Comparing planners for rail planning in PDDL

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Introduction

- Storing trains is a complex problem
- TUSP: Train Unit Shunting Problem
- PDDL: Planning Domain Definition Language, used for scheduling
- Shunting yards have different layouts
- Apply and combine existing methods for real world replication

Research Question

Can a planner in PDDL be optimised which handles domains that contain commonly encountered types of shunting yard layouts?

Figure 1a: example Shuffleboard

Figure 1b: example carousel

Figure 1c: example station

Method

- **Creating the domain**
  - types
  - predicates
  - actions
- **Creating problem instances**

- **Evaluating planners**
  - Speed
  - Plan cost
  - Solvability

- **Optimising planners**
  - Improving the planner
  - Improving the domain
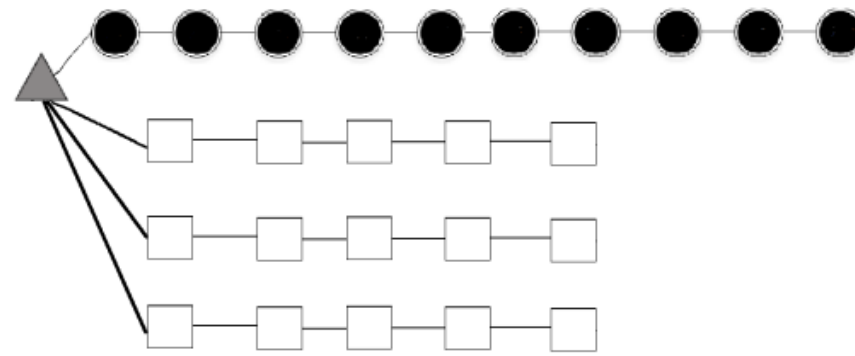
Figure 2: example carousel using PDDL
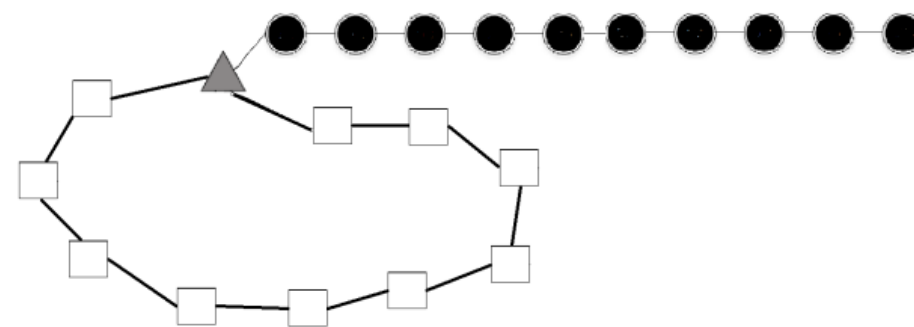
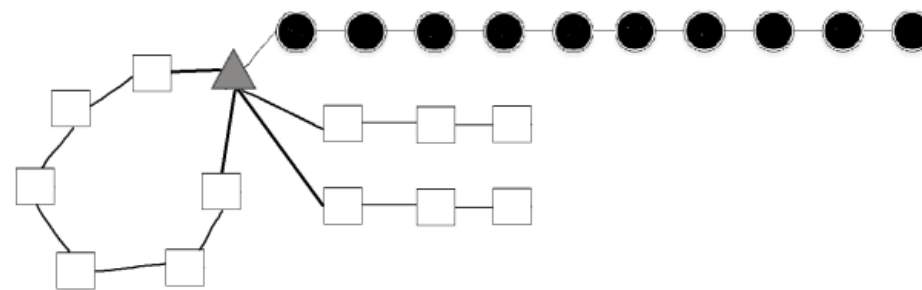Figure 3: Complex Shuffleboard Problem

Figure 4: Complex Carousel Problem

Figure 5: Complex Station Problem

	Shuffleboard	Carousel	Station
Baseline	1200s N/A cost False	1200s N/A cost False	1200s N/A cost False
Team 2	1200s N/A cost False	1200s N/A cost False	1200s 73 cost False
Team 4	182s 213 cost True	2.6s 199 cost True	3.2s 185 cost True
Team 35	336s N/A cost False	323s N/A cost False	296s 173 cost True

Table 1: Evaluation of different planners

Results

- **Finalizing the domain**
  - Last In First Out tracks
  - Free tracks
  - Switching tracks

- **Complex problems**
  - Figures 3 - 5

- **Evaluating planners**
  - Table 1
  - Team4 best results

- **Optimisation of the planner**
  - SAT solver
  - LIFO tracks
  - Table 2

  predicates:
  (nextTo ?x ?y - trackpart)

  (next ?x ?y - trackpart)
  (prev ?x ?y - trackpart)
  (last-track ?x - trackpart)

Figure 5: LIFO track optimisation

	Shuffleboard	Carousel	Station	Shuffle2
Team4	182s 213 cost True	2.6s 199 cost True	3.2s 185 cost True	47.5s 170 cost True
	Improved	Improved	Improved	Improved
Team4	6.4s 145 cost True	3s 193 cost True	10s 176 cost True	5.4s 151 cost True

Table 2: Evaluation of optimisation on the domain

Conclusion

- **Different shunting yards**
  - LIFO vs. Free tracks

- **PDDL for TUSP**
  - Domain
  - Problems

- **Real-world integration**

- **Future work**
  - Explore other planners
  - More optimisations
  - Real problems

- **Contributions**
  - Domain
  - Evaluation
  - Optimisation