Alan Creak
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# AN ATTEMPT ( probably doomed to failure ) TO IMPOSE A LOGICAL STRUCTURE ON UNIVERSITY ENROLMENT.

## WHAT THIS NOTE IS ABOUT.

Despite the rather pretentious title, this is just my way of trying to collect together a number of scattered thoughts and to make some sense of them. I began with a fairly clear idea of what the problem was, but now I'm much less sure about it. So I'm offering a few statements, definitions, attempts at defining terminology, and other oddments in the hope that writing it down will help to clarify my thoughts.

## THE PROBLEM SPACE.

A node in the problem space is equivalent to a student's record. It is a set of triples { paper, date, result }, each recording the result obtained when a certain paper was attempted in a particular year. Notice that "result" includes examination grades, "withdrawn", DNS, etc.

*REMARKS : Must the data also include the degree for which the paper was taken ?*

The **goal** is any node in the problem space which satisfies certain conditions. The conditions will only rarely identify a specific point in the space, if only because the order in which papers are taken ( apart from the need to satisfy prerequisites and corequisites ) is ( usually ? ) unimportant in determining whether or not a degree or other qualification can be awarded. The student is aiming at a **target** ( which is as good a name for it as anything; it would be better to avoid "goal", which has the technical connotation used above ) which may be as vague as "To get a B.Sc.", or may be rather precise : "To get a B.Sc.(Hons) in Computer Science, taking papers from Computer Science, Mathematics, and Physics".

A movement in the problem space corresponds to a year's study at the university : we may call it a **course**. We wish to identify a course for this year which will lead the student to a node closer to ( ideally, identical to ) a goal node. But we are dealing with an "uncertain outcome" problem : the student may not pass the examinations.

*REMARKS : I originally thought that a node should include the student's current course and future plan. On reflection, I don't think that's very useful. The future plan is better seen as helping to determine the goal; it has little function as a formal component of the state. The current course is a bit different - it certainly has to be recorded somewhere, but its status is not as firm as that of the academic record in that it is still subject to change. I observe that with the definition I've given, the problem space is clearly ordered by set inclusion. ( Although that may not be so if the degree is included as part of the information on a paper. )*

*The choice of current course is determined by academic factors, which are essentially those connected with the student's target, and by several criteria of other sorts : limitations on the number of papers which may be taken in a year, the need to qualify for a bursary, a limited number of hours available for study, timetable clashes, restrictions and exclusions … . In some cases there may be no way of reaching the target, and advice on special concessions by deans and the vice-chancellor may be appropriate.*

## VIEWPOINTS.

Student vs. Administration : From the student's point of view, enrolment is a matter of planning a reasonable course which leads more or less directly towards the target, whatever that may be. The student needs help in designing the course, advice on a proposed course, and suggestions as to what can be done in difficult cases. From the Registry's end, the need is to observe the progress of enrolment, and to identify and deal with anomalies. A student's enrolment is not seen as a single act, but as a sequence of transactions, which may not always be mutually consistent; inconsistencies should be detected and reported.

Search vs. Conflict resolution : These views are in some ways related to the previous pair. We can think of the problem as essentially geographic, when the aim is to find a route from the present position to a goal state by moving through a predefined search space; or we can see it as a set of propositions, some of which conflict and must be resolved. Roughly speaking, the geographic search is driven by academic constraints : which courses the student wants to do, what emphasis is desired on the different subjects studied. The propositions approach is driven by the need to satisfy regulations, as the conflicts are between the current state and the goal.

High vs. Low level : The student's plan is expressed in terms of rather broad subject descriptions - physics, anthropology, not much mathematics, etc. - but the official course must be specified in fine detail paper by paper. The regulations apply paper by paper too. The high level description is important, because it corresponds more nearly to the level on which we discuss course decisions; it's also at this level that we can usefully tallk about relationships between subject areas, which we need to take into account when we suggest changes to existing courses. We "know" things like "Mathematics is a good supporting subject for physics"; "zoology and physics don't mix well"; "a chemist who likes mathematics will tend to do physics; one who doesn't will be more likely to take biological sciences".

> REMARK : *perhaps the difficulty of planning a student's course is related to this difference between the ( high ) level at which the plans are made and the ( low ) level at which they must be satisfied ? Things were easier in the older system where a student just had to take a satisfactory combination of subjects.*

Long-term vs. short-term : The target is a long-term aim, but we can only propose a course, which is at most part of a short-term solution. The course must fit into some plausible longer-term plan which will lead the student to the target, but our real concern is simply this year's course.

Truth maintenance : I originally thought this was the right name for the topic. I had in mind an interpretation of a student's course as a set of propositions - roughly of the form "I will take 07.340" - with the regulations as a set of relationships - like "X takes 340 -> X has passed 210 and 230", "X has 20 stage 3 credits in science subjects", and so on. Then any alteration to a course would affect some of these assertions and relationships, and something like truth maintenance methods, with corequisite and prerequisite regulations as the justifications, could lead to a newly consistent course. ( My ideas were shaped by reading about things like data dependencies, as in "*Artificial Intelligence*" ( E. Charniak and D.V. McDermott, Addison-Wesley 1985 ) p411. ) Now I'm not so sure. My original idea depended on the existence throughout the student's career of a rather specific course plan covering the whole of the student's time from first enrolment to passing the degree. That really doesn't make much sense in terms of the ( quite sensible ) vagueness of many students' plans for future years, and I think that the ideas of goal and target which I "defined" earlier are more realistic.

CONCLUSION ?

We are trying to *guess* at a course which *should* ( if he passes ) lead a student closer to a *goal*, which is one of many corresponding to a *target*, which may change. ( If we can deal with uncertainty at that level, we ought to have no trouble with the straightforward student who wants to do mathematics, computing, physics, and chemistry, and always passes ! Is there any need to think about such easy cases as well ? )

In such circumstances, should we be aiming at what could be called a *robust* solution - one that will need little change in case of examination failures or changes of goal to related areas ? ( There's clearly little we can do in general terms to help students who suddenly want to change from chemistry to mediæval history. )

I don't know whether I've managed to clarify my ideas. If I have, it's by recognising the multi-layered character of the problem, and perhaps in the idea of "robustness".