Expected knowledge from course NAIL071 Planning and Scheduling

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Foundations:

- Define planning and scheduling problems, explain their relation and differences.
- Formulate planning domain and planning problem, define the notions of action and planning operator, rigid atom and fluent.
- Define set-theoretical, classical, and multi-valued state representations of planning domains/problems, explain their relations.

State-space planning:

- Define a planning state, transition function, applicability and relevance of action, and regression set.
- Describe forward and backward planning and prove their properties.
- Describe STRIPS algorithm and its properties (Sussman anomaly).
- Describe some heuristics for state-space planning.

Plan-space planning:

- Define a partial plan, explain notions of open goal and threat and describe how they are resolved. Describe a solution plan.
- Describe plan-space planning algorithm and prove its properties.
- Describe PoP algorithm.
- Compare plan-space and state-space planning.
- Describe some heuristics for plan-space planning.

Other planning techniques:

- Define a planning graph, describe how it is constructed; describe the notions of propositional and action mutexes, how they are constructed and what properties they have. Describe layered plan, Graphplan algorithm and its properties.
- Give some examples of compiling a planning problem to SAT and CSP. Explain frame axiom.
- Describe the concept of hierarchical task networks.
- Explain control rules and their usage in planning and how they are encoded in linear temporal logic.

Planning with Time and Resources:

- Describe approaches for modeling time: point and interval algebras, simple temporal networks, temporal constraint networks, disjunctive temporal networks; describe their properties and relations; how consistency is achieved.
- Describe how temporal relations are used in planning. Define timeline, chronicle, separation constraint, and consistency. Describe how planning with chronicles is realized.
- Describe how resources are modeled in planning, define a minimal critical set, describe how it is constructed and used to resolve resource conflicts.

Classical scheduling:

- Define Graham (α|β|γ) notation, describe the typical objectives (makespan, lateness, earliness, tardiness), task properties (time windows, preemptivness), properties of resources (capacity, alternative resources).
- Explain EDD rule and critical path method on examples of scheduling problems.
- Define shop problems (open-shop, flow-shop, job-shop), show approaches to solve problems F2| $|C_{max}$ and J2|n≤2|C_{max} and a general shop problem (define a disjunctive graph).

Constraint-based Scheduling:

- Describe a core constraint model for scheduling problems.
- Describe techniques behind some resource constraints (edge-finding, not-first/not-last, timetable constraint, orp/prp filtering).
- Explain the notion of slack and how it is used during scheduling.