Robot Autonomy HW3 - Austin Windham

The code snippets for the three new actions are below.

Code for Robot moving to the pantry if it is in the kitchen:

```
### Move to Pantry
Precond=np.zeros([nrObjects, nrPredicates])
# TODO: Robot in the kitchen and Robot not in the pantry
Precond[0][1] = 1 # Robot in kitchen
Precond[0][5] = -1 # Robot not in pantry

Effect=np.zeros([nrObjects, nrPredicates])

# TODO: Move robot from the kitchen to the pantry (remove from kitchen and add to pantry)
Effect[0][1]= -2. #Robot not in kitchen
Effect[0][5]= 2.  # Robot in pantry

ActionPre.append(Precond)
ActionEff.append(Effect)
ActionDesc.append("Move to Pantry from Kitchen")
```

Code for Robot moving to the kitchen if it is in the pantry:

```
### Move from Pantry
Precond=np.zeros([nrObjects, nrPredicates])
# TODO: Robot not in the kitchen and Robot in the pantry
Precond[0][1]= -1  # Robot not in kitchen
Precond[0][5]= 1  #Robot in pantry

Effect=np.zeros([nrObjects, nrPredicates])
# TODO: Move robot from the pantry to the kitchen (remove from pantry and add to kitchen)
Effect[0][1]= 2. # Robot in the kitchen
Effect[0][5]= -2.  # Robot not in pantry

ActionPre.append(Precond)
ActionEff.append(Effect)
ActionDesc.append("Move to Kitchen from Pantry")
```

Code for Robot cutting fruit if Robot, knife, and fruit are in the kitchen and the fruit is uncut:

```
###Cut fruit in kitchen
for j in [1,2]:
    Precond=np.zeros([nrObjects, nrPredicates])
    # TODO: Robot in the kitchen, fruit in the kitchen, knife in the kitchen, fruit not chopped
    Precond[0][1]= 1  # Robot in kitchen
    Precond[j][1]= 1  # Fruit in kitchen
    Precond[4][1]= 1   # Knife in kitchen
    Precond[j][6]= -1 # Fruit not chopped

    Effect=np.zeros([nrObjects, nrPredicates])
    # TODO: Fruit is chopped
    Effect[j][6]=2 # Fruit chopped

    ActionPre.append(Precond)
    ActionEff.append(Effect)
    ActionDesc.append("Cut "+Objects[j]+" in the kitchen")
```

The print output for Djikstra's algorithm is below. The length of the plan was 16, and the number of vertices in the graph after finding the path to Goal is 5894. The final plan is in the screenshot below.

```
Path Found:  True
States Explored:  5894
Plan Length:  16

Plan:
Move to InKitchen from InHallway
Move to Pantry from Kitchen
Pick up Lemon from InPantry
Move to Kitchen from Pantry
Move to InHallway from InKitchen
Move to InOffice from InHallway
Pick up Knife from InOffice
Move to InHallway from InOffice
Move to InGarden from InHallway
Pick up Strawberry from InGarden
Place Lemon at InGarden
Move to InHallway from InGarden
Move to InKitchen from InHallway
Place Strawberry at InKitchen
Place Knife at InKitchen
Cut Strawberry in the kitchen
```

The print output for the A* algorithm is below. The length of the plan was 16, and the number of vertices in the graph after finding the path to Goal is 2005. The final plan is also in the screenshot below.

```
Path Found:  True
States Explored:  2005
Plan Length:  16

Plan:
Move to InKitchen from InHallway
Move to Pantry from Kitchen
Pick up Lemon from InPantry
Move to Kitchen from Pantry
Move to InHallway from InKitchen
Move to InGarden from InHallway
Pick up Strawberry from InGarden
Place Lemon at InGarden
Move to InHallway from InGarden
Move to InOffice from InHallway
Pick up Knife from InOffice
Move to InHallway from InOffice
Move to InKitchen from InHallway
Place Strawberry at InKitchen
Place Knife at InKitchen
Cut Strawberry in the kitchen
```