

# Plan Validation Report

VAL

April 27, 2017

## 1 Domain and Problem

**Domain:** refuel

**Problem:** refuel\_prob

## 2 Plan: solution

### 2.1 Plan

Plan size: 7

Time	Action
0:	(open_tank arm0 t0) [2]
2.001:	(refuel_fast arm2 t0) [1]
2.005:	(refuel_fast arm0 t0) [1]
3.002:	(refuel_slow arm1 t0) [1]
3.004:	(refuel_slow arm2 t0) [1]
4.003:	(refuel_slow arm0 t0) [1]
5.004:	(close_tank arm0 t0) [0.5]

### 2.2 Plan To Validate

Time	Happening
0:	(open_tank arm0 t0) - <i>start</i>
2:	(open_tank arm0 t0) - <i>end</i>
2.001:	(refuel_fast arm2 t0) - <i>start</i>

2.005: *Invariant for (refuel\_fast arm2 t0)*  
 2.005: *Update of changing Primitive Numerical Expressions*  
 2.005: *(refuel\_fast arm0 t0) - start*

3.001: *Invariant for (refuel\_fast arm2 t0)*  
       *Invariant for (refuel\_fast arm0 t0)*  
 3.001: *Update of changing Primitive Numerical Expressions*  
 3.001: *(refuel\_fast arm2 t0) - end*

3.002: *Invariant for (refuel\_fast arm0 t0)*  
 3.002: *Update of changing Primitive Numerical Expressions*  
 3.002: *(refuel\_slow arm1 t0) - start*

3.004: *Invariant for (refuel\_fast arm0 t0)*  
       *Invariant for (refuel\_slow arm1 t0)*  
 3.004: *Update of changing Primitive Numerical Expressions*  
 3.004: *(refuel\_slow arm2 t0) - start*

3.005: *Invariant for (refuel\_fast arm0 t0)*  
       *Invariant for (refuel\_slow arm1 t0)*  
       *Invariant for (refuel\_slow arm2 t0)*  
 3.005: *Update of changing Primitive Numerical Expressions*  
 3.005: *(refuel\_fast arm0 t0) - end*

4.002: *Invariant for (refuel\_slow arm1 t0)*  
       *Invariant for (refuel\_slow arm2 t0)*  
 4.002: *Update of changing Primitive Numerical Expressions*  
 4.002: *(refuel\_slow arm1 t0) - end*

4.003: *Invariant for (refuel\_slow arm2 t0)*  
 4.003: *Update of changing Primitive Numerical Expressions*  
 4.003: *(refuel\_slow arm0 t0) - start*

4.004: *Invariant for (refuel\_slow arm2 t0)*  
       *Invariant for (refuel\_slow arm0 t0)*  
 4.004: *Update of changing Primitive Numerical Expressions*  
 4.004: *(refuel\_slow arm2 t0) - end*

5.003: *Invariant for (refuel\_slow arm0 t0)*  
 5.003: *Update of changing Primitive Numerical Expressions*

5.003: (refuel\_slow arm0 t0) - *end*

5.004: (close\_tank arm0 t0) - *start*

5.504: (close\_tank arm0 t0) - *end*

## 2.3 Plan Validation

Time	Details
0:	Checking Happening... ...OK! Deleting (free arm0) Deleting (closed t0)
2:	Checking Happening... ...OK! Adding (open t0) Adding (free arm0)
2.001:	Checking Happening... ...OK! Deleting (free arm2)
2.005:	Checking Happening... ...OK!
2.005:	Checking Happening... ...OK! $(\text{fuel\_amount } t0)(t) = 20t$ Updating (fuel_amount t0) (0) by 0.08 for continuous update.
2.005:	Checking Happening... ...OK! Deleting (free arm0)
3.001:	Checking Happening... ...OK!
3.001:	Checking Happening... ...OK! $(\text{fuel\_amount } t0)(t) = 40t + 0.08$ Updating (fuel_amount t0) (0.08) by 39.92 for continuous update.
3.001:	Checking Happening... ...OK! Adding (free arm2)

- 3.002:**    Checking Happening... ...OK!
- 3.002:**    Checking Happening... ...OK!  
                $(\text{fuel\_amount } \mathbf{t0})(t) = 20t + 39.92$   
               Updating  $(\text{fuel\_amount } \mathbf{t0})$  (39.92) by 39.94 for continuous up-  
               date.
- 3.002:**    Checking Happening... ...OK!  
               Deleting (free arm1)
- 3.004:**    Checking Happening... ...OK!
- 3.004:**    Checking Happening... ...OK!  
                $(\text{fuel\_amount } \mathbf{t0})(t) = 22t + 39.94$   
               Updating  $(\text{fuel\_amount } \mathbf{t0})$  (39.94) by 39.984 for continuous up-  
               date.
- 3.004:**    Checking Happening... ...OK!  
               Deleting (free arm2)
- 3.005:**    Checking Happening... ...OK!
- 3.005:**    Checking Happening... ...OK!  
                $(\text{fuel\_amount } \mathbf{t0})(t) = 24t + 39.984$   
               Updating  $(\text{fuel\_amount } \mathbf{t0})$  (39.984) by 40.008 for continuous  
               update.
- 3.005:**    Checking Happening... ...OK!  
               Adding (free arm0)
- 4.002:**    Checking Happening... ...OK!
- 4.002:**    Checking Happening... ...OK!  
                $(\text{fuel\_amount } \mathbf{t0})(t) = 4t + 40.008$   
               Updating  $(\text{fuel\_amount } \mathbf{t0})$  (40.008) by 43.996 for continuous  
               update.
- 4.002:**    Checking Happening... ...OK!  
               Adding (free arm1)
- 4.003:**    Checking Happening... ...OK!

**4.003:**    Checking Happening... ...OK!  
                $(\text{fuel\_amount } t0)(t) = 2t + 43.996$   
               Updating **(fuel\\_amount t0)** (43.996) by 43.998 for continuous  
               update.

**4.003:**    Checking Happening... ...OK!  
               Deleting **(free arm0)**

**4.004:**    Checking Happening... ...OK!

**4.004:**    Checking Happening... ...OK!  
                $(\text{fuel\_amount } t0)(t) = 4t + 43.998$   
               Updating **(fuel\\_amount t0)** (43.998) by 44.002 for continuous  
               update.

**4.004:**    Checking Happening... ...OK!  
               Adding **(free arm2)**

**5.003:**    Checking Happening... ...OK!

**5.003:**    Checking Happening... ...OK!  
                $(\text{fuel\_amount } t0)(t) = 2t + 44.002$   
               Updating **(fuel\\_amount t0)** (44.002) by 46 for continuous up-  
               date.

**5.003:**    Checking Happening... ...OK!  
               Adding **(free arm0)**

**5.004:**    Checking Happening... ...OK!  
               Deleting **(free arm0)**  
               Deleting **(open t0)**

**5.504:**    Checking Happening... ...OK!  
               Adding **(closed t0)**  
               Adding **(free arm0)**

Plan executed successfully - checking goal

$(\text{free arm0}) (\text{closed } t0) (\text{free arm2}) (\text{free arm1}) (\text{fuel\_amount } t0) = 46$

# 2.4 Primitive Numerical Expression Graphs

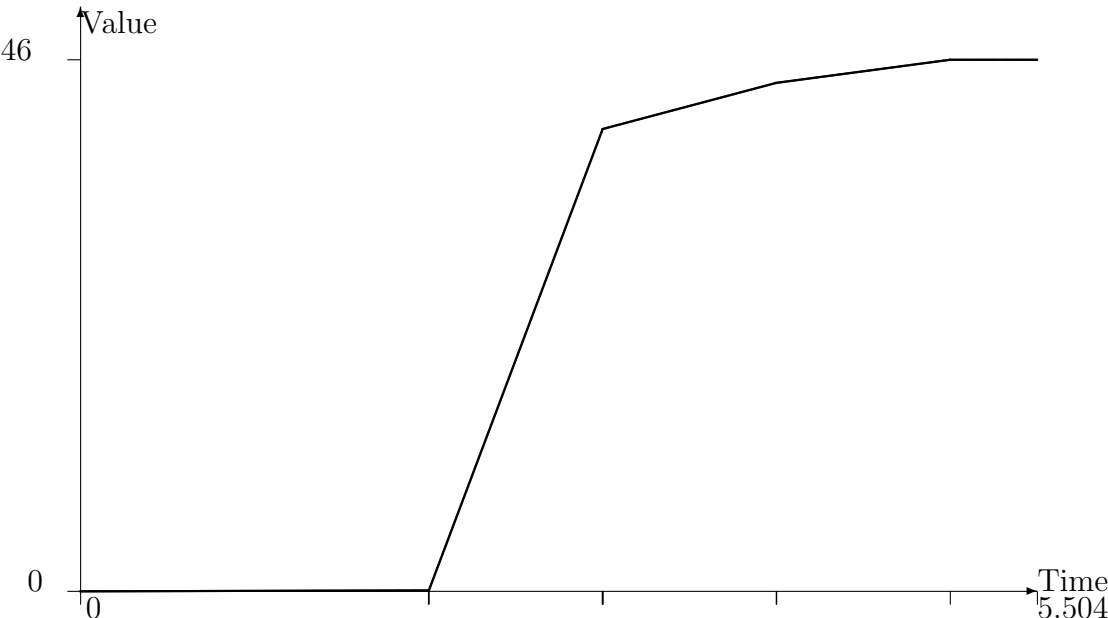


Figure 2.1: Graph of (fuel\_amount t0).

# 2.5 Gantt Chart

## Gantt Chart Key

Row 1

No	Time	Action
1	0	(open_tank arm0 t0) [2]
2	2.001	(refuel_fast arm2 t0) [1]
4	3.002	(refuel_slow arm1 t0) [1]
6	4.003	(refuel_slow arm0 t0) [1]
7	5.004	(close_tank arm0 t0) [0.5]

Row 2

No	Time	Action
3	2.005	(refuel_fast arm0 t0) [1]

Row 3

No	Time	Action
5	3.004	(refuel_slow arm2 t0) [1]

### 3 Successful Plans

Value	Plan
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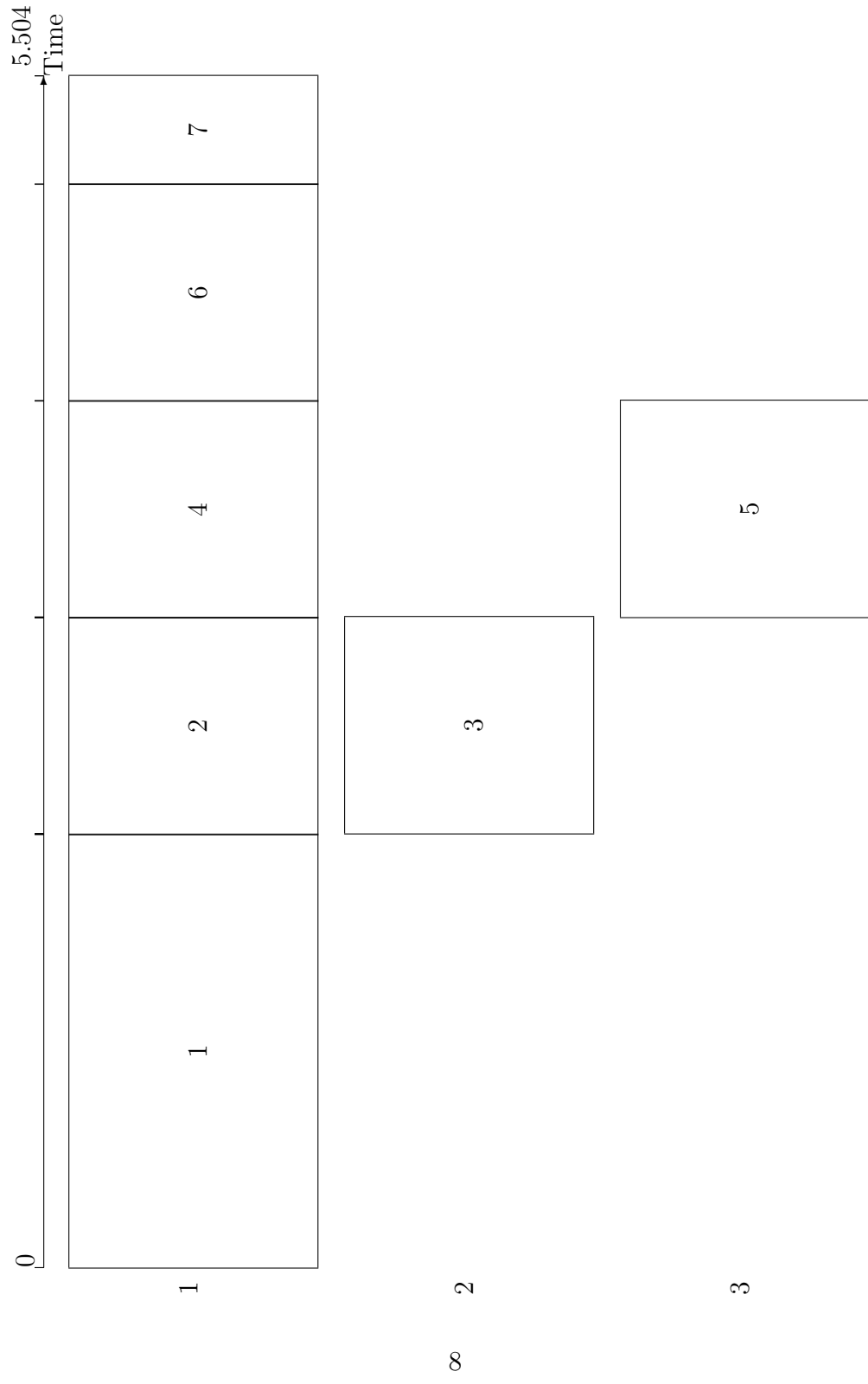


Figure 2.2: Gantt Chart