



BARMAN BDI

Domínio HDDL

Contexto do domínio

Um barman que tem que preparar drinks que possuem ingredientes específicos

Ao usar um recipiente ou uma coqueteleira, o mesmo ficará sujo e deverá ser limpo antes de reutilizar

Para preparar um drink é preciso seguir uma ordem específica de tarefas



Predicados

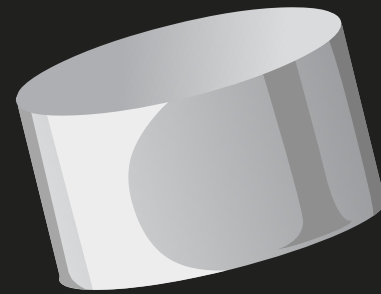
(:predicates

```
(clean ?p0 - container)
(cocktailPart1 ?p0 - cocktail ?p1 - ingredient)
(cocktailPart2 ?p0 - cocktail ?p1 - ingredient)
(contains ?p0 - container ?p1 - beverage)
(dispenses ?p0 - dispenser ?p1 - ingredient)
(empty ?p0 - container)
(handEmpty ?p0 - hand)
(holding ?p0 - hand ?p1 - container)
(ingredient ?p0 - ingredient)
(next ?p0 - level ?p1 - level)
(ontable ?p0 - container)
(shaked ?p0 - shaker)
(shakerEmptyLevel ?p0 - shaker ?p1 - level)
(shakerLevel ?p0 - shaker ?p1 - level)
(unshaked ?p0 - shaker)
(used ?p0 - container ?p1 - beverage)
```

)



Tarefas



```
(:task AchieveHandEmpty :parameters (?x_0 - hand))
(:task AchieveCleanShot :parameters (?x_0 - shot))
(:task AchieveCleanShaker :parameters (?x_0 - shaker))
(:task AchieveContainsShotIngredient :parameters
  (?x_0 - shot ?x_1 - ingredient)
)
(:task AchieveContainsShakerIngredient :parameters
  (?x_0 - shaker ?x_1 - ingredient)
)
(:task AchieveContainsShakerCocktail :parameters
  (?x_0 - shaker ?x_1 - cocktail)
)
(:task DoPourShakerToShot :parameters
  (?x_0 - shaker ?x_1 - shot ?x_2 - cocktail)
)
(:task AchieveOnTable :parameters (?x_0 - container))
(:task AchieveHolding :parameters
  (?x_0 - hand ?x_1 - container)
)
(:task AchieveContainsShotCocktail :parameters
  (?x_0 - shot ?x_1 - cocktail)
)
```

Métodos

MakeAndPourCocktail

MakeAndPourCocktailNull

MakeCocktail

MakeCocktailNull

AddIngredientToEmptyShaker

AddIngredientToUsedShaker

AddIngredientToShakerNull

AddIngredientToShot

AddIngredientToShotNull

CleanFullShot

CleanEmptyShot

CleanShotNull

pour_shaker_to_shot_action

CleanEmptyShaker

CleanFullShaker

CleanShakerNull

PickUp

HoldingNull

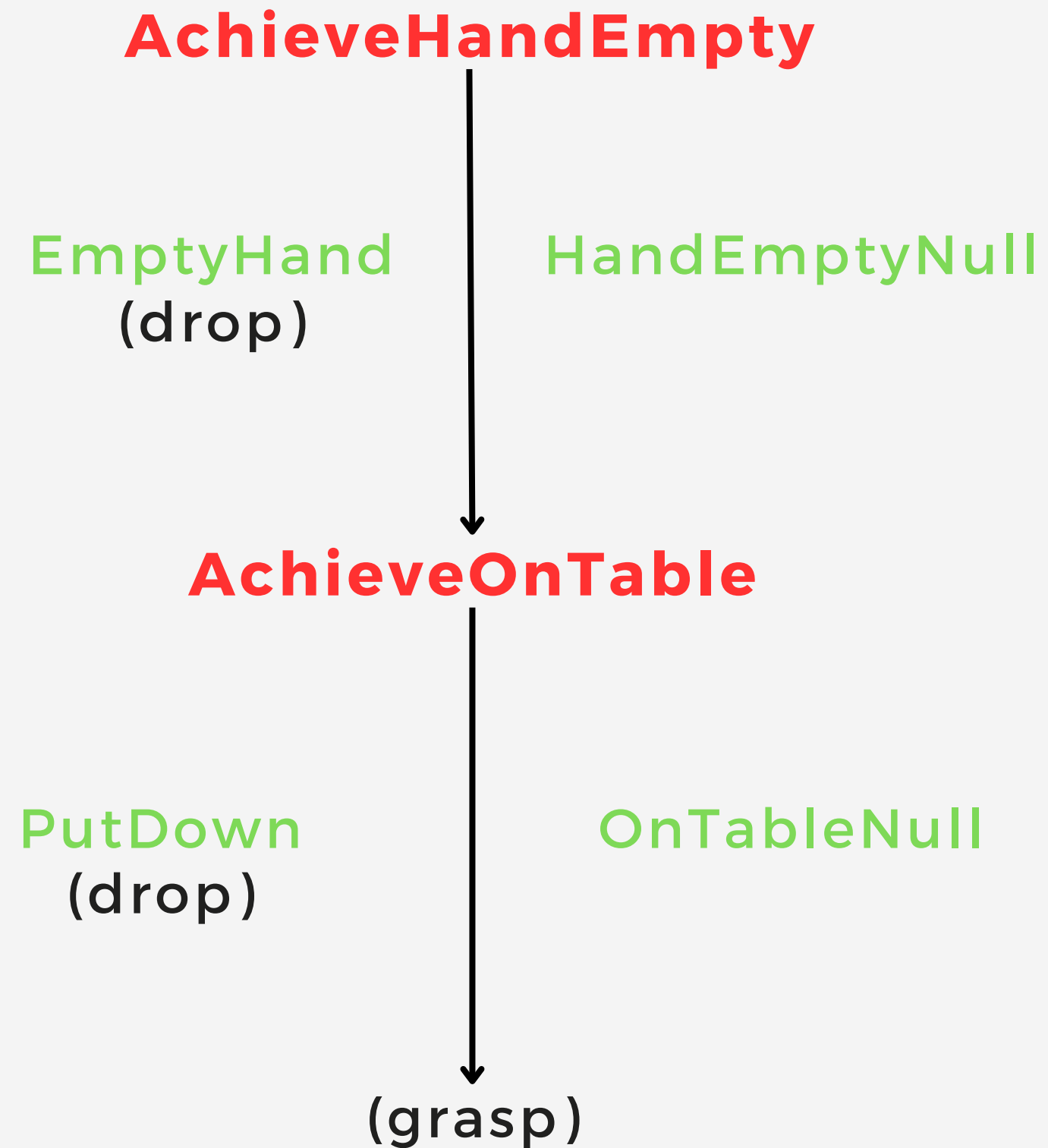
EmptyHand

HandEmptyNull

PutDown

OnTableNull

Exemplo: **PickUp**



```
(:method PickUp
  :parameters (?x_0 - hand ?x_1 - container)
  :task (AchieveHolding ?x_0 ?x_1)
  :precondition (and
    (not (holding ?x_0 ?x_1))
  )
  :ordered-subtasks (and
    (AchieveHandEmpty ?x_0)
    (AchieveOnTable ?x_1)
    (grasp ?x_0 ?x_1)
  )
)
```

Ações

clean-shaker

clean-shot

drop

empty-shaker

empty-shot

fill-shot

grasp

pour-shaker-to-shot

pour-shot-to-clean-shaker

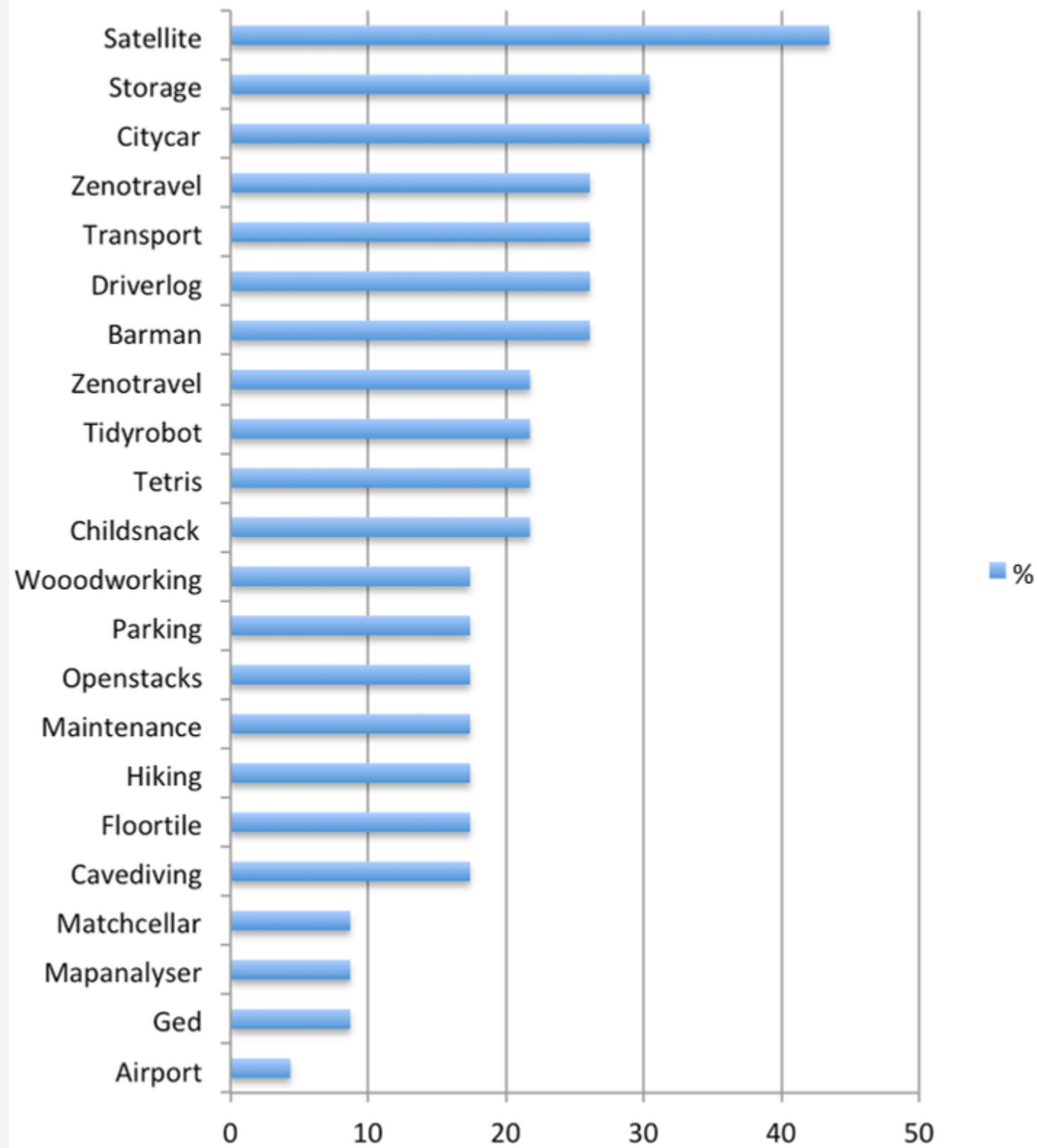
pour-shot-to-used-shaker

shake

Diagrama



<https://whimsical.com/barman-phddl-CLMnCj7QT9GpHRTUpP4K7E>



PDDL VS HDDL

- Sem diferença nas ações, predicados e tipos ao comparar o domínio PDDL com HDDL.
- O domínio HDDL possui novos requirements (negative-preconditions, hierarchy, typing, equality, method-preconditions)
- O domínio HDDL possui tasks, methods e ordered-subtasks

```
1 (define (domain barman)
2   (:requirements :strips :typing)
3   (:types hand level beverage dispenser container - object
4         ingredient cocktail - beverage
5         shot shaker - container)
6   (:predicates (ontable ?c - container)
7               (holding ?h - hand ?c - container)
8               (handempty ?h - hand)
9               (empty ?c - container)
10              (contains ?c - container ?b - beverage)
11              (clean ?c - container)
12              (used ?c - container ?b - beverage)
13              (dispenses ?d - dispenser ?i - ingredient)
14              (shaker-empty-level ?s - shaker ?l - level)
15              (shaker-level ?s - shaker ?l - level)
16              (next ?l1 ?l2 - level)
17              (unshaked ?s - shaker)
18              (shaked ?s - shaker)
19              (cocktail-part1 ?c - cocktail ?i - ingredient)
20              (cocktail-part2 ?c - cocktail ?i - ingredient))
21
22   (:action grasp
23     :parameters (?h - hand ?c - container)
24     :precondition (and (ontable ?c) (handempty ?h))
25     :effect (and (not (ontable ?c))
26                (not (handempty ?h))
27                (holding ?h ?c)))
```

Desempenho

PDDL

Executado na máquina Chococino
PDDL Fast Downward

```
fast-downward.py --alias lama-first domain.pddl pfile02.pddl
```

```
[t=0.00635799s, 10564 KB] Plan length: 31 step(s).  
[t=0.00635799s, 10564 KB] Plan cost: 31  
[t=0.00635799s, 10564 KB] Expanded 151 state(s).  
[t=0.00635799s, 10564 KB] Reopened 0 state(s).  
[t=0.00635799s, 10564 KB] Evaluated 161 state(s).  
[t=0.00635799s, 10564 KB] Evaluations: 313  
[t=0.00635799s, 10564 KB] Generated 711 state(s).  
[t=0.00635799s, 10564 KB] Dead ends: 9 state(s).  
[t=0.00635799s, 10564 KB] Number of registered states: 161  
[t=0.00635799s, 10564 KB] Int hash set load factor: 161/256 = 0.628906  
[t=0.00635799s, 10564 KB] Int hash set resizes: 8  
[t=0.00635799s, 10564 KB] Search time: 0.00209252s  
[t=0.00635799s, 10564 KB] Total time: 0.00635799s  
Solution found.  
Peak memory: 10564 KB  
Remove intermediate file output.sas  
search exit code: 0  
INFO Planner time: 0.09s
```

Desempenho

Executado na
máquina Chococino
PDDL Fast
Downward
fast-downward.py --
alias lama-first
domain.pddl
pfile02.pddl

PDDL

```
grasp left shaker1 (1)
grasp right shot3 (1)
drop left shaker1 (1)
fill-shot shot3 ingredient1 right left dispenser1 (1)
grasp left shaker1 (1)
pour-shot-to-clean-shaker shot3 ingredient1 shaker1 right level1 level1 (1)
drop left shaker1 (1)
clean-shot shot3 ingredient1 right left (1)
fill-shot shot3 ingredient2 right left dispenser2 (1)
grasp left shaker1 (1)
pour-shot-to-used-shaker shot3 ingredient2 shaker1 right level1 level1 (1)
drop left shaker1 (1)
clean-shot shot3 ingredient2 right left (1)
fill-shot shot3 ingredient3 right left dispenser3 (1)
grasp left shaker1 (1)
pour-shot-to-used-shaker shot3 ingredient3 shaker1 right level1 level1 (1)
drop left shaker1 (1)
clean-shot shot3 ingredient3 right left (1)
grasp left shaker1 (1)
drop right shot3 (1)
shake cocktail2 ingredient3 ingredient1 shaker1 left right (1)
pour-shaker-to-shot cocktail2 shot3 left shaker1 level1 level1 (1)
empty-shaker left shaker1 cocktail2 level1 level1 (1)
clean-shaker left right shaker1 (1)
grasp right shot1 (1)
drop left shaker1 (1)
fill-shot shot1 ingredient3 right left dispenser3 (1)
pour-shot-to-clean-shaker shot1 ingredient3 shaker1 right level1 level1 (1)
clean-shot shot1 ingredient3 right left (1)
grasp left shaker1 (1)
drop right shot1 (1)
shake cocktail1 ingredient2 ingredient3 shaker1 left right (1)
pour-shaker-to-shot cocktail1 shot1 left shaker1 level1 level1 (1)
```

Desempenho

HDDL

Executado na máquina Chococino
HDDL (Partial-Order) PandaPI
pandasolver domain.hddl pfile02.hddl
Custo: 32 ações

```
1055874 60 601Shaker1P0Shot Shaker1Shots cocktail2 / pool_Shaker1_
Command being timed: "/home/software/planners/pandaPI/panda
User time (seconds): 8.74
System time (seconds): 0.43
Percent of CPU this job got: 99%
Elapsed (wall clock) time (h:mm:ss or m:ss): 0:09.23
Average shared text size (kbytes): 0
Average unshared data size (kbytes): 0
Average stack size (kbytes): 0
Average total size (kbytes): 0
Maximum resident set size (kbytes): 222720
Average resident set size (kbytes): 0
Major (requiring I/O) page faults: 0
Minor (reclaiming a frame) page faults: 88778
Voluntary context switches: 57
Involuntary context switches: 44
```

Desempenho

Executado na máquina
Chococino
HDDL (Partial-Order)
PandaPI
pandasolver
domain.hddl
pfile02.hddl
Custo: 32 ações

HDDL

```
grasp right shot1
fill-shot shot1 ingredient2 right left dispenser2
pour-shot-to-clean-shaker shot1 ingredient2 shaker1 right level1 level1
clean-shot shot1 ingredient2 right left
fill-shot shot1 ingredient3 right left dispenser3
pour-shot-to-used-shaker shot1 ingredient3 shaker1 right level1 level1
grasp left shaker1
drop right shot1
shake cocktail1 ingredient2 ingredient3 shaker1 left right
drop left shaker1
grasp left shot1
clean-shot shot1 ingredient3 left right
drop left shot1
grasp left shaker1
pour-shaker-to-shot cocktail1 shot1 left shaker1 level1 level1
empty-shaker left shaker1 cocktail1 level1 level1
clean-shaker shaker1 left right
grasp right shot3
drop left shaker1
fill-shot shot3 ingredient3 right left dispenser3
pour-shot-to-clean-shaker shot3 ingredient3 shaker1 right level1 level1
clean-shot shot3 ingredient3 right left
fill-shot shot3 ingredient1 right left dispenser1
pour-shot-to-used-shaker shot3 ingredient1 shaker1 right level1 level1
grasp left shaker1
drop right shot3
shake cocktail2 ingredient3 ingredient1 shaker1 left right
grasp right shot3
drop left shaker1
clean-shot shot3 ingredient1 right left
grasp left shaker1
pour-shaker-to-shot cocktail2 shot3 left shaker1 level1 level1
```

Desempenho

HDDL

Executado na máquina Chococino
HDDL (Total-Order) PandaPI
pandasolver domain.hddl pfile02.hddl
Custo: 27 ações

```
Command being timed: /home/software/planners/pandaPI/pa
User time (seconds): 0.04
System time (seconds): 0.02
Percent of CPU this job got: 51%
Elapsed (wall clock) time (h:mm:ss or m:ss): 0:00.13
Average shared text size (kbytes): 0
Average unshared data size (kbytes): 0
Average stack size (kbytes): 0
Average total size (kbytes): 0
Maximum resident set size (kbytes): 6656
Average resident set size (kbytes): 0
Major (requiring I/O) page faults: 0
Minor (reclaiming a frame) page faults: 2392
```

Desempenho

Executado na
máquina Chococino
HDDL (Total-Order)
PandaPI
pandasolver
domain.hddl
pfile02.hddl
Custo: 27 ações

HDDL

```
grasp left shot3
fill-shot shot3 ingredient2 left right dispenser2
pour-shot-to-clean-shaker shot3 ingredient2 shaker1 left level1 level1
clean-shot shot3 ingredient2 left right
fill-shot shot3 ingredient1 left right dispenser1
pour-shot-to-used-shaker shot3 ingredient1 shaker1 left level1 level1
grasp right shaker1
drop left shot3
shake cocktail1 ingredient2 ingredient1 shaker1 right left
pour-shaker-to-shot cocktail1 shot1 right shaker1 level1 level1
9 empty-shaker right shaker1 cocktail1 level1 level1
5 clean-shaker shaker1 right left
2 grasp left shot2
6 drop right shaker1
7 fill-shot shot2 ingredient3 left right dispenser3
6 pour-shot-to-clean-shaker shot2 ingredient3 shaker1 left level1 level1
9 clean-shot shot2 ingredient3 left right
2 fill-shot shot2 ingredient2 left right dispenser2
8 pour-shot-to-used-shaker shot2 ingredient2 shaker1 left level1 level1
9 grasp right shaker1
5 drop left shot2
6 shake cocktail2 ingredient3 ingredient2 shaker1 right left
5 grasp left shot3
4 drop right shaker1
5 clean-shot shot3 ingredient1 left right
6 grasp right shaker1
9 pour-shaker-to-shot cocktail2 shot3 right shaker1 level1 level1
```


Repositórios

HDDL

<https://github.com/panda-planner-dev/ipc2020-domains/blob/master/total-order/Barman-BDI/>

PDDL

<https://github.com/aibasel/downward-benchmarks/>