Real World Planning

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Outline

Review

- Classical Planning
  - fully observable
  - deterministic
  - finite
  - static
  - discrete

Review

- (non) Classical Planning (for uncertainty)
  - ~~fully observable~~ partially observable
  - ~~deterministic~~ non deterministic
  - finite
  - static
  - discrete

Review

- (non) Classical Planning (for uncertainty)
  - ~~fully observable~~ partially observable
  - ~~deterministic~~ non deterministic
  - finite
  - static
  - discrete
- Approaches
  - Sensorless Planning
  - Conditional Planning
  - Execution Monitoring and Replanning
  - Uncertainty Modeling

Weighty Tower of Hanoi

- Similar to regular Tower of Hanoi
  - disk are to be ordered by their weight
  - `clear()`, `on()`, `smaller()`, `disk()`

Figure: objects: disks - red, green, blue; pegs - A, B, C

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- Similar to regular Tower of Hanoi
  - disk are to be ordered by their weight
  - `clear(), on(), smaller(), disk()`
  - `clear(), on()`, ~~smaller()~~ lighter(), `disk()`

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  - disk are to be ordered by their weight
  - `clear()`, `on()`, `smaller()`, `disk()`
  - `clear()`, `on()`, ~~`smaller()`~~ lighter(), `disk()`
- Initial state
  `on(Red, Green)`, `on(Green, Blue)`, `on(Blue, A)`, `clear(Red)`, `disc(Red)`, `disc(Green)`, `disk(Blue)` `clear(B)`, `clear(C)`, `lighter(Red, A)`, `lighter(Red, B)` ...

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  - `clear(), on(),` ~~`smaller()`~~ lighter(), `disk()`
- Initial state

`on(Red, Green), on(Green, Blue), on(Blue, A), clear(Red), disc(Red), disc(Green), disk(Blue) clear(B), clear(C), lighter(Red, A), lighter(Red, B)` ...

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  - Action

```
Action(move(disk, source, destination)
PRECOND: clear(disk) ^ on(disk, source) ^ clear(destination)
^lighter(disk,destination)
EFFECT: on(disk, destination) ^ -on(disk, source) ^
-clear(destination) ^clear(source)
```

Weighty Tower of Hanoi

- Can we do sensorless planning?

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- How would the agent do conditional planning?

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- Percept Schema

```
Percept(lighter(d1,d2)
PRECOND: disk(d1) ^ disk(d2) ^ comparing(d1,d2))
```

Weighty Tower of Hanoi

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- How would the agent do conditional planning?
- Percept Schema

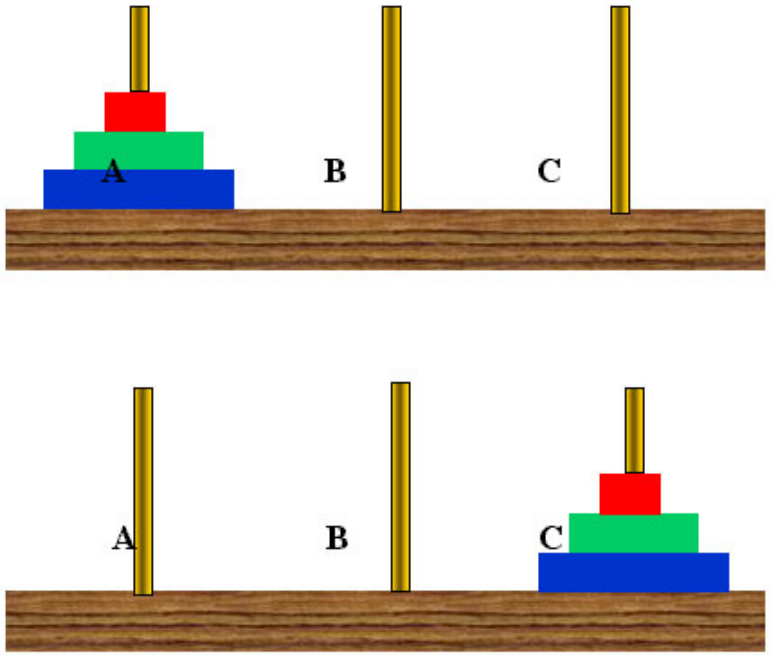
```
Percept(lighter(d1,d2)
PRECOND: disk(d1) ^ disk(d2) ^ comparing(d1,d2))
```

- Information-gathering Action

```
Action(compare-weight(d1,d2)
PRECOND: disk(d1) ^ disk(d2) ^ clear(d1) ^ clear(d2)
EFFECT: comparing(d1,d2))
```

Slippery Tower of Hanoi

- Similar to regular Tower of Hanoi
  - `clear()`, `on()`, `smaller()`, `disk()`
  - the gripper is slippery. sometimes the disk is displaced to the destination but at others it remains at the source.



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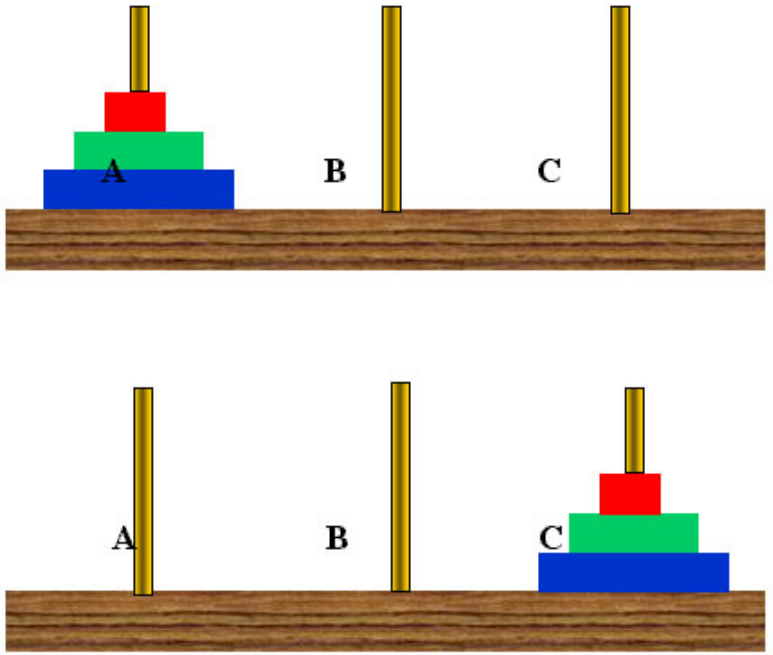

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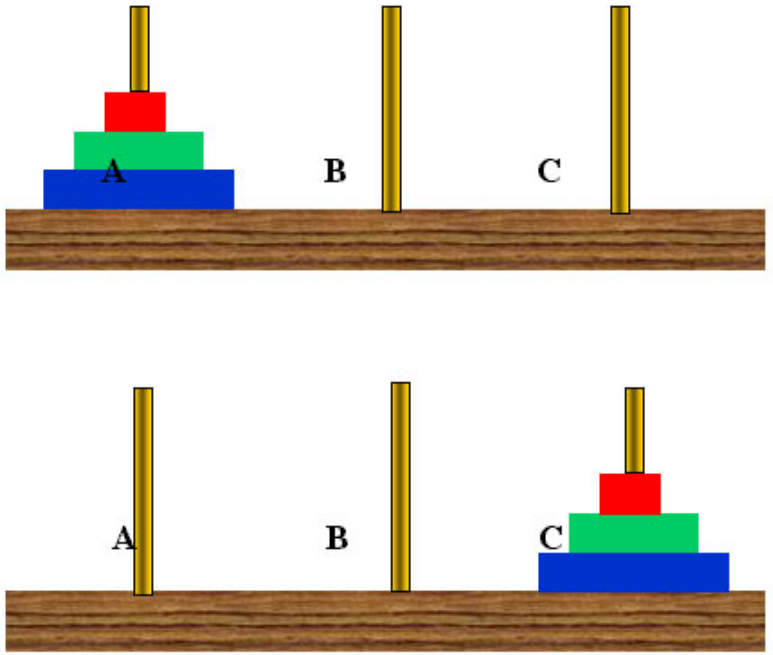
- Goal State?



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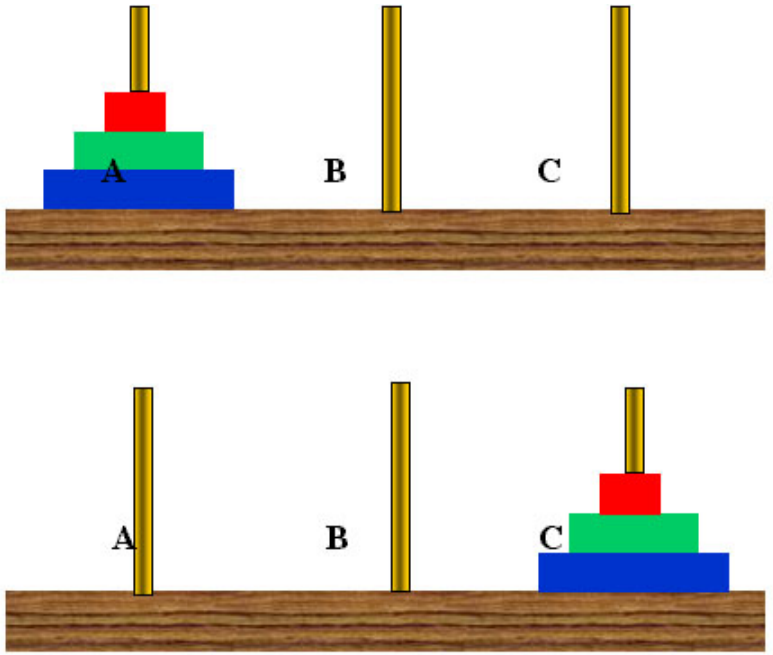

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- Action

```
Action(move(disk, source, destination)
PRECOND: clear(disk) ^ on(disk, source) ^ clear(destination)
^smaller(disk,destination)
EFFECT: (on(disk, destination) ^ -on(disk, source) ^
-clear(destination) ^clear(source)) V (on(disk, source))
```