RESEARCH PAPER ON FORWARD REASONING IN HIERARCHICAL REPRESENTATION

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ABSTRACTION

As we know that the field of computer science increases day by day, so by the means of many development we are now able to take the enjoy of usefulness of that kind of advancement.
Our criteria of discussion are now focused on the "ARTIFICIAL INTELLIGENCE".
In that field i.e. in A.I. the main theme is based on reasoning we consider some conditions and by the means of it we can analyze some points, and we can say by the reasoning we get that result.
In A.I. there are many type of reasoning's are used in that custom but I am interested today in talking about "Forward reasoning". Although in the same custom we are also consider as Backward reasoning but we are not discuss about it because it is the totally different view of reasoning and it is the counterpart of forward reasoning.
So we can assume only forward reasoning in account and suppose by the means of its counterpart the backward reasoning is must be solved.

WHATS ARE FORWARD AND BACKWARD REASONING;
In forward reasoning, reasoning proceeds forward, beginning with factor, chaining through rules and finally establishing the goal.

When the left side of sequence of rules is instantiated first and the rules are executed from left to right the process is called forward chaining/reasoning. This is also known as data driven search, since, input data are used to guide the direction of the inference process. For example, we can chain forward to show that when a student is encouraged, is healthy, and has goals, the student will succeed.
e.g.,
ENCOURAGED(student) →MOTIVETED(student)

MOTIVETED(student)&HEALTHY(student) →WORKHARD(student)

WORKHARD(student)&HASGOALS(student) →EXCELL(student)

EXCELL(student) →SUCCEED(student).

On the other hand, when the right side of the rules is instantiated first, the left hand conditions become sub goals. These sub goals may in turn cause sub-sub goals to be established, and so on until facts are found to match the lowest sub goal conditions. When this form of inference takes place, we say that backward chaining is performed. This form of inference also known as goal driven inference since an initial goal establishes the backward direction of inferring.

e.g. ,
the initial goal in a consultation is “Does the patient have a certain disease?”.

This causes sub goals to be established such as “are certain bacteria are present in the patient?”. Determining if certain bacteria present may require such things as tests on cultures taken from the patient. This process of setting up sub goals to confirm a goal continues until all the sub goals are eventually satisfied or fail. If satisfied, the backward chain is established thereby confirming main goal.
Some systems use both forward and backward chaining/reasoning, depending on the type of problem and the information available. Likewise rules may be tested exhaustively or selectively, depending on the control structure.
Now we are interested in the process by the means of which we will able to define the forward reasoning in the term of “CLASS HIERARCHY”, the most common word and custom for the object oriented programmer.
We use class hierarchy in OOPs to reuse as much as data and/or functions that have been designed already, we create a class hierarchy. Class hierarchy consists of a base class and derived classes.
Now it can be clearer by the means of pictorial representation. We can divide the pictorial representation in the three parts
i.e.

(1) Objects in solution space

(2) First level of hierarchy

(3) Second level of hierarchy

[Here it is worth noticed that there are many levels of hierarchy are possible but for simple understanding purpose we take only till second level.]

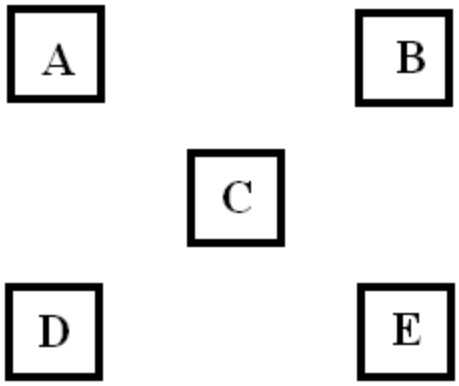

Fig.1 Objects in solution spaces

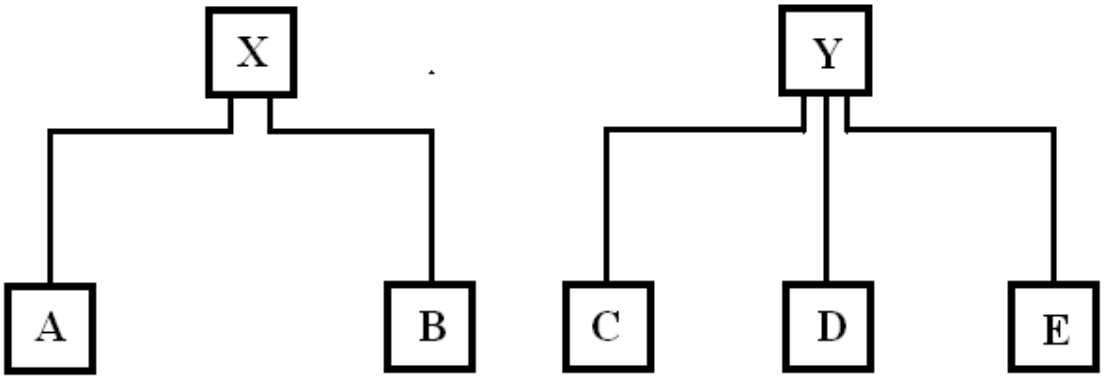

Fig.2 Firtst level of hierarchy

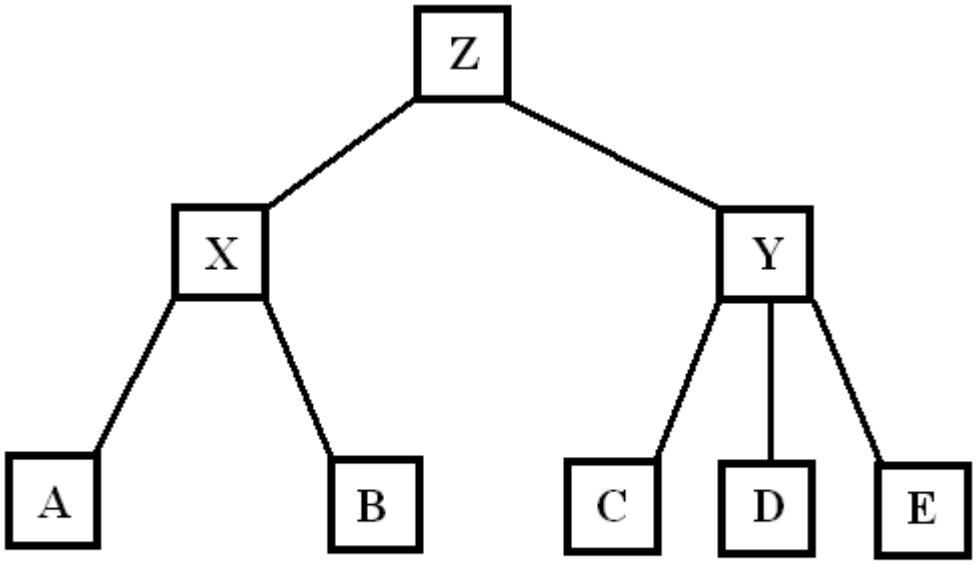

Fig. 3 second level of hierarchy

Organization of the class hierarchies involves identification of common attributes and functions among a group of related classes and then combining them to form a new class. The new class will serve as super class and the others as subordinate classes (which derive attribute from the super class).

A super class is a class from which another class inherits properties. A super class shares its properties with its child classes. A sub class is a class that inherits attributes and methods from a super class.

Subclasses are not limited to the methods provided to them by the super class. They can also have their own data members and methods a part from those inherited from the super class.

The process of combining the common attributes and functions among a group of related classes may be repeated at different levels of abstraction with the ***sole*** objective of extending classes. As hierarchy structure becomes progressively higher, the amount of specification and implementation inherited by the lower level classes increases. We may repeat the process until we sure that no new class can be formed.

Figures 1 , 2 , and 3 show two level iteration process.

Here our aim to discuss Hierarchy structure is that, by the means of it we can define forward reasoning.
The main criterion is that in the conventional representation we use HORIZONTAL way, while in our optional idea we can use the VERTICAL way of representation.
The very simple way to understand it we consider a very simple example.

A--->B--->C--->D

Fig.4 conventional way(horizontal representation)

Whilst our representation is of the form

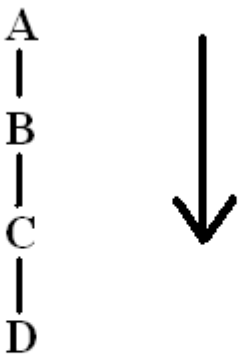

Fig. 5 new vertical representation(hierarchical way)

On the other hand one question arisen in ones mind why we use that approach? In answering I am told them that by the means of that way we are able to data reusability and even it is more powerful weapon where the very large amount of data is consumed.
However it is not so easy to apply horizontal to vertical conversion, many type of factors affecting it and it is really a hard task to achieve counter part of horizontal one.
Although by the means of mathematical part of computer science, we are able to perform some operation which is proven its conversion as precise.
We apply "MARKOV chaining" to convert it.

MARKOV CHAIN;
It is a markov process in which the state space ***I*** is discrete (finite). Markov chain is a finite stochastic process consisting of a sequence of trials whose outcomes say x1, x2, x3….. satisfy the following two conditions:

(a) Each outcomes belongs to the state space ***I*** = {a1, a2, …a n}, which is the finite set of outcomes.
(b) The outcome of any trial depends at most upon the outcome of the immediately preceding trial and not upon any other previous outcomes. This Markov property can be stated as

$$P(X_n=i_n/X_0=i_0/X_1=i_1,\ldots.,X_{n-1})$$

$$=P(X_n=i_n/X_{n-1}=i_{n-1}).$$

By applying the above explain equilibrium of Markov chaining/reasoning we can say that a selection must apply on the choices and it must be necessary that we are assuming some formulae by the means of which we are suppose proper replacement of it.

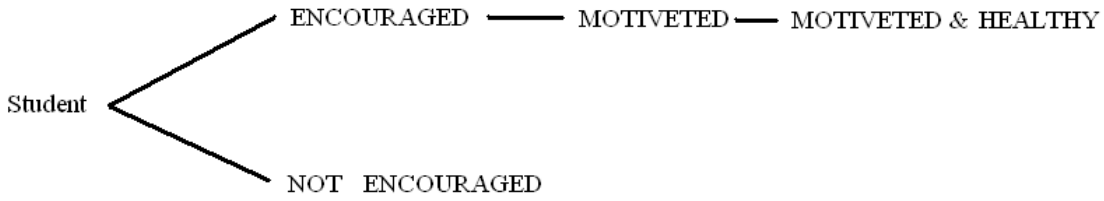

Fig . 6 Apply Markov chaining on options

For the sake of simplicity we can also define an algorithm by the means of which we can consider the above depicted figure.
However the hierarchy classes are hard to show in the conventional way but the representation of the forward reasoning is the straight forward one in compare to conventional one so it is easy to achieve to find the proper response of the illustration.

Now by the means of algorithms we can lightning the problem more clear.
Its algorithm
Suppose a student is in the school

IF the student (ENCOURAGED);
THEN the student is (MOTIVETED);
IF NOT;
THEN (NOT MOTIVETED);
IF the student (MOTIVETED)&HEALTHY;
THEN student(WORKHARD);
ELSE he/she will not perform well // in normal conditions.
IF the student (WORKHARD))&HASGOALS;
THEN do EXCELL;
IF the student do EXCELL;
the student (SUCCEED);
ELSE FAIL.

The above algorithm is success perform the proper task and the basis of which we can modified the proper Markov function in the form of verticalness.

Now the system is said to be in state ‘a i ’at time n or at the nth step if a i is the outcome of the nth hierarchy.
So by the means of which we may be able to convert horizontal to vertical is the Markov chain process.

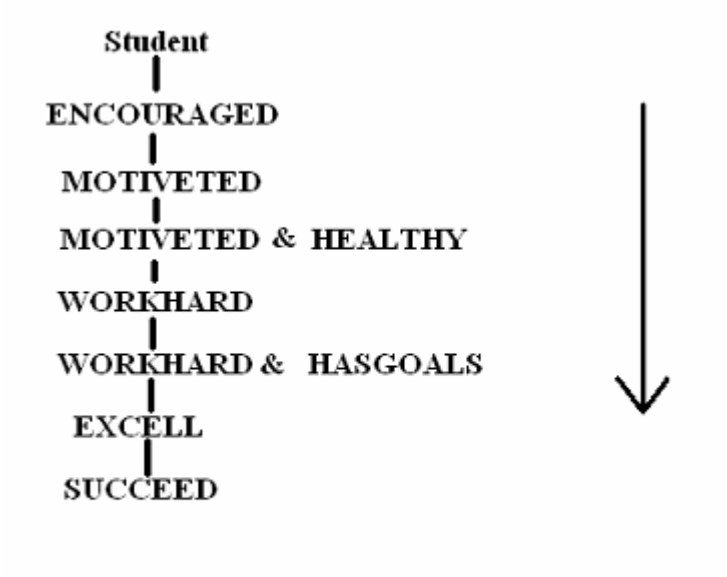

Fig .7 Vertical representation of illustratiion

COCLUSION

In the above criterion we are able to assume that the reasoning is achieved by the means of horizontal to vertical conversion and vice-versa.

The core argument behind the apply of that idea is the use of more reusability of data. Obviously as we increases in the data quantity major the factor of the memory consumed by that data, our key axiom is loosely held on the data reusability as its counterpart in OOPs there are many occupation are in fashioned since last decades by the same idea of thought we use and apply it in the major problem of A.I.'s reusability of data.

Our final purpose is achieved by the means of same idea as we discussed above.
Finally it is undisputedly says that although it is not revolutionary change in that custom, but it will open the doors to find some more ways for the new inventions.

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