

The Planning Graph

asst 8 is posted

## The Planning Graph

- Simple Heuristics
- Planning Graphs
- Cake World
- Break
- Relaxed Plan
- Comparison
- Heuristics
- Concurrent  
Actions
- EOLQs

# The Planning Graph

# Simple Heuristics

---

## The Planning Graph

### Simple Heuristics

- Planning Graphs
- Cake World
- Break
- Relaxed Plan
- Comparison
- Heuristics
- Concurrent Actions
- EOLQs

1.  $h(n) = 0$
2. number of unachieved goals
3. reachability ('don't delete'):  $H_1$  max
4.  $H_1$  sum

# The 'Planning Graph'

---

## The Planning Graph

■ Simple Heuristics

■ Planning Graphs

■ Cake World

■ Break

■ Relaxed Plan

■ Comparison

■ Heuristics

■ Concurrent

Actions

■ EOLQs

2 types of layers: fact and action

track both positive and negative grounded literals

'no-op' frame actions

actions  $a$  and  $b$  mutex iff:

**inconsistency:**  $a$  deletes add of  $b$

**interference:**  $a$  deletes precondition of  $b$

**competing needs:** inconsistent preconditions

literals  $a$  and  $b$  mutex iff:

**inconsistent:**  $a$  is  $\neg b$

**inconsistent support:** all ways of achieving them are mutex

# Cake World

---

## The Planning Graph

- Simple Heuristics
- Planning Graphs
- **Cake World**
- Break
- Relaxed Plan
- Comparison
- Heuristics
- Concurrent Actions
- EOLQs

Initial: Have(Cake)

**Eat:** Pre: Have(Cake)

Post:  $\neg$  Have(Cake), Eaten(Cake)

**Bake:** Pre:  $\neg$ Have(Cake)

Post: Have(Cake)

Goal: Have(Cake), Eaten(Cake)

# Break

---

## The Planning Graph

- Simple Heuristics
- Planning Graphs
- Cake World

## ■ Break

- Relaxed Plan
- Comparison
- Heuristics
- Concurrent Actions
- EOLQs

- project proposals
- asst 7
- asst 8

# Relaxed Plan

---

## The Planning Graph

- Simple Heuristics
- Planning Graphs
- Cake World
- Break
- Relaxed Plan
- Comparison
- Heuristics
- Concurrent Actions
- EOLQs

$H_1$  max too small, sum too large

Basic graph assumes parallelism: serial planning graph

building a relaxed plan:

- choose no-op when possible
- re-use previously chosen action when possible

optimal relaxed plan is admissible but NP-hard  
need actions if optimizing costs (not makespan)

# Comparison

---

## The Planning Graph

- Simple Heuristics
- Planning Graphs
- Cake World
- Break
- Relaxed Plan
- Comparison
- Heuristics
- Concurrent Actions
- EOLQs

level-based heuristics

1. poor if many 'concurrent' actions at one level

max vs sum

1. sum poor if positive interactions

$h^n$

1. poor if negative interactions

# Heuristics

---

## The Planning Graph

- Simple Heuristics
- Planning Graphs
- Cake World
- Break
- Relaxed Plan
- Comparison
- Heuristics
- Concurrent Actions
- EOLQs

1. 0
2. number of unachieved goals
3.  $H_1$  max
4.  $H_1$  sum
5. planning graph max
6. planning graph sum
7. relaxed plan

# Concurrent Actions

---

$2^k$  vs incremental

The Planning Graph

- Simple Heuristics
- Planning Graphs
- Cake World
- Break
- Relaxed Plan
- Comparison
- Heuristics
- Concurrent Actions
- EOLQs

## The Planning Graph

- Simple Heuristics
- Planning Graphs
- Cake World
- Break
- Relaxed Plan
- Comparison
- Heuristics
- Concurrent Actions

## ■ EOLQs

- What question didn't you get to ask today?
- What's still confusing?
- What would you like to hear more about?

Please write down your most pressing question about AI and put it in the box on your way out.

*Thanks!*