International Planning Competition

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Outline

- **IPC 2014** – overview
- **Deterministic** track
- **Other** tracks
- **Challenge** – what is my intention
- Possible **approaches**

IPC 2014 - Overview

- Nearly **biennial event**
- In the context of the **ICAPS**-14, Portsmouth (USA)
- **Goals:**
  - **Empirical comparison** of planning systems
  - **Highlighting challenges** to the community
  - New **directions for research**
  - New links with **other fields of AI**
  - New **data sets for benchmarks**

IPC 2014 – Important **dates** (for deterministic track)

- June 13: Call for **Participation** available
- June 13: Call for **Domains** available
- July 13: **Competition Rules** are now available
- Oct, 31, 13: **Registration** deadline
- Nov, 15, 13: **Demo problems,** supporting **tools**
- Nov, 15, 13: **Domain submission** deadline
- Jan, 17, 14: **Planners submission** deadline
- March, 28, 14: **Papers submission** deadline

Four different **Tracks**

- **Deterministic** Track
- **Learning** Track
- **Probabilistic** Planning Track
  Continuous
- **Probabilistic** Planning Track
  Discrete

Deterministic Track

- Three tracks
  - **Sequential** track
  - **Temporal** track
  - **Preferences** track
- Two different subtracks **for each track**
  - **Optimal**, **Satisficing** subtracks
- Additional two subtracks **for Sequential track**
  - **Multi-core, Agile** subtracks

Deterministic - **Sequential**

- Classical STRIPS planning (**non-durative actions**)
- **Non-negative costs**
- **Negative preconditions and conditional effects**
- Reasonable time, low-cost plans
- Core features: **STRIPS, action costs, negative preconditions, conditional effects**
- Optional features: ADL, derived predicates
- **Total cost** of each plan is the sum of the **costs of** its **actions**
- Objective function: **minimize total cost**

Deterministic - **Temporal**

- Temporal planning with **metric constraints**
- Core features: **STRIPS, durative actions, metric quantities**
- Optional features: ADL, derived predicates
- Objective function: **Minimize makespan**

Deterministic - **Preferences**

- Planning with **soft goals**
  - Valid plan **does not have to achieve all goals**
  - Not achieving a goal implies a certain **penalization** added to the cost of the plan
  - Cost of the plan is a combination of the total actions cost and penalizations
- Core features: **STRIPS, action costs, goal utilities, metric quantities**
- Optional features: ADL, derived predicates
- Objective function: **Minimize total cost**

Optimal variants

- **30 minutes** to solve each problem
- What matters is only whether the problem was **solved or not**
- Plans **have to be optimal**
- At least **one** plan in a given domain is **non-optimal**
  => **all results** of that planner **in** that **domain** are **ignored**
- At least **one non-optima**l plan on at least **two different domains**
  => the planner is **disqualified**
- Objective function: maximize **number of solved problems**

Satisficing/multi-core variants

- **30 minutes** to solve each problem.
- What matters is only whether the problem was **solved or not**
- **Optimal/Best** solution has **quality Q***
- **Planner** finds a plan with **quality Q**<Q*
- **Quality ratio is Q/Q***
- Objective function: **maximize sum of quality ratios**

Sequential **Agile** variant

- Satisficing solution **as soon as possible**
- Very **short amount of CPU time** available
- Domains and problems from **real-world applications**
- The aim to "simulate" planning techniques in a real environment
- Objective function: **minimize CPU time**

Sequential **Agile** variant

- **5 minutes** to solve each problem.
- The **quality** of the resulting plans is **not important**
- What matters is only whether the problem was **solved or not within 5 mins, and** the **CPU time** required.
- **Minimum time required** by any planner is **T***
- **Planner solves** the problem **in time T**
- For **solved problem** gets the planner **score 1/(1 + log10(T/T*))**
- For **not solved problem** gets the planner **score of 0**
- Objective function: **maximize sum of scores over all problems**

Sequential **Multi-core** variant

- **Growing interest** in multi-core/parallel computation in the planning community
- **Different cores simultaneously** and/or with **different threads on each core**
- **No GPU** available
- **Only one computer** with a **number of cores** available (four cores expected)

Resources

- Demo problems
- **Plan Validator** for PDDL
  VAL: The Plan Validator
- **PDDL 3.1 - description**

Call for **Domains**

- **Negative preconditions** and/or **conditional effects** encouraged
- **Relation to real applications** desirable
- Only **one entry per team** allowed

Some of **demo problems**

- Sokoban
- TSP
- Elevators
- Transport

The **evaluation process**

- Competitors will be given a **set of representative** domain/problem **instances to test** their **planners** on their own machines.
- **Final version** of planners will be run on the actual competition **domains/problems unknown to the competitors** till this time

Participation

- The **focus** is **on data-collection** and **presentation**, with **interpretation of results** being understated
- The **real goal** is to make **as much data as possible** available to the community
- All competitors must **submit an abstract** (max. 300 words) and a 4-page paper describing their planners
- All **source codes** of planners will be **public**

Learning Track

The Quality subtrack

- Domains using the plan quality evaluation from the deterministic track
- Comparison of **learning versus non-learning** planners
- **Quality metric** from the recent deterministic competitions
- Three **awards**: **overall**, **basic solver,** and **best learner**

Learning Track

The Quality subtrack

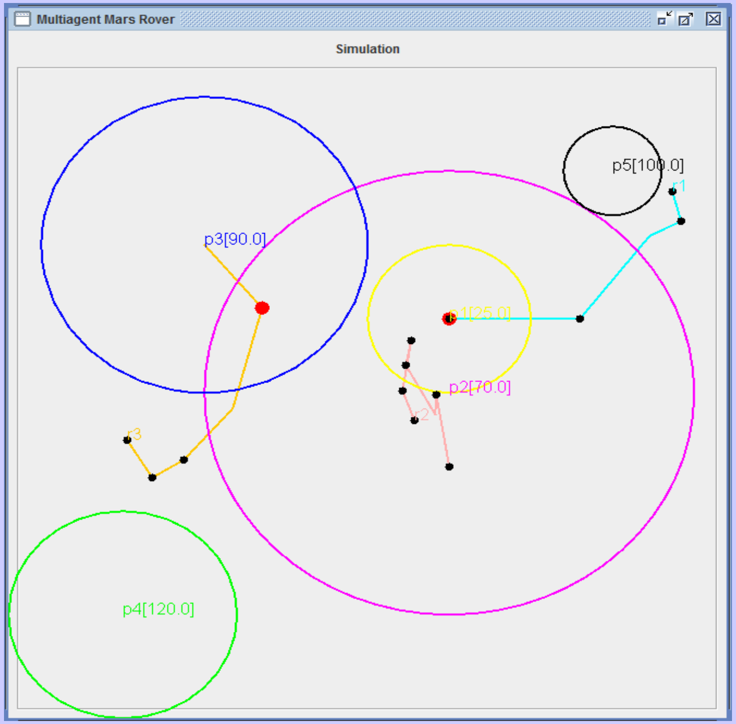
- The **learning stage**
  - The **domain definition**
  - The **problem generator**
  - **Domain-specific Control Knowledge**
  - Sets of **training files**
- The **testing stage**

Learning Track
The Integrated Execution subtrack

- Planner generates plans as **part of** a much **larger system**
- Learning and planning within the **context of a simple execution loop**
- Focus on **fully observable, discrete, non-adversarial, deterministic, single-agent domains**
- Awards: **best overall** learner, **most adaptable** learner, **best anytime** learner

Probabilistic Planning Track
Continuous

- Domains written in **RDDL** or **RDDL2**
- Examples:
  - **Traffic Control**
  - **Mars Rover**



Probabilistic Planning Track
Discrete

- Domains written in **RDDL** and various translations
- Examples:
  - **Game of life**
  - **Elevators**
  - **Traffic**

My **motivaton** is

- To **practice my skills** in planning
- To solve **declaratively described problems**
- To try out **existing tools**

My **intention**

- **Trying out of** some **existing planners**
- **Examination of** currently **used techniques**
- **Creation** of my own **basic planner**
  - **Sequential deterministic** track
  - **Satisfiable** subtrack
  - Support for **core features**
  - Usage of some **interesting techniques**

Time complexity

- Using negative pre-/post-conditions
- **Existence** of a plan:
  - **EXPSPACE-c**
- **Existence** of a plan **for** given **maximal makespan**:
  - **NEXPTIME-c**

Existing techniques

- **State/Plan space** planning
- Planning with **planning graph**
- **Forward** search
- **Backward** search (lifted, strips)
- **CSP, SAT**
- **Domain knowledge**
- **Abstraction, heuristics**

Some **preferred techniques**

- **Plan space** planning
- **Local changes**
- **Domain knowledge**
- **Abstraction**
- **CSP/SAT** for some subproblems

Thank you for your attention

> Questions && Answers

More information on:

ipc.icaps-conference.org

Sources

- **ICAPS Competitions** - webpage
  http://ipc.icaps-conference.org/
- **Fast-Forward Domain Collection** by Joerg Hoffmann
  http://fai.cs.uni-saarland.de/hoffmann/ff-domains.html
- **VAL: The Plan Validator**
  http://www.inf.kcl.ac.uk/research/groups/PLANNING/index.php?option=com_content&id=70&Itemid=77
- **Action description language** (ADL)
  http://en.wikipedia.org/wiki/Action_description_language
- Lectures on **Planning and Scheduling**
  http://ktiml.mff.cuni.cz/~bartak/planovani/