Boxman Game

Contents

1 Examples

1.1 Spare Tire

domain_spare_tire.pddl

```
(define (domain spare_tire)
  (:requirements :strips :equality:typing)
  (:types physob location)
  (:predicates  (Tire ?x - physob)
    (at ?x - physob ?y - location))

(:action Remove
             :parameters (?x - physob ?y - location)
             :precondition (At ?x ?y)
             :effect (and (not (At ?x ?y)) (At ?x Ground)))

  (:action PutOn
             :parameters (?x - physob)
             :precondition (and (Tire ?x) (At ?x Ground)
                                (not (At Flat Axle)))
             :effect (and (not (At ?x Ground)) (At ?x Axle)))
  (:action LeaveOvernight
             :effect (and (not (At Spare Ground)) (not (At Spare Axle))
                          (not (At Spare Trunk)) (not (At Flat Ground))
                          (not (At Flat Axle)) (not (At Flat Trunk)) ))
 )
```

spare_tire.pddl

```
(define (problem prob)
 (:domain spare_tire)
 (:objects Flat Spare -physob Axle Trunk Ground - location)
 (:init (Tire Flat)(Tire Spare)(At Flat Axle)(At Spare Trunk))
 (:goal (At Spare Axle))
)
```

```
ai2017@osboxes:~/Desktop/spare_tire$ ff -o domain_spare_tire.pddl -f spare_tire.pddl

ff: parsing domain file
domain 'SPARE_TIRE' defined
 ... done.
ff: parsing problem file
problem 'PROB' defined
 ... done.



Cueing down from goal distance:    3 into depth [1]
                                   2            [1]
                                   1            [1]
                                   0

ff: found legal plan as follows

step    0: REMOVE FLAT AXLE
        1: REMOVE SPARE TRUNK
        2: PUTON SPARE


time spent:    0.00 seconds instantiating 9 easy, 0 hard action templates
               0.00 seconds reachability analysis, yielding 11 facts and 8 actions
               0.00 seconds creating final representation with 10 relevant facts
               0.00 seconds building connectivity graph
               0.00 seconds searching, evaluating 4 states, to a max depth of 1
               0.00 seconds total time
```

2 Boxman Game

If you don't know how to play the boxman game, you can play boxman online 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`).

3 Codes

domain:

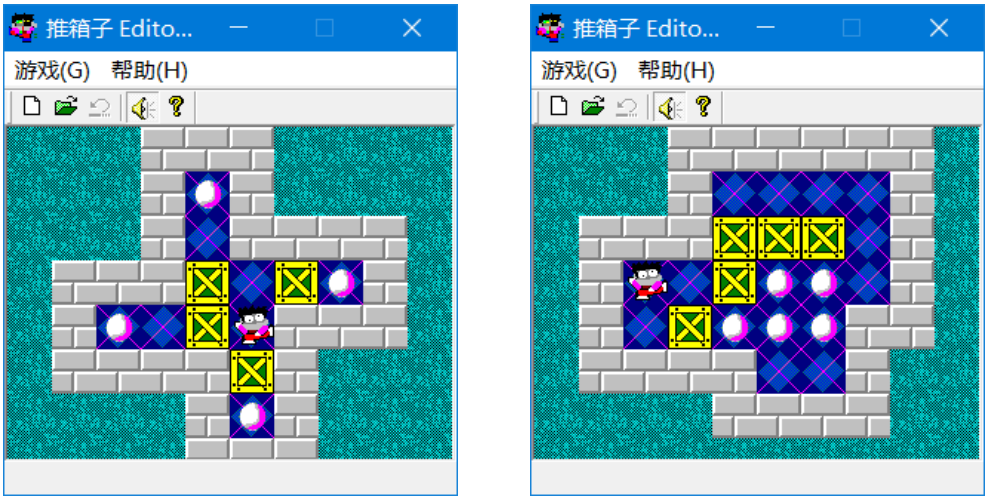

Figure 1: Boxman case1 (level 1) and case2 (level 10)

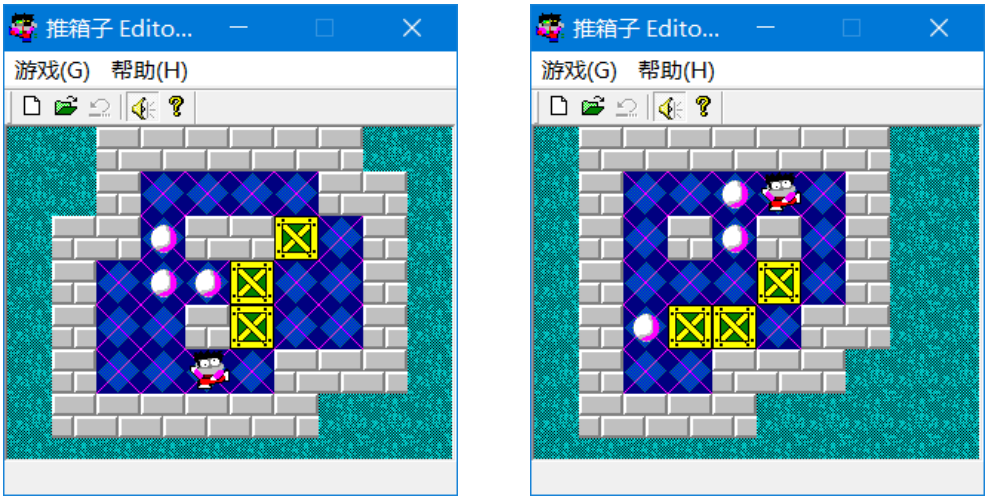

Figure 2: Boxman case3 (level 30) and case4 (level 40)

```
(define (domain boxman)
(:requirements :strips :typing:equality
:universal-preconditions
:conditional-effects)
(:types physob loc)
(:predicates
(blank ?p - loc)
(man ?p - loc)
(box ?p - loc)
(at ?b - physob ?p - loc)
(line ?p0 ?p1 ?p2 - loc)
```

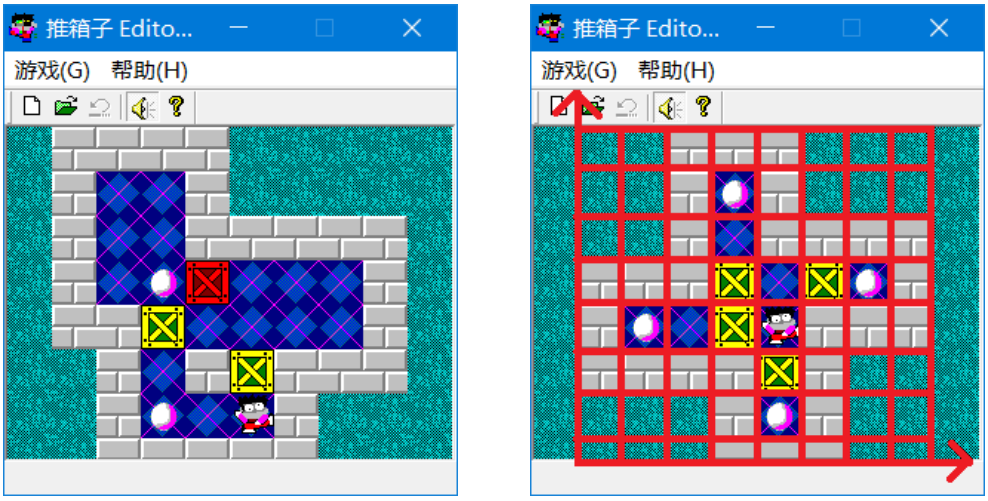

Figure 3: Boxman case5 (level 50) and modelling

```
(adjacent ?p1 ?p2 - loc)
)
(:action move
:parameters(?c - loc ?g - loc)
:precondition(
and(blank ?g)(man ?c)(adjacent ?c ?g)
)
:effect(
and(man ?g)(not(man ?c))
)
)
(:action push
:parameters(?b - physob ?m - loc ?p - loc ?g - loc )
:precondition(
and(man ?m)(at ?b ?p)(blank ?g)(line ?m ?p ?g)
)
:effect(
and(man ?p)(not(man ?m))(at ?b ?g)(not(at ?b ?p))(blank ?p)
(not(blank ?g))
)
)
)
```

problem:

```
(define (problem prob)
(:domain boxman)
(:objects
P1 P2 P3 P4 P5 P6 P7 P8 P9 P10
P11 P12 P13 P14 P15 P16 P17 P18
P19 P20 P21 - loc
B1 B2 B3 - physob
)
(:init
(blank P1) (blank P2) (blank P3) (blank P4)
(blank P5) (blank P6) (not(blank P7))
(blank P8) (blank P9) (blank P10)
(not(blank P11)) (blank P12) (blank P13)
(blank P14) (blank P15) (blank P16)
(not(blank P17)) (not(blank P18))
(blank P19) (blank P20) (blank P21)
(man P21)
(at B1 P7) (at B2 P11) (at B3 P18)
(adjacent P1 P2)(adjacent P1 P3)(adjacent P2 P1)(adjacent P2 P4)
(adjacent P3 P1)(adjacent P3 P4)(adjacent P4 P3)(adjacent P4 P2)
(adjacent P5 P3)(adjacent P5 P6)(adjacent P6 P5)(adjacent P6 P4)
(adjacent P6 P7)(adjacent P6 P11)(adjacent P7 P6)(adjacent P7 P8)
(adjacent P7 P12)(adjacent P8 P7)(adjacent P8 P9)(adjacent P8 P13)
(adjacent P9 P8)(adjacent P9 P10)(adjacent P9 P14)(adjacent P10 P9)
(adjacent P10 P15)(adjacent P11 P6)(adjacent P11 P12)(adjacent P11
P16)
(adjacent P12 P11)(adjacent P12 P7)(adjacent P12 P13)(adjacent P12
P17)
(adjacent P13 P12)(adjacent P13 P8)(adjacent P13 P14)(adjacent P13
P18)
(adjacent P14 P9)(adjacent P14 P13)(adjacent P14 P15)(adjacent P15
P14)
(adjacent P15 P10)(adjacent P16 P11)(adjacent P16 P17)(adjacent P16
P19)
(adjacent P17 P12)(adjacent P17 P16)(adjacent P17 P18)(adjacent P17
P20)
(adjacent P18 P13)(adjacent P18 P17)(adjacent P18 P21)(adjacent P19
```

```
P16)
(adjacent P19 P20)(adjacent P20 P19)(adjacent P20 P17)(adjacent P20
P21)
(adjacent P21 P20)(adjacent P21 P18)
(line P1 P3 P5)(line P5 P3 P1)(line P2 P4 P6)(line P6 P4 P2)
(line P4 P6 P11)(line P11 P6 P4)(line P6 P11 P16)(line P16 P11 P6)
(line P11 P16 P19)(line P19 P16 P11)(line P5 P6 P7)(line P7 P6 P5)
(line P6 P7 P8)(line P8 P7 P6)(line P7 P8 P9)(line P9 P8 P7)(line P8
P9 P10)
(line P10 P9 P8)(line P11 P12 P13)(line P13 P12 P11)(line P12 P13
P14)
(line P14 P13 P12)(line P13 P14 P15)(line P15 P14 P13)(line P8 P13
P18)
(line P18 P13 P8)(line P13 P18 P21)(line P21 P18 P13)
(line P19 P20 P21)(line P21 P20 P19)
)
(:goal
(or(and(at B1 P6)(at B2 P7)(at B3 P19))(and(at B1 P6)(at B2 P19)(at
B3 P7))
(and(at B1 P7)(at B2 P6)(at B3 P19))(and(at B1 P7)(at B2 P19)(at B3
P6))
(and(at B1 P19)(at B2 P6)(at B3 P7))(and(at B1 P19)(at B2 P7)(at B3
P6)))
)
)
```

4 Results

Output:

```
(push b3 p2i p18 p13)
(move p18 p21)
(move p21 p20)
(move p2o p19)
(move p19 p16)
(push b2 p16 p11 p6)
(move p11 p12)
```

```
(push b3 p12 p13 p14)
(move p13 p8)
(move p8 p9)
(move p9 p1o)
(move p1o p15)
(push b3 p15 p14P13)
(push b3 p14 p13 p12)
(move p13 p18)
(move p18 p21)
(move p21 p2o)
(move p2o p19)
(move p19 p16)
(move p16 p11)
(push b2 p11 p6 p4)
(push b1 p6 p7 p8)
```