Tutorial weeks 6-7: AI Planning

Background:
In this tutorial, we are going to solve some planning problems.

Blocksworld is a well-known planning domain. In this domain, we have a number of blocks and a gripper or a robot hand. The blocks are placed on the table. Initially, they could be organised in many ways. The planner's job is to provide a plan(s) to achieve the objectives.

Practice:
For example, if we have 3 blocks such as A, B and C.

Initial State:
The initial states are as below –

1. Block A is on the table
2. Block C is on block A
3. Block B is on the table and there is no block on B
4. Initially, the robot's hand is empty

Figure 1: Initial state of 3 blocks

Goal State:

1. Block C is on the table
2. Block B is on block C
3. Block A is on block B
4. Robot's hand is empty

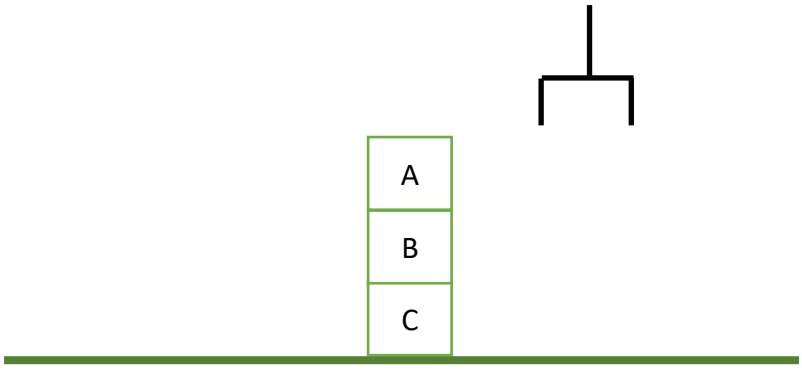


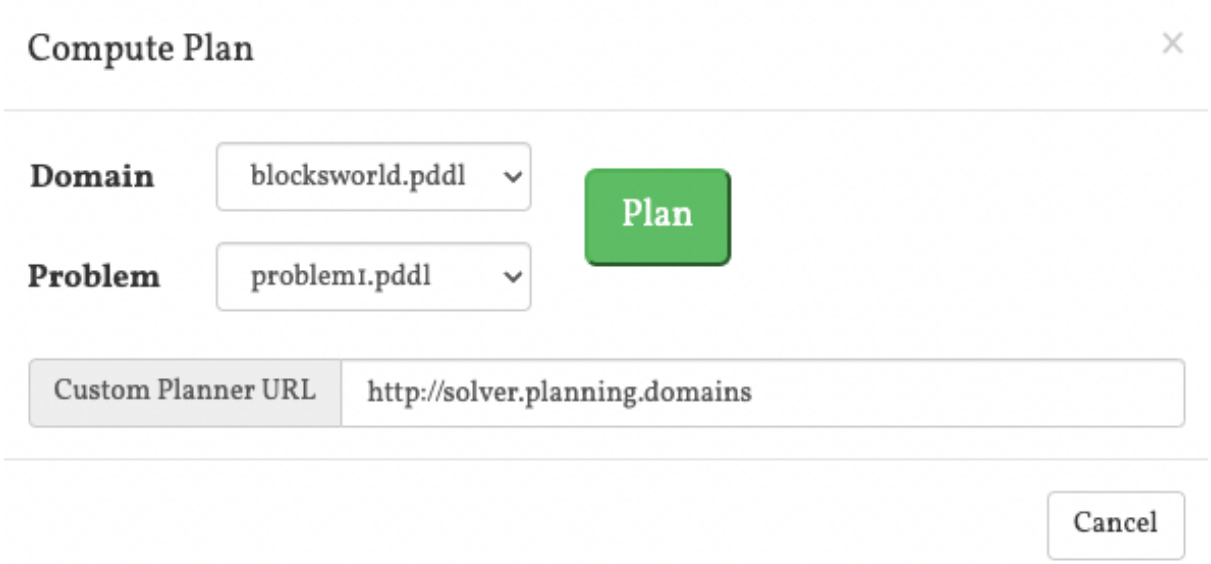
Figure 2: The goal States of the 3 blocks

To solve a block world problem we need –

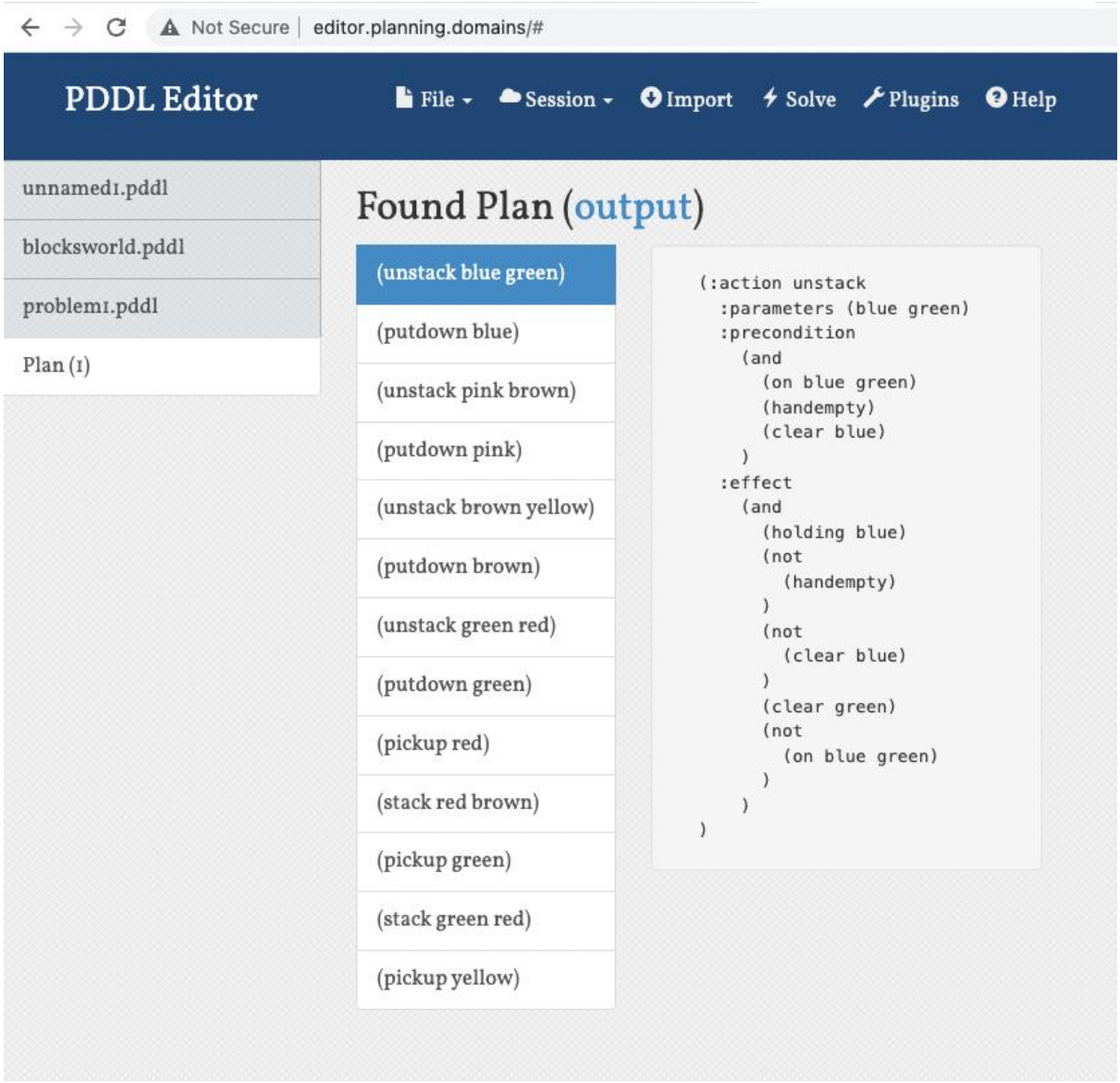
- A domain file (blocksworld.pddl)
- A problem file (problem1.pddl, problem2.pddl etc.)
- a planner

Steps

1. Open a new tab on your browser
2. Look for http://editor.planning.domains/
    a. In PDDL Editor you can create, edit and run a planning problem to get a solution
3. Click on file menu and load the domain and problem file
4. Click on 'Solve' and select your appropriate domain file and problem file
5. Hit the 'Plan' button



1. If there is a plan you will see the plan appears on the left menu



Activity 1:

Create a planning problem (problem3.pddl) for the Blocksworld domain, which will have initial states and goal states.

- There will be 10 blocks such as A, B, C, D, E, F, G, H, I and J.
- You can organise the initial state of the block as you like
- The goal state must be in ascending order A, B, C, D, E, F, G, H, I and J. J will be on the table and there will be nothing on top of A.

Activity 2:

Once you have completed Activity 1, you can create another planning problem (problem4.pddl).

- In this planning problem, you need to set the goal as opposite of Activity 1 i.e., J will be on the top and A will be at the bottom.

Activity 3:

Download the LogisticsDomain folder and take the domain file and the problem file to your PDDL Editor environment. Once loaded solve the planning problem by clicking the solver. This domain has two cities and 3 packages to move between them. Understand the domain problem including the objects, initial state and goal state.

Create a new planning problem using by adding more packages (probably 3 more) to move between the cities. You can choose the goal as you like however, the objects must move to different locations.

Activity 4:
This is an open exercise to find the domain you are interested in and find the plan.

Click on the Import menu in PDDL Editor and you will find several links from which you will be able to import domain models and problem files that you like. You can solve the problems using the solver provided in the PDDL Editor.

Write down your experience of solving the planning problems (if the problem is solved).

Next: Think about how you would solve your future planning problem. Probably you want to model a new domain!

Useful Links:

1. PDDL Editor: Not secure but easy to use http://editor.planning.domains/

2. Run planner online: Copy and paste the domain file on the left and the problem file on the right and hit the plan button

   https://web-planner.herokuapp.com/

3. Write PDDL in Visual Studio Code: if you paste the domain file in a new file and save it as PDDL, it will ask you to add the plug-ins

   https://marketplace.visualstudio.com/items?itemName=jan-dolejsi.pddl

4. BlocksWorld YouTube video: https://www.youtube.com/watch?v=NMqYpYOcbwg&t=238s