

## Worksheet: L10 – Fast-Forward

CSCI-534: Robot Planning &amp; Manipulation

Spring 2020

<http://www.neil.dantam.name/rpm/B10-ff.pdf>

You may use this handout to attempt the examples presented on the slides.

1. **Relaxed Planning Domain:** Construct the relaxed planning domain for the operators in Figure 1.

```

(define (domain air-cargo)
  (:predicates (plane ?x) (cargo ?x)
               (airport ?x) (at ?x ?y))
  (:action fly :parameters (?p ?x ?y)
   :precondition
   (and (plane ?p) (airport ?x) (airport ?y)
        (at ?p ?x))
   :effect (and (not (at ?p ?x)) (at ?p ?y)))
  (:action load :parameters (?c ?p ?a)
   :precondition
   (and (cargo ?c) (plane ?p) (airport ?a)
        (at ?c ?a) (at ?p ?a))
   :effect (and (not (at ?c ?a)) (at ?c ?p)))
  (:action unload :parameters (?c ?p ?a)
   :precondition
   (and (cargo ?c) (plane ?p) (airport ?a)
        (at ?c ?p) (at ?p ?a))
   :effect (and (not (at ?c ?p)) (at ?c ?a))))

(a)

```

```

(define (problem air)
  (:domain air-cargo)
  (:objects cargo-0 cargo-1
            plane-0 plane-1
            ATL SFO)
  (:init (cargo cargo-0)
         (cargo cargo-1)
         (plane plane-0)
         (plane plane-1)
         (airport ATL)
         (airport SFO)
         (at plane-0 ATL)
         (at plane-1 SFO)
         (at cargo-0 ATL)
         (at cargo-1 SFO))
  (:goal (and (at cargo-0 SFO)
              (at cargo-1 ATL))))

(b)

```

Figure 1: Air Cargo Domain

Name:

- 2. Relaxed Planning Graph:** Draw one level of the *relaxed planning graph* for the domain in Figure 1. You may omit the following constant predicates to make the drawing neater: `plane(?x)`, `cargo(?x)`, `airport(?x)`.