2 handouts: slides, asst 2 reference
Logics of Action

- Event Calculus
- Situation Calculus
- Problems
- Break
- Planning

Logics of Action
Events and fluents are reified:

\[ \text{Member} (E_{23}, \text{Flyings}) \land \text{Agent} (E_{23}, \text{John}) \land \text{Happens} (E_{23}, I_{7}) \ldots \]

\[ T(\text{At}(\text{John}, \text{KN133}), t_1) \land \text{Terminates} (E_{23}, \text{At}(\text{John}, \text{KN133}), t_2). \]
World state (= situation) is reified:

\[ \text{Result}(\text{GoForward}, s_0) = s_1 \]

\[ \text{Result}(\text{Turn(right)}, s_1) = s_2 \]

\[ \forall s, a, b \; \text{Clear}(a, s) \land \text{Clear}(b, s) \rightarrow \text{On}(a, b, \text{Result}(\text{PutOn}(a, b), s)) \]
Defaults: hard to have coherent semantics and efficient inference (default logics, probabilistic logic)

Ramification problem: choosing what to infer (specialized systems)

Retraction: when previous truth becomes false (truth maintenance systems)

Qualification problem: making rules correct (probabilistic logic)
Break

- asst 2
- exam 1: Thurs 12:40-2 (common exam time)
- asst 3: domain-independent planner
- final projects: must see me before turning in proposal, due Apr 2
State-space Planning
Types of Problems

- actions serial or parallel
- actions unit time or varying
- actions unit cost or varying
- minimize makespan, cost, combination, or multi-objective
- just logical fluents or metric quantities (eg, resources) too
- off-line or on-line planning
- world controlled or has autonomous (predictable) dynamics
- ‘single agent’ or other agents modifying state
- actions deterministic or stochastic
- states fully, partially, or not observable
- initial state known or unknown
- single goal state or set
- goals of achievement or maintenance
- action space discrete or continuous
- state space discrete or continuous

plan, conditional plan, policy
representational: how to represent what doesn’t change
inferential: how to compute new state quickly
qualification: how to represent preconditions
Operator schema:

**Parameters:**  \( \text{Move}(\text{block, src, dest}) \)

**Preconditions:**  \( \text{On}(\text{block, src}), \text{Clear}(\text{block}), \text{Clear}(\text{dest}) \)

**Delete list:**  \( \text{On}(\text{block, src}) \text{ Clear}(\text{dest}) \)

**Add list:**  \( \text{On}(\text{block, dest}) \text{ Clear}(\text{src}) \)

Assume everything else is static. Closed world assumption.

Invented for Shakey (SRI).
Initial: At(Home), Sells(HWS, Drill), Sells(SM, Milk), Sells(SM, Bananas)

**Go (here,there)**
- Pre: At(here)
- Post: At(there), ⊳ At(here)

**Buy(store, x)**
- Pre: At(store), Sells(store, x)
- Post: Have(s)

Goal: At(Home), Have(Drill), Have(Milk), Have(Bananas)
Initial state: initial state
Branch on all applicable actions
Applicable: preconditions hold
Effects: delete deletes, add adds
Goal reached when all goal atoms are true.
What question didn’t you get to ask today?
What’s still confusing?
What would you like to hear more about?

Please write down your most pressing question about AI and put it in the box on your way out.

*Thanks!*