

# Robust Planning for Sokoban with Probabilistic Inference

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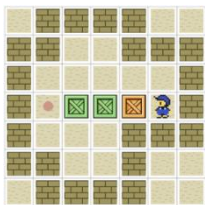
## 1 Introduction

**Automated planning** creates a sequence of actions to achieve a goal in a domain.

**Probabilistic programming language (PPL)** allows for creating probabilistic models using code.

**Sokoban** is a planning domain where the player's goal is to push all boxes to a goal.

Classically planning algorithms do not consider uncertainty, causing them to fail in real-world uncertain domains.



## 2 Objective

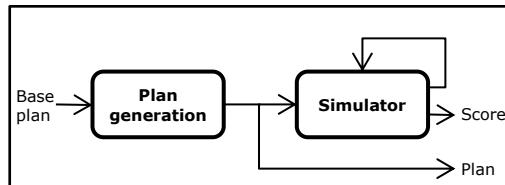
How can an existing planning algorithm be used to robustly solve uncertain Sokoban problems?

## 3 Problem description

**Uncertain Move Sokoban:** moves have a probability  $\alpha$  of failing.

**Robust plan:** plan with highest probability of solving level.

## 4 Method



Probabilistic model of plans written in Gen.jl:

- Generates plan based on existing plan by doubling random moves
- Evaluates robustness using simulator

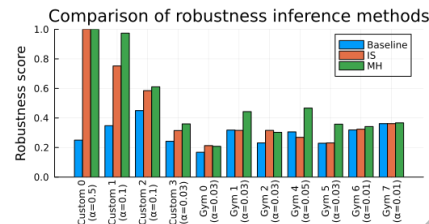
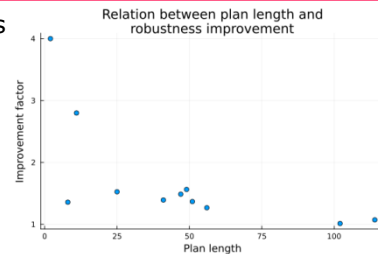
Robustness score constrained to 1  
Inference techniques infer robust plan:

- Importance sampling (IS)
- Metropolis-Hastings (MH)

Performance measured on test levels from PDDLgym and custom levels. Inferred plans ran 1000 times to measure robustness.

## 5 Results

- Metropolis-Hastings performs better in most cases
- The improvement offered by robust plans varies
- Shorter levels showed more improvement than longer ones



## 6 Conclusion & Future work

**Main conclusion:** Metropolis-Hastings is able to infer robust plans from the probabilistic model for short to medium-length levels.

**Limitation:** Ability to make a robust plan is dependent on the base plan provided by planner.

**Future work:** Create a dedicated planner for the problem to improve robustness and planning speed.