AI
Assignment

1) Basic Plan Generation System :-

Planning in AI :

* The Planning in the AI is about the decision making tasks performed by the agent (or) Computer Program to achieve a spec goal.
* The execution of planning is about choosing a sequence of actions with a high to Comple Specific tasks

Steps in planning :

1) Choose the best rule for applying the next rule based on the best available heuristics
2) Apply the choosen value rule for Computing the new problem state.
3) Detect dead ends, so that they can be abondoned and the system's effort can be directed in more fruitfull directions.
4) Direct when an almost correct Solution has been found.

→ Planning refers to the process of Computing several steps of a problem Solving before exe cuting any of them.

→ planning is useful as a problem solving technique for non-decomposable problem.

Components of planning System:

To choose rules:

→ Isolate a set of (rules) differences b/w the desired goal State and Current State.

→ Identify those rules that are relavent to reducing these differences

→ If more rules are found then apply heuristic information to choose out.

To apply rules.

→ Applying rules was easy as each other Rules Specifies the Problem. State that would result from its application

→ In Complex problem we deal with rules that Specify only a Small part of Complete Problem Stats.

Importance of planning:

→ Automation is an emergency trend that requires efficient automated planning

→ many applications of planning in industry are raising up

Applications of planning

→ Evacuation Planning

→ Evacuating Terrorists Threats

→ fighting forest fires.

→ Controlling multiple UAV

→ Software System Integration
→ Automated Composition of web services
→ Bussiness workflow management
→ Project planning
→ Traffic Control management
→ Transport logistic Analysis
→ web Agents and Robots
→ Games
→ Autonomous vehicle

Advantages of AI planning:
→ when explainibility is desired:
  → when to explain particular course of action
  → Assignment of responsibility
→ short-time to solution
→ open source contributions.

Different Algorithms of planning:-

1) classical planning:-
→ forward chaning state space search possibly enhanced with heuristics
→ Backward chaining state space search possibly enhanced by the use of state constraints (STRIPS, GRAPHPLAN)
→ partial-order planning (susman-anomaly)

2) Reduction Planning:-

→ Reduction to Propositional Satisfaction Problem (Sat plan)
→ Reduction to model-checking, both essentially problems of traversing state spaces and classical planning.

3) Temporal planning:-

→ Solved with methods similar to classical planning
→ closely related to scheduling problems.
→ Timed automata

4) Probabilistic planning:-

→ value iteration
→ policy iteration
→ partial observability with iterative methods
→ defined for space of beliefs

5) Preference - based planning:-

→ objective of satisfy user-specified preferences
→ Reward - based planning

6) Conditional planning:-

→ Deterministic planning
→ Behavioural tree
→ Program synthesis

7) Contigent planning, conformant planning

2)

Dempster Shafer theory was given by Arthur P. Dempster in 1967 and his student G. Lenn Shafer in 1976. This theory was released because of these reasons,

* Bayesian theory only concerned about single evidences
* Bayesian probality cannot describe ignorance.

DST is an evidence theory, it combines all possibility of the outcomes of the problem. Hence, it is used to solve problems where there may be a chance that a different evidence will lead to someone different result. The uncertainity of this model is given by:

* Consider all possible outcomes.
* Belief will lead to believe in some possibility by bringing out some evidence.
* Plausibility will make evidence compabitible with possible outcomes.

for example,

Let us consider a room where four people are present A, B, C, D. Suddenly the lights go out and when the lights comeback, B has been stabbed in the back by a knife, leading to this death. No one came into the room and no one left the room. we know that B has not committed suicide. Now we have to find out who the murderer is

To solve this there are following possibilities

* Either {A} or {C} or {D} has killed him.
* Either {A, C} or {C, D} or {A, D} have killed him.

*or the three of them killed him i.e, {A,C,D}.
*None of them have killed him {0} (let's say)

There will be the possible evidence by which we can find the murderer by measure of plausibility.
Using the above example we can say:
set of possible conclusion (P): $\{P_1, P_2, \cdots P_n\}$ he
where P is a set of possible conclusions and e
cannot be exhaustive, i.e, at least one(P), must be true or (P), must be mutually exclusive
Powerset will contain 2^n elements where n is the number of elements in the possible set

Mass function m(K):
It is an interpretation of m({K or B}) i.e, it means there is evidence for {K or B} which cannot be divided among more specific beliefs for K and B.

Belief in K:
The belief in element K of powerset is the sum of masses of element which are subjects of K. This can be explained via an example
Lets say K = {a, b, c}.
Bel(K) = m(a) + m(b) + m(c) + m(a,b) + m(b,c) + m(a,c) + m(a,b,c)

Plausibility in K:
It is the sum of masses of set that intersected with K
i.e

$$Pl(k) = m(a) + m(b) + m(c) + m(a,b) + m(b,c) + m(b,c) + m(a,c) + m(a,b,c)$$

Characteristics of Dempster Shafer theory:

* Ignorance is reduced in this theory by adding more and more evidences
* Combination rule is used to combine various types of possibilities

Advantages:

* As we add more information, uncertainity interval reduces
* DST has much lower level of Ignorance
* Diagnose heirarchies can be represented using this
* Person dealing with such problems is free to think about evidences

Disadvantages:

In this Computation effort is high, as we have due to deal with 2^n of sets

B

(3) Many Problems in AI can be considered as problems of Constraint satisfaction, in which got goal state satifies a given set of Constraint. Constraint Satisfaction Problem (CSP) can be solved by using any of the Seach Strategies The general form of the Constraint Satisfaction Procedure is as follows. until a Complete Solution is found or until all paths have led to lead ends, do

* select an unexpected or unexpanded node of the Seach. graph
* Apply the Constraint interference rules to the selected node to generate all possible new Constraints.
* If the Set of Constraints Contain a Contradiction, then report the path is a dead end
* If the set of Constraints describes a Complete Solution then report Succers
* If neither a Constraint nor a Complete Solution has been found then apply the rules to generate new Partial Solutions Insert the Partial Solutions into the search graph
* for Example, Consider the crypt arithmetic Problem

```
  SEND
+ MORE
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 MONEY
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Assign decimal digit to each of the letters in such a way that the answer to the problem is correct to the same letter occurs more than once, it must be assign same digit each other. No two different letters may be assigned the same digit.

for the crypt arithmetic Problem mentioned above, the Constraints are,

* No two digit can be assigned to same letter
* only single digit number can be assignment to a letter
* No two letters can be assigned same digit
* Assumption can be made at various levels such that they do not contradict each other
* Any of the search technique may be used
* Rules of arithmetic may be followed.
* Backtracking maybe performed as applicable as applied search technique

Initial state of problem:

D=?, E=?, Y=?, N=?, R=?, O=?, S=?, M=?,
C1=?, C2=?, C3=?

C_1, C_2, C_3 stands for the carry variables.

Goal State:

The digits to the letters must be assigned in such a manner so that the sum is satisfied

Solution Process:-

we are following the depth first method to Solve the Problem.

* Initial guess m=1 because the Sum of two magic Single digits can generate at most a Caary '1'
* when m=1, O=0 or 1 because the largest Single digit number added to m=1 can generate the Sum of either 0 or 1 depend on the Caary recieved from the Caary Sum. By this we Conclude that O=0 because m is already 1 have we cannot assign Same digit another letter
* we have m=1 and O=0 to get O=0 we have S= 8 or 9, again depending on the Caary recieved from the eaalier Sum.

The Same Procers can be repeated further. The Problem has to be Composed into various Constraints and Each Constraints is to be Satisfied by guessing the possible digits that the letters can be assumed that the initial guess has been already made.

Solution State:

Y= 2; D= 7, S=9, R=8, N=6, E=5, O=0,
M=1, C_1=1, C_2=0, C_3=0

	$C_3(0)$	$C_2(1)$	$C_1(1)$	
	S(9)	E(5)	N(6)	D(7)
+	M(1)	O(0)	R(8)	E(5)
	M(1)	O(0)	N(6)	E(5)	Y(2)