“AI Planning” – What It Is and What You Can Do for It

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Think of Puzzles...

♦ 15-Puzzle
♦ Rubik’s Cube
♦ Sokoban
♦ FreeCell
Real-Life Puzzles: Airport Ground Traffic Control

- Route aircraft between runways and terminals.
- Aircraft must be kept safely separated!
  Safe distance depends on aircraft size and mode of travel (pushing or under own power).
- Minimize taxi and wait times.

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Figure from Trüg, Hoffmann & Nebel.
Real-Life Puzzles: Manufacturing Automation

◊ “Pick & Place” in circuit-board manufacturing.
◊ Plan component placement order & grouping, tray allocation, and movement path.
◊ Minimize (average) completion and reconfiguration time, subject to complex constraints (e.g. vibrations, acceleration, heat).

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The relationship between different organisms can be measured by the number of “evolution events” (rearrangements) that separate their genomes.

Find shortest (or most likely) sequence of rearrangements between pairs of genomes.
The AI Planner: A Universal Puzzle Solver

◊ What do all puzzles have in common?
  ◦ There are **rules** which define the legal “moves” of the game.
  ◦ There is an **objective**: A goal state to reach, and a measure of solution cost.

◊ To a **domain-independent** AI planner, formal **descriptions** of the rules and objective are given as **input** along with an instance of the problem to solve.

◊ The hardness of the domain-independent planning problem depends on the **expressivity** of the input **language**.
Some Suggested Projects/Topics

♦ Detection and use of symmetries in planning problems.
♦ Methods for splitting planning problems into parts that can be solved (semi-) independently and joining the solutions.
♦ Comparing approaches to managing uncertainty in planning.
♦ Bounded lookahead algorithms for planning problems with time and resource constraints.
♦ Designing a more usable problem specification language, with compilation to basic PDDL.

users.rsise.anu.edu.au/~thiebaux/student_projects.html