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INTRODUCTION TO TASK PLANNING

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Task Planning – An Example Scenario

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Scenario: Christmas is less than a week away and you realised that you forgot to get a gift for a friend who lives in another city. There is a souvenir-cum-book shop and a post office near your home. What would you do?

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1. **Go** to the shop.
2. **Select** the *gift*.
3. **Purchase** the *gift*.
4. **Bring** the *gift* home.
5. **Pack** the *gift*.
6. **Label** the *package*.
7. **Bring** the *package* to post office.
8. **Hand-over** the *package* for shipment.

Key Terms in Task Planning

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What did you do to achieve this goal?

- You performed **a sequence of actions** which at the end fulfilled your goal.
- That is, you executed a **plan** to make the **goal condition** 'Christmas-gift-has-been-sent-to-the-friend' **become true**.

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- The **action names** are shown in bold font.
- The *objects* to which these actions are applied are shown in italics.
- The locations to which the agent moves are underlined.

- Your world consists of yourself (the agent), certain objects (gift, package) and a set of locations (home, shop, post office).

Task Planning Example
What is the State of Your World?

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- Your world consists of yourself (the agent), certain objects (gift, package) and a set of locations (home, shop, post office).
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  - Is the post office open?
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- These properties can be specified as conditions which can be either true or false.
- The set of all such conditions describes the **state** of the world.

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  - The package can be labeled only after the gift is packed.
  - The gift can be packed only after it has been purchased and brought home.

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  - The package can be labeled only after the gift is packed.
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- The effects of some actions make other actions possible.

Task Planning versus Path Planning

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- The **state** describes the relevant properties of all things in the world.
- An action can be performed only if its **preconditions** are satisfied in the current state.
- When an action is performed, it has an **effect** on the state.

Task Planning versus Path Planning

A Comparison

Criteria	Path Planning	Task Planning
Input	Initial pose (position, orientation)	Initial state (a set of conditions)
Input	Goal pose	Goal (a set of conditions)
Input	Global map	**Planning domain** (objects, conditions, actions)
Output	Globally optimal path (sequence of poses)	Plan (sequence of actions) that changes the initial state into a state that satisfies the goal
Sensing	Current pose	Current state
Execution	Obstacle avoidance	Applicability of actions

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Task planning deals with...

Given a planning domain, the initial state, and the goal, how can the robot **autonomously find a plan**, i.e. a sequence of actions, in order to go from the initial state to a state that satisfies the goal?

Algorithms that do this are called **planners**.

Cook a meal

Move to a new house

Build a tower

Fun exercise: Formulate plans for tasks related to these scenarios.

References

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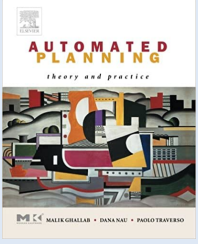
Automated Planning: Theory & Practice (English)

- Chapter 2: Representations for Classical Planning
- Chapter 4: State-Space Planning



Author's lecture slides: `https://www.cs.umd.edu/~nau/planning/slides/`

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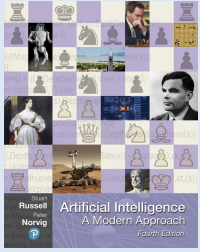
Artificial Intelligence:
A Modern Approach (English)

- Chapter 11.1: The Planning Problem
- Chapter 11.2: Planning with State-Space Search



Chaper 11 available at: `http://aima.cs.berkeley.edu/newchap11.pdf`

Next Part – Task Planning: Representation and Algorithms