16-662 Autonomy Homework 3

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1 New Action Code Snippets

Figure 1 is a code snippet of the three new actions. The first action is for moving the robot from the kitchen to the pantry. The second action is for moving the robot from the pantry to the kitchen. The third action is for slicing fruit in the kitchen.

```
### Move to Pantry
Precond=np.zeros([nr0bjects, nrPredicates])
Precond[0][1]=1 # Robot in the kitchen
Precond[0][5]=-1 # Robot not in the pantry
Effect=np.zeros([nr0bjects, nrPredicates])
Effect[0][1]=-2. # Robot not in the kitchen
Effect[0][5]=2. # Robot in the the pantry
ActionPre.append(Precond)
ActionEff.append(Effect)
ActionDesc.append("Move to InPantry from InKitchen")
### Move from Pantry
Precond=np.zeros([nr0bjects, nrPredicates])
Precond[0][5]=1 # Robot in the pantry
Precond[0][1]=-1 # Robot not in the kitchen
Effect=np.zeros([nr0bjects, nrPredicates])
Effect[0][5]=-2. # Robot not in the pantry
Effect[0][1]=2. # Robot in the the kitchen
ActionPre.append(Precond)
ActionEff.append(Effect)
ActionDesc.append("Move to InKitchen from InPantry")
###Cut fruit in kitchen
for j in [1,2]:
    Precond=np.zeros([nr0bjects, nrPredicates])
    Precond[0][1]=1 # Robot in the kitchen
    Precond[j][1]=1 # Fruit j in the kitchen
    Precond[4][1]=1 # Knife in the kitchen
    Precond[j][6]=-1 # Fruit is not chopped
    Effect=np.zeros([nr0bjects, nrPredicates])
    Effect[j][6]=2 # Fruit is chopped
    ActionPre.append(Precond)
    ActionEff.append(Effect)
    ActionDesc.append("Cut "+Objects[j]+" in the kitchen")
```

Figure 1: Code snippet of the three new actions.

2 Path Planning Results

Figure 2 shows the results of planning a path using both Dijkstra's algorithm and the A^* algorithm. Dijkstra's takes much longer and must explore 4545 states in order to find a path with 16 actions. This is guaranteed to be optimal. A^* is faster, only exploring 1835 states before finding a solution with 16 steps. The solution A^* produces is optimal in this case, but it is not guaranteed to be optimal in general.

```
Path Found:
Path Found: True
                                        States Explored:
                                                           1835
States Explored:
                   4545
                                        Plan Length: 16
Plan Length: 16
                                        Plan:
Plan:
                                        Move to InKitchen from InHallway
Move to InKitchen from InHallway
                                        Move to InPantry from InKitchen
Move to InPantry from InKitchen
                                        Pick up Lemon from InPantry
Pick up Lemon from InPantry
                                        Move to InKitchen from InPantry
Move to InKitchen from InPantry
Move to InHallway from InKitchen
                                        Move to InHallway from InKitchen
                                        Move to InGarden from InHallway
Move to InOffice from InHallway
                                        Pick up Strawberry from InGarden
Pick up Knife from InOffice
                                        Place Lemon at InGarden
Move to InHallway from InOffice
Move to InGarden from InHallway
                                        Move to InHallway from InGarden
                                        Move to InOffice from InHallway
Pick up Strawberry from InGarden
                                        Pick up Knife from InOffice
Place Lemon at InGarden
                                        Move to InHallway from InOffice
Move to InHallway from InGarden
                                        Move to InKitchen from InHallway
Move to InKitchen from InHallway
                                        Place Strawberry at InKitchen
Place Strawberry at InKitchen
                                        Place Knife at InKitchen
Place Knife at InKitchen
Cut Strawberry in the kitchen
                                        Cut Strawberry in the kitchen
```

Figure 2: Results after running Dijkstra's (left) and A* (right) algorithms.