

E08 FF Planner(2)

18340149 Sun Xinmeng

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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`).

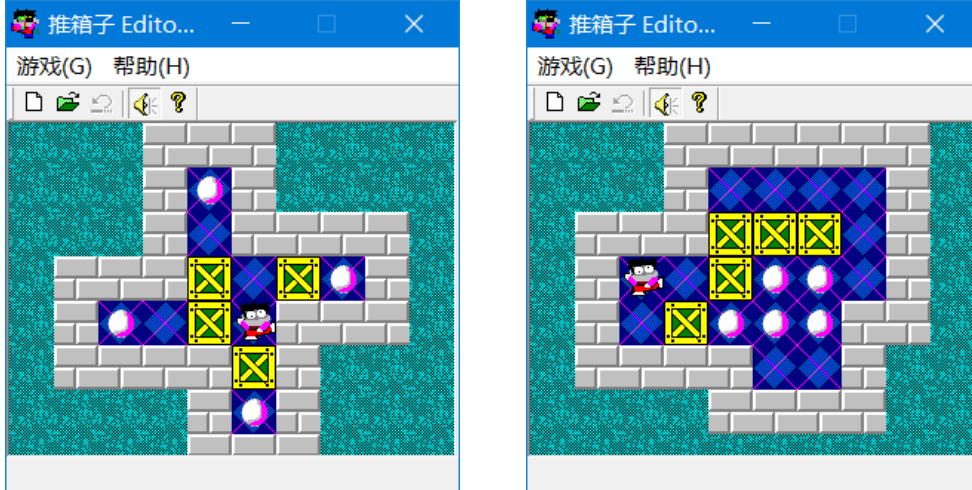


图 1: Boxman case1 (level 1) and case2 (level 10)

2 Notes

Please send **E08_YourNumber.zip** which should contain the codes(ai_2020@foxmail.com).

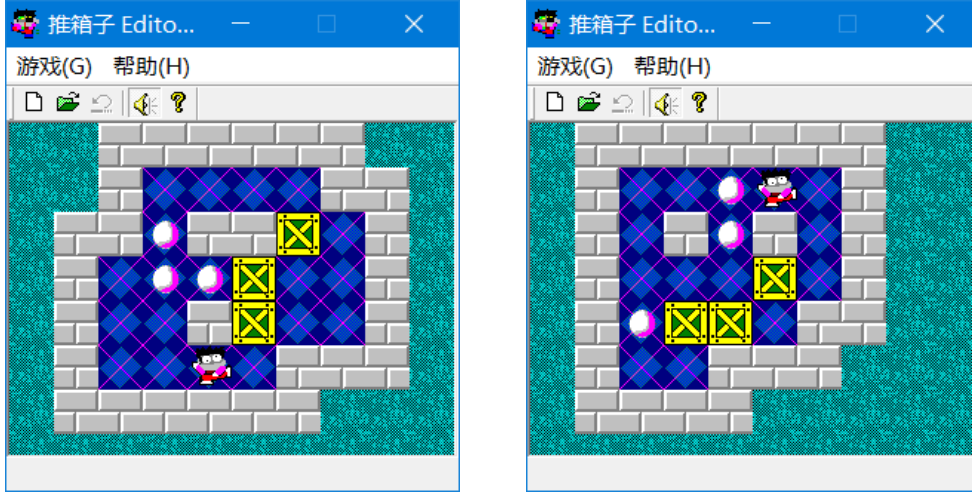


图 2: Boxman case3 (level 30) and case4 (level 40)

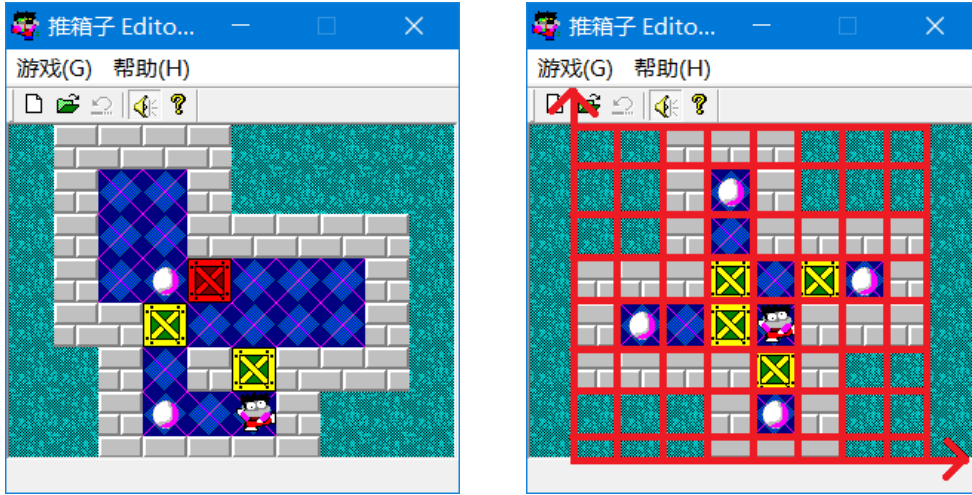


图 3: Boxman case5 (level 50) and modelling

3 Codes and Results

```

boxman_domain.pddl
1 (define (domain boxman)
2   (:requirements :strips :typing:equality
3                 :universal-preconditions
4                 :conditional-effects)
5   (:types physob loc)
6
7   (:predicates

```

```

8      (blank ?p - loc) ; 位置是否是空白格子, 也即是能走的格子p
9      (man ?p - loc) ; 当前角色是否在p
10     (box ?p - loc) ; 箱子是否在位置p
11     (line ?p0 ?p1 ?p2 -loc) ; p0 p1 是否是联通的p2
12     (adjacent ?p1 ?p2 -loc) ; p1 是否是相邻的p2
13 )
14
15 ; 填写相关代码 (人物不推箱子移动的代码) from x to y
16 (:action move
17   :parameters (?x ?y - loc)
18   :precondition( and (adjacent ?x ?y) (blank ?y) (man ?x) (
19     blank ?x))
19   :effect (and
20     (not (man ?x) )
21     (man ?y)
22
23   )
24 )
25
26 ; 填写相关代码 (人物推箱子移动代码) man on x push b from y to z
27 (:action push
28   :parameters (?b - physob ?x ?y ?z - loc)
29   :precondition (and (line ?x ?y ?z )
30     (box ?y )
31     (blank ?z)
32     (blank ?x)
33     (man ?x)
34   )
35   :effect (and
36     (box ?z)
37     (not (box ?y) )
38     (blank ?y)
39     (not (blank ?z))

```

```

40             (man ?y)
41             (not (man ?x) )
42
43         )
44     )
45 )

```

box_problem.pddl

```

1  (define (problem boxman)
2      (:domain boxman)
3      (:objects
4          p61 p62 — loc
5          p51 p52 — loc
6          p41 p42 p43 p44 p45 p46 — loc
7          p32 p33 p34 p35 p36 — loc
8          p22 p24 — loc
9          p12 p13 p14 — loc
10     )
11     (:init
12         (blank p61) (blank p62)
13         (blank p51) (blank p52)
14         (blank p41) (blank p42) (blank p44) (blank p45) (blank p46
15             )
16         (blank p33) (blank p34) (blank p35) (blank p36)
17         (blank p22)
18         (blank p12) (blank p13) (blank p14)
19
20         (man p14)
21         (box p43)
22         (box p32)
23         (box p24)
24
25         (line p61 p51 p41) (line p41 p51 p61)

```

25 (line p62 p52 p42) (line p42 p52 p62)
 26 (line p32 p42 p52) (line p52 p42 p32)
 27 (line p22 p32 p42) (line p42 p32 p22)
 28 (line p12 p22 p32) (line p32 p22 p12)
 29 (line p24 p34 p44) (line p44 p34 p24)
 30 (line p14 p24 p34) (line p34 p24 p14)
 31 (line p43 p42 p41) (line p41 p42 p43)
 32 (line p44 p43 p42) (line p42 p43 p44)
 33 (line p45 p44 p43) (line p43 p44 p45)
 34 (line p44 p45 p46) (line p46 p45 p44)
 35 (line p32 p33 p34) (line p34 p33 p32)
 36 (line p33 p34 p35) (line p35 p34 p33)
 37 (line p34 p35 p36) (line p36 p35 p34)
 38 (line p12 p13 p14) (line p14 p13 p12)
 39
 40 (adjacent p61 p62) (adjacent p62 p61)
 41 (adjacent p51 p52) (adjacent p52 p51)
 42 (adjacent p41 p42) (adjacent p42 p41)
 43 (adjacent p42 p43) (adjacent p43 p42)
 44 (adjacent p43 p44) (adjacent p44 p43)
 45 (adjacent p44 p45) (adjacent p45 p44)
 46 (adjacent p45 p46) (adjacent p46 p45)
 47 (adjacent p32 p33) (adjacent p33 p32)
 48 (adjacent p33 p34) (adjacent p34 p33)
 49 (adjacent p34 p35) (adjacent p35 p34)
 50 (adjacent p35 p36) (adjacent p36 p35)
 51 (adjacent p12 p13) (adjacent p13 p12)
 52 (adjacent p13 p14) (adjacent p14 p13)
 53 (adjacent p61 p51) (adjacent p51 p61)
 54 (adjacent p51 p41) (adjacent p41 p51)
 55 (adjacent p62 p52) (adjacent p52 p62)
 56 (adjacent p52 p42) (adjacent p42 p52)
 57 (adjacent p42 p32) (adjacent p32 p42)

```

58         (adjacent p32 p22) (adjacent p22 p32)
59         (adjacent p22 p12) (adjacent p12 p22)
60         (adjacent p43 p33) (adjacent p33 p43)
61         (adjacent p44 p34) (adjacent p34 p44)
62         (adjacent p34 p24) (adjacent p24 p34)
63         (adjacent p24 p14) (adjacent p14 p24)
64         (adjacent p45 p35) (adjacent p35 p45)
65         (adjacent p46 p36) (adjacent p36 p46)
66     )
67     (:goal
68         (and
69             (box p42)
70             (box p43)
71             (box p12)
72         )
73     )
74 )

```

Result Picture

4 My thoughts

本次对问题的建模比较复杂，尤其是问题的初始状态十分复杂，尤其需要注意的是line和adjacent函数的对称性需要我们自己手动指定，否则可能有些情况人类判断可以推箱子但是机器不行。这就是“非表示出来的命题均为F”。另外关于动作的前提和后果需要仔仔细细考虑清楚，否则会无法规划。

(push p14 p24 p34)	<pre>(:action push :parameters (p14 p24 p34) :precondition (and (line p14 p24 p34) (man p14) (box p24) (blank p34) (blank p14) (not (blank p24))) :effect (and (man p24) (not (man p14)) (box p34) (not (box p24)) (blank p24, 截图(Alt + A)) (not (blank p34))))</pre>
(move p24 p14)	
(move p14 p13)	
(move p13 p12)	
(move p12 p22)	
(push p22 p32 p42)	
(move p32 p33)	
(push p33 p34 p35)	
(move p34 p44)	
(move p44 p45)	
(move p45 p46)	
(move p46 p36)	

		(move p34 p35)	
		(move p35 p36)	
		(move p36 p46)	
		(push p46 p45 p44)	
		(push p45 p44 p43)	
		(move p44 p34)	
		(move p34 p33)	
		(move p33 p32)	
		(move p32 p42)	
		(move p42 p41)	
		(move p41 p51)	(move p61 p62)
		(move p51 p61)	(push p62 p52 p42)
(push p36 p35 p34)	(push p43 p44 p45)		
(push p35 p34 p33)	(move p44 p34)		
(move p34 p24)	(push p34 p33 p32)		
(move p24 p14)	(move p33 p43)		
(move p14 p13)	(move p43 p42)		
(move p13 p12)	(push p42 p32 p22)		
(move p12 p22)	(push p32 p22 p12)		
(move p22 p32)	(move p22 p32)		
(push p32 p42 p52)	(move p32 p33)		
(push p42 p43 p44)	(move p33 p34)		