_path(cameFrom, current)
29: else
30:   return Goal Not Reachable, reconstruct_path(cameFrom, current)
```

Algorithm 3 *heuristic_cost_estimate(start, goal)*

```
1: return [how far ahead is goal state]/2
```

Algorithm 4 *reconstruct_path(cameFrom, current)*

```
1: total_path = []
2: total_path.append(current)
3: while current in cameFrom.keys do
4:   total_path.append(cameFrom[current])
5:   current = cameFrom[current]
6: total_path.append(current)
7: return total_path
```
