# E07 FF Planner 2

| 姓名	学号	日期
张天祎	18340215	2020.10.21

1 Boxman Game

If you don't know how to play the boxman game, you should open BoxMan.zip and click BoxMan.exe to have a try. You can also choose the level of the game to challenge yourselves. There are five cases choosed from level 1, 10, 30, 40, 50 in the following figures.

You can model the location information based on rectangular coordinates as mapped out in Figure 3. For example, we denote by P13 the position (1,3). The calculated action sequence can be like this:MOVE P12 P13, PUSH BOX1 P14 P15...,which means the guy runs from position (1,2) to position (1,3), and push the box1 from position (1,4) to position (1,5). However, this is only a very simple and intuitive approach to representing the actions and positions. If you have any other better methods, you can have a try.

Please solve the boxman game by using FF planner. You should hand in 2 files, including a domain file (boxman domain.pddl) and data file (boxman5.pddl).
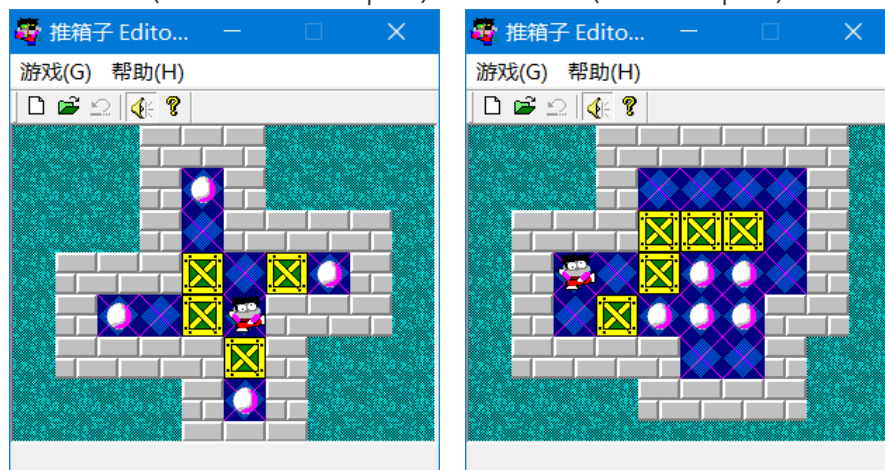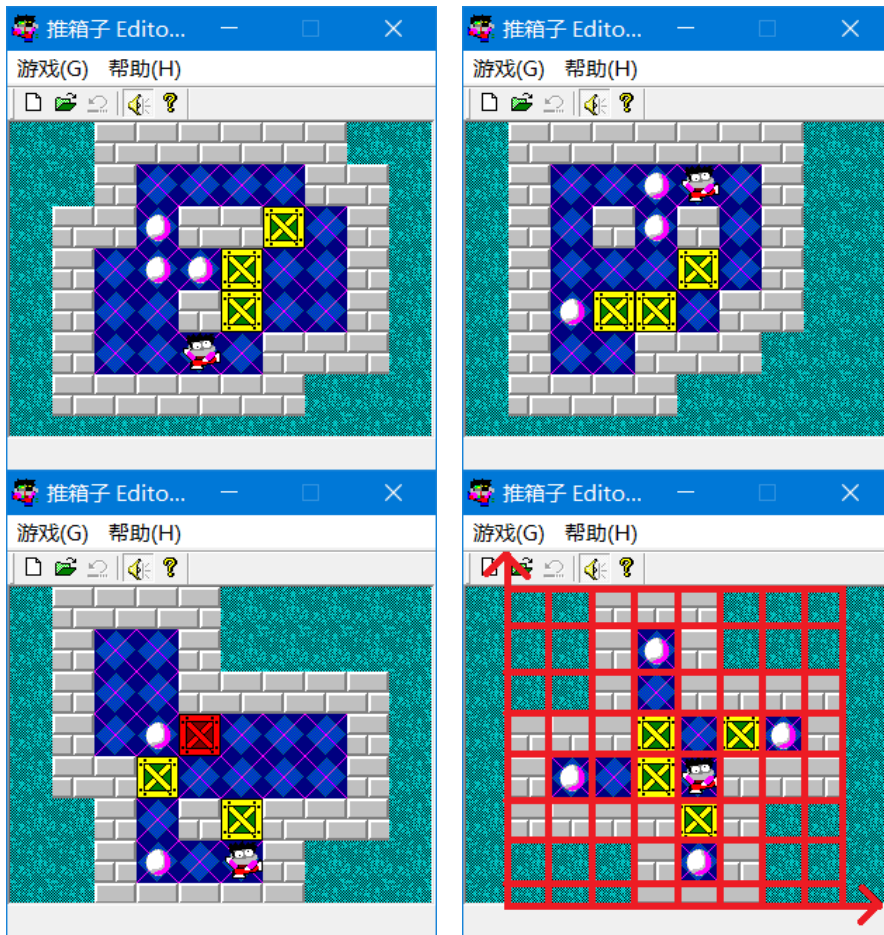
2 Notes

Please send E07 YourNumber.zip which should contain the codes() .

3 Codes and Results

```
(define (domain boxman_domain)
  (:requirements :strips :typing:equality
                 :universal-preconditions
                 :conditional-effects
  )
  (:types loc)
  (:predicates
    (man ?p - loc)
    (box ?p - loc)
    (td ?p1 - loc ?p2 - loc)
    (lr ?p1 - loc ?p2 - loc)
  )

    (:action move
    :parameters (?x - loc ?y - loc )
    :precondition (and (man ?x)(or (td ?x ?y)(lr ?x ?y))(not(box ?y))(not(= ?x ?
y)))
    :effect (and (not(man ?x)) (man ?y))
    )

    (:action push
            :parameters (?x - loc ?y - loc ?z - loc)
```

```
              :precondition (and (man ?x) (box ?y) (not(box ?z)) (or (and (td ?x ?
y) (td ?y ?z))(and (lr ?x ?y) (lr ?y ?z)))(not(= ?x ?y))(not(= ?y ?z))(not(= ?z ?
x)))
              :effect (and
                        (man ?y)
                        (not(man ?x))
                        (box ?z)
                        (not(box ?y))
                    )
    )
)
```

```
(define (problem boxman) (:domain boxman_domain)
(:objects
        l11 l12
        l21 l22
        l31 l32 l33 l34 l35 l36
            l42 l43 l44 l45 l46
            l52     l54
            l62 l63 l64
    - loc
)

(:init
    (man l64)
    (box l33)
    (box l42)
    (box l54)
    (td l11 l21)
    (td l12 l22)
    (td l21 l11)
    (td l21 l31)
    (td l22 l12)
    (td l22 l32)
    (td l31 l21)
    (td l32 l22)
    (td l32 l42)
    (td l33 l43)
    (td l34 l44)
    (td l35 l45)
    (td l36 l46)
    (td l42 l32)
    (td l42 l52)
    (td l43 l33)
    (td l44 l34)
    (td l44 l54)
    (td l45 l35)
    (td l46 l36)
    (td l52 l42)
    (td l52 l62)
    (td l54 l44)
    (td l54 l64)
    (td l62 l52)
    (td l64 l54)
    (lr l11 l12)
    (lr l21 l22)
    (lr l31 l32)
```

```
      (lr l12 l11)
      (lr l22 l21)
      (lr l32 l31)
      (lr l32 l33)
      (lr l42 l43)
      (lr l62 l63)
      (lr l33 l32)
      (lr l33 l34)
      (lr l43 l42)
      (lr l43 l44)
      (lr l63 l62)
      (lr l63 l64)
      (lr l34 l33)
      (lr l34 l35)
      (lr l44 l43)
      (lr l44 l45)
      (lr l64 l63)
      (lr l35 l34)
      (lr l35 l36)
      (lr l45 l44)
      (lr l45 l46)
      (lr l36 l35)
      (lr l46 l45)
  )


  (:goal (and
            (box l32)
            (box l33)
            (box l62)
        )
  )

  )
```

在VScode的PDLL插件中运行（实际上也是发送数据到在线运行网站）结果如下，找到了一条51步的路径：

```
Planning service: http://solver.planning.domains/solve
Domain: boxman_domain, Problem: boxman
 --- OK.
 Match tree built with 78 nodes.

PDDL problem description loaded:
    Domain: BOXMAN_DOMAIN
    Problem: BOXMAN
    #Actions: 78
    #Fluents: 54
Landmarks found: 3
Starting search with IW (time budget is 60 secs)...
rel_plan size: 11
#RP_fluents 17
Caption
{#goals, #UNnachieved,  #Achieved} -> IW(max_w)

{3/3/0}:IW(1) -> rel_plan size: 11
#RP_fluents 17
{3/2/1}:IW(1) -> [2][3][4][5][6][7][8][9][10][11][12][13][14][15][16][17][18][19][20][21][22][23][24][25][26][27][28]rel_plan size: 1
#RP_fluents 3
{3/1/2}:IW(1) -> [2][3][4][5][6][7][8][9][10][11];; NOT I-REACHABLE ;;
Total time: -1.49012e-09
Nodes generated during search: 290
Nodes expanded during search: 286
IW search completed
Starting search with BFS(novel,land,h_add)...
--[4294967295 / 15]--
```

```
--[1 / 15]--
--[1 / 14]--
--[1 / 12]--
--[1 / 9]--
--[1 / 6]--
--[1 / 3]--
--[1 / 2]--
--[1 / 1]--
--[1 / 0]--
--[0 / 0]--
Total time: 0.164
Nodes generated during search: 11522
Nodes expanded during search: 4550
Plan found with cost: 51
BFS search completed
0.00100: (push 164 154 144)
0.00200: (move 154 164)
0.00300: (move 164 163)
0.00400: (move 163 162)
0.00500: (move 162 152)
0.00600: (push 152 142 132)
0.00700: (move 142 143)
0.00800: (push 143 144 145)
0.00900: (move 144 134)
0.01000: (move 134 135)
0.01100: (move 135 136)
0.01200: (move 136 146)
0.01300: (push 146 145 144)
0.01400: (push 145 144 143)
0.01500: (move 144 154)
0.01600: (move 154 164)
0.01700: (move 164 163)
0.01800: (move 163 162)
0.01900: (move 162 152)

0.02000: (move 152 142)
0.02100: (push 142 132 122)
0.02200: (push 132 133 134)
0.02300: (push 133 134 135)
0.02400: (move 134 144)
0.02500: (push 144 143 142)
0.02600: (move 143 133)
0.02700: (move 133 132)
0.02800: (push 132 142 152)
0.02900: (push 142 152 162)
0.03000: (move 152 142)
0.03100: (move 142 132)
0.03200: (move 132 131)
0.03300: (move 131 121)
0.03400: (move 121 111)
0.03500: (move 111 112)
0.03600: (push 112 122 132)
0.03700: (move 122 121)
0.03800: (move 121 131)
0.03900: (push 131 132 133)
0.04000: (move 132 142)
0.04100: (move 142 143)
0.04200: (move 143 144)
0.04300: (move 144 134)
0.04400: (push 134 133 132)
0.04500: (move 133 134)
0.04600: (move 134 144)
0.04700: (move 144 145)
0.04800: (move 145 146)
0.04900: (move 146 136)
0.05000: (push 136 135 134)
0.05100: (push 135 134 133)
Planner found 1 plan(s) in 1.499secs.
```

经游戏验证，该路径时有效且高效的。