III UNIT

PLANNING WITH STATE SPACE SEARCH

INTRODUCTION

- The most straight forward approach of planning algorithm is , state space search

- Two types of search

  Forward state Space Search Algorithm (Progression)

  Backward state space Search Algorithm(Regression)

- Because the descriptions of actions in a planning problem specify both **preconditions and effects**

- It is possible to search in both directions: forward means initial state and backward means from the goal state.

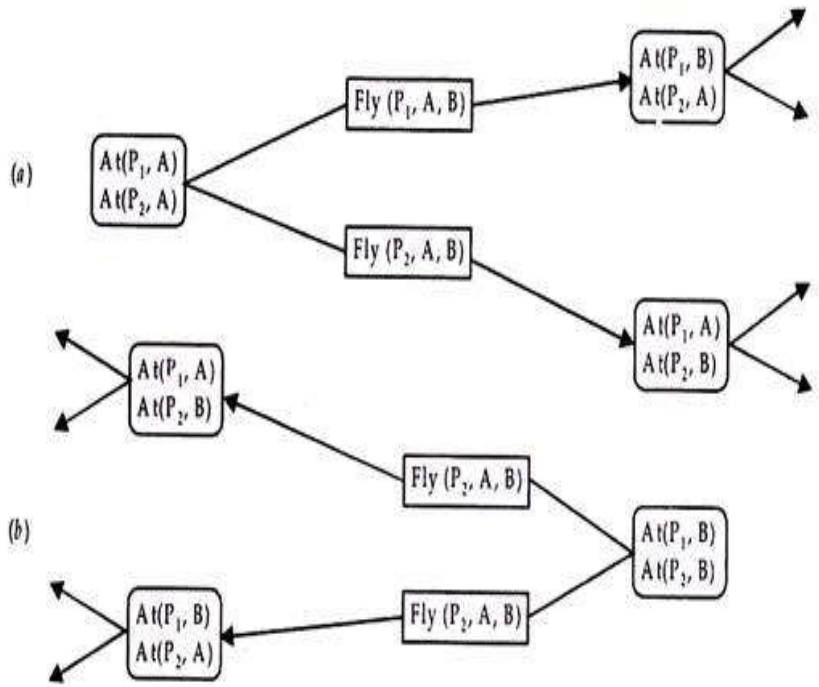


Fig. 8.5. *Two approaches to searching for a plan, (a) Forward (Progression) state-space search, starting in the initial state and using the problem's actions to search forward for the goal state, (b) Backward (regression) state-space search: a belief-state search starting at the goal state(s) and using the inverse of the actions to search backward for the initial state.*

Forward State-Space Search:

- Planning with forward state-space search is similar to the problem-solving approach. It is sometimes **called progression planning**, because it moves in the forward direction.
- We start with the problem's initial state, considering sequences of actions until we reach a goal state.

The formulation of planning problem as state-space search problems is as follows:

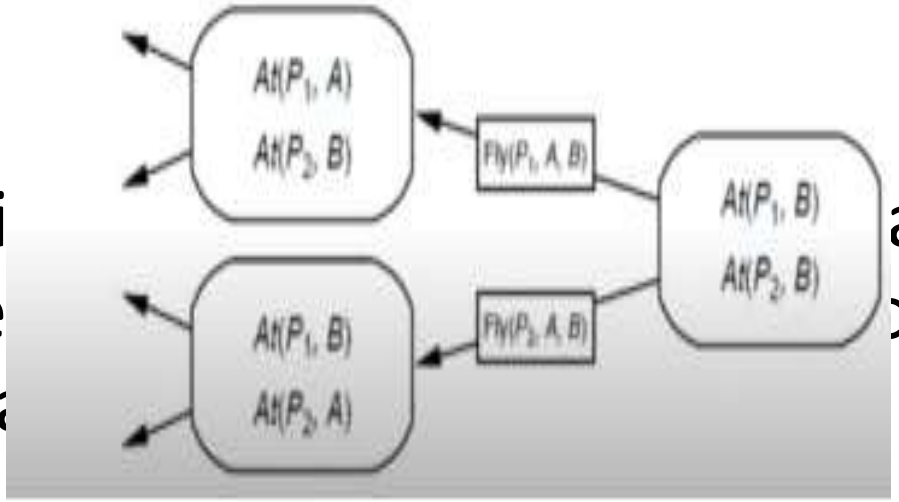
- i. The initial state of the search is the initial state from the planning problem. In general each state will be set of positive ground literals; literals not appearing are false.
- ii. The actions which are applicable to a state are all those whose preconditions are satisfied. The successor state resulting from an action is generated by adding the positive effect literals and deleting the negative effect literals.
- iii. The goal test checks whether the state satisfies the goal of the planning problem.
- iv. The step cost of each action

Cont…

- From the early days of planning research it is known that forward state-space search is too inefficient to be practical. Mainly, this is because of a big branching factor since forward search does not address only relevant actions, (all applicable actions are considered).
- Consider for example, an air cargo problem with 10 airports, where each airport has 5 planes and 20 pieces of cargo.
- The goal is to move all the cargo at airport A to airport B. There is a simple solution to the problem: load the 20 pieces of cargo into one of the planes at A, fly the plane to B, and unload the cargo. But finding the solution can be difficult because the average branching factor is huge: each of the 50 planes can fly to 9 other airports, and each of the 200 packages can be either unloaded (if it is loaded), or loaded into any plane at its airport (if it is unloaded).
- On average, let's say there are about 1000 possible actions, so the search tree up to the depth of the obvious solution has about 1000 nodes. It is thus clear that a very accurate heuristic will be needed to make this kind of search efficient.

Backward (regression)state space search

- In regression state we start at the goal and apply the actions backward until we find the sequence of steps that reaches the initial state.



- It i arch be ctions tha (or current state).