Outline

- Monitoring and Rescanning
- Conditional Planning
- The real world
possible conditional outcomes of actions

can never finish listing all the required preconditions and

Quantification problem:

Missing/Incorrect postconditions have incorrect operators

Current state incorrect, e.g., spare NOT intact

Inconsistent Information

\[ \text{Inflated}(x) \land \text{Inflated}(x) \land \text{Brakendump}(x) \land \text{ShowHas}(x) \]

Distinctive effects, e.g., Inflate(x) causes

\text{Inflated}(x), \text{Inflated}(x), \text{Inflated}(x)

Complete Information

Things go wrong
In general, some monitoring is unavoidable. Unauthorized outcomes may lead to failure (e.g., no AAA card).

Unmonitored outcomes during execution, replace if necessary.

Assume normal states, outcomes monitoring/replanning.

Expensive because it plans for many unlikely cases.

Subplan for each contingency, e.g.,

Plan to obtain information (observation actions)

Conditional planning
KnowsIf(Intact(x))

CheckTire(x)

Insert conditional step with these subplans:

- Complete plan for each possible observation outcome
- Add the action to the plan

If an open condition can be established by observation action:

Conditional planning: just like POP except

Execution: check $p$ against current KB; execute "then" or "else"

[... if $p$ then plan[else plan[else plan[...]]]]
Conditional Planning Example

(Start)
(On Tire1)
(Inflated(Spare))
(On Tire1)
(On Tire1)
(On Tire1)

(Start)
(On Tire1)
(Inflated(Spare))
(On Tire1)
(On Tire1)
(On Tire1)

(Start)
(On Tire1)
(Inflated(Spare))
(On Tire1)
(On Tire1)
(On Tire1)

(Start)
(On Tire1)
(Inflated(Spare))
(On Tire1)
(On Tire1)
(On Tire1)
Conditional planning example
Conditional planning example
Conditional Planning Example
Conditional planning example
In both cases, need to replan
(or action itself fails, e.g., robot bump sensor)

"failure = preconditions of next action not met"

Action monitoring
preconditions = causal links at current time
"failure = preconditions of remaining plan not met"

Execution monitoring

Monitoring
Preconditions for remaining plan
Failure Response

Preconditions

START

FINISH

Get(Red)

Color(Chair,Blue) ~ Have(Red)

Paint(Red)

Have(Red)

COLOR(Chair,Red)

FAILURE

Preconditions

N/A

None

None

Better: plan to get back on track by recompute to best continuation

Simplest: on failure, re-plan from scratch

Replanning