ASSIGNMENT - 9

AIM : Develop a POP for scheduling your higher studies exam. Assume suitable data like college submission schedule, college exams, Constraint that a paper publication is must to appear before the exam, a family function at home and so on.

OBJECTIVE :

- To understand the concept of Partial Order Planning(POP).
- To develop a POP for scheduling higher studies exam.

MATHEMATICAL MODEL :

Consider a following set theory notations related to a program. The mathematical model M for partial order planning is given as below,

M={S,So,A,G}

Where,

S=State space.
So= Initial State.Basic knowledge about colleges and their cut-off.
A=Set of Actions/Operators.All the necessary tasks such as In-Sem Exam,Project work,Mid term submission,unit tests ,presentation etc.
G=Goal state.,completing education with first class or first class distinction.

THEORY :

The planning problem in Artificial Intelligence is about the decision making performed by intelligent creatures like robots, humans, or computer programs when trying to achieve some goal. It involves choosing a sequence of actions that will (with a high likelihood) transform the state of the world, step by step, so that it will satisfy the goal. The world is typically viewed to consist of atomic facts (state variables), and actions make some facts true and some facts false.

POP is a regression planner; it uses problem decomposition; it searches plan

space rather than state space; it build partially-ordered plans; and it operates by the principle of least-commitment.

A partial-order plan or partial plan is a plan which specifies all actions that need to be taken, but does not specify an exact order for the actions when the order does not matter. It is the result of a partial-order planner. A partial-order plan consists of four components:

1. A set of actions (also known as operators).
2. A partial order for the actions. It specifies the conditions about the order of some actions.
3. A set of causal links. It specifies which actions meet which preconditions of other actions. Alternatively, a set of bindings between the variables in actions.
4. A set of open preconditions. It specifies which preconditions are not fulfilled by any action in the partial-order plan.

In order to keep the possible orders of the actions as open as possible, the set of order conditions and causal links must be as small as possible. A plan is a solution if the set of open preconditions is empty. A linearization of a partial order plan is a total order plan derived of the particular partial order plan.

Example :

A plan for baking a cake might start:

1. Go to the store.
2. Get eggs; get flour; get milk.
3. Pay for all goods.
4. Go to the kitchen.

This is a partial plan because the order for finding eggs, flour and milk is not specified, the agent can wander around the store reactively accumulating all the items on its shopping list until the list is complete.

Partial-order planner :

A partial-order planner is an algorithm or program which will construct a partialorder plan and search for a solution. The input is the problem description, consisting of descriptions of the initial state, the goal and possible actions.

The problem can be interpreted as a search problem where the set of possible partial-order plans is the search space. The initial state would be the plan with the open preconditions equal to the goal conditions. The final state would be any plan with no open preconditions, i.e. a solution.

The initial state is the starting conditions, and can be thought of as the preconditions to the task at hand. For a task of setting the table, the initial state could be a clear table. The goal is simply the final action that needs to be accomplished, for example setting the table. The operators of the algorithm are the actions by which the task is accomplished. For this example there may be two operators: lay (tablecloth), and place (glasses, plates, and silverware).

Representing a Partial-Order Plan :

A partial-order plan will be represented as a graph that describes the temporal constraints between plan steps selected so far. That is, each node will represent a single step in the plan (i.e., an instance of one of the operators), and an arc will designate a temporal constraint between the two steps connected by the arc.

POP as a Search Problem :

1. States are (unfinished) plans : The empty plan contains only Start and Finish actions.
2. Each plan has 4 components:
    - A set of "actions" (steps of the plan)
    - A set of ordering constraints: A<B (A before B) - Cycles represent contradictions.
    - A set of causal links between actions - The plan may not be extended by adding a new action C that conflicts with the causal link

- A set of open preconditions - Preconditions not achieved by actions in the plan

3. A partial order plan can be executed by repeatedly choosing any of the possible next actions.

This flexibility is a benefit in non-cooperative environments.

- Initial plan contains:
  1. Start and Finish
  2. Ordering constraint Start $<$ Finish
  3. No causal links yet
  4. All the preconditions in Finish are open (yet to be satisfied)
- Successor function :
  1. Picks one open precondition p on an action B and
  2. Generates a successor plan for every possible consistent way of choosing action A that achieves p .
- Test goal
- Heuristic function used to decide which open precondition to pick (e.g., most constrained first)

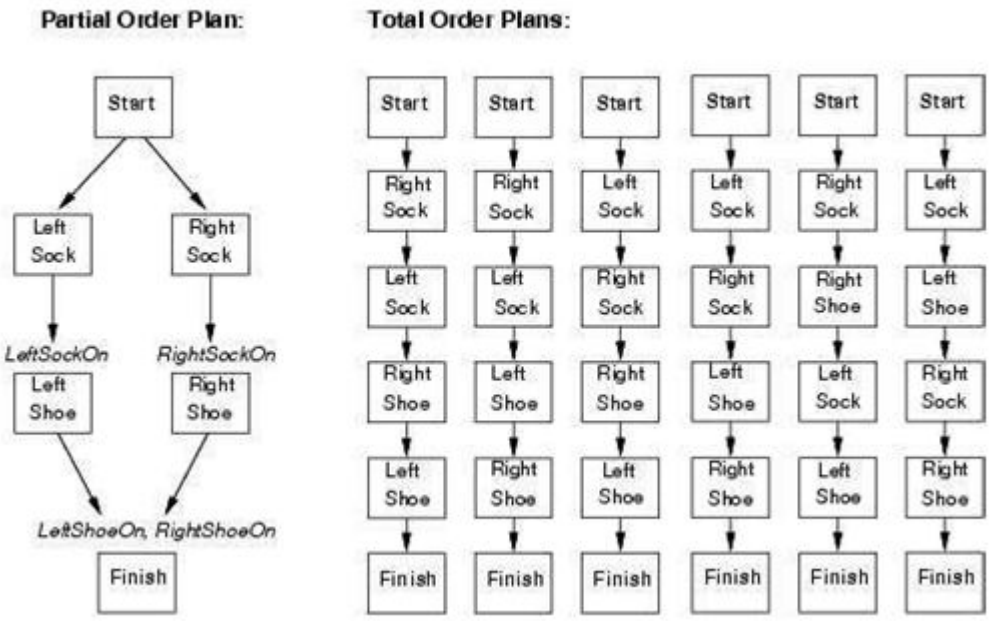
Shoe example :

1. Init()
2. Goal(RightShoeOn and LeftShoeOn)
3. Action(RightShoe, PRECOND: RightSockOn EFFECT: RightShoeOn)
4. Action(RightSock, PRECOND: EFFECT: RightSockOn)
5. Action(LeftShoe, PRECOND: LeftSockOn EFFECT: LeftShoeOn)
6. Action(LeftSock, PRECOND: EFFECT: LeftSockOn)

Planner :

Two subplans (actions can be interleaved),

1. leftsock, leftshoe and



2. rightsock, rightshoe

Disadvantages to partial-order planning :

One drawback of this type of planning system is that it requires a lot more computational power for each node. This higher per-node cost occurs because the algorithm for partial-order planning is more complex than others. This has important artificial intelligence implications. When coding a robot to do a certain task, the creator needs to take into account how much energy is needed. Though a partial-order plan may be quicker it may not be worth the energy cost for the robot. The creator must be aware of and weigh these two options to build an efficient robot.

CONCLUSION :

Thus, we have studied and developed a POP for scheduling higher studies exam.

Roll No.	Name of Student	Date of Performance	Date of Submission	Sign.
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