Software Teaching and Research at the University of Grenoble

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It is convenient to review the structure of the University in relation to the teaching of computing science. The section numbers in the following description refer to the column numbers of Fig. 1.

1. The Polytechnic Institute

The students in the Polytechnic Institute are mathematicians and engineers who enter the University as a result of nation wide examination after two years of preparatory work. In France the most able students go to the first level of engineering schools such as Ecole Polytechnique in Paris. Of the remainder those achieving a given standard enter a second level institute such as that at Grenoble, for which entry is also competitive. Here the first year courses are very general and advanced computing is not introduced until the second year. In the third (final) year specialist courses are given, for example, in system building and compiler construction. In this way early specialisation is avoided. Postgraduate work comes under the jurisdiction of the Faculty of Science. Student numbers are about 60 per year.

In addition to the normal three year course there is a one year special section which provides highly intensive instruction in computing for students from students of other faculties of the University or other Universities. In the special section a selection of the courses from the final two years of normal engineer-mathematician training is offered.

2. The Faculty of Science

In the Faculty of Science the course is basically one of three years which can be followed by postgraduate work. During the first two years there is considerable freedom of choice in combining courses from the different science subjects. Student numbers here are about 1000 per year.

After two years here a student may depart for one year to take up a teacher training course.

A number of students will stay on to do postgraduate work and since their background is not yet adequate for that, one year of study is interposed leading to a Diploma of Advanced Study. This comprises further theoretical and practical work and a dissertation. After this a student may progress to presenting a thesis which leads to something comparable to a Master's degree (Doctorat de specialite). The thesis is presented after one year of research under the guidance of one of the research groups. This in practice is now almost a prerequisite to doing research for a higher degree.

Of the two other doctorate degrees that of Doctor Engineer is between a Master's degree and a Ph.D. It is usually obtained after a further year of work, usually but not necessarily, on the topic started in the previous year. The senior doctorate degree (Doctorat d'Etat) which is necessary to become a professor requires a further two to ten years depending on whether the work is full or part time. The output at the Doctor-Engineer and Docteau d'Etat level is small, perhaps two or three a year; they have spent at least five years at the University and are much in demand.

3. The Institute of Programming

A final important section is the Institute of Programming. It is here that programmers are trained who will do much of the routine work not demanding great sophistication. The students here, about 60 per year, are of very mixed ability; some are students who have failed one of the mandatory subjects for entry to the normal path through the Faculty of Science. The training is basic and very practical - Fortran, Cobol operating system facilities and the like. Students may leave after one or two years. This training provides an access to computing outside the University - it is also the source of supply of trained programmers within the University.

4. The Institute of Technology

At a lower level the Institute of Technology provides similar courses geared to the requirements of the Business School. Great emphasis is laid on Cobol and on small computers. There are 80 students in each year. The course lasts two years.

5. The Evening School

The teaching here extends over six years and covers essentially what is taught in three years of full time work.

6. Refresher Courses

The teaching of refresher courses is at two levels, one for people who left University ten or more years ago and have had no formal training in computing and the other at a higher level for more recent graduates who wish to be brought up to date.

TEACHING STAFF

In view of this rather complex teaching organisation, the teaching staff is very small. Applied Mathematics has not been long established as a university subject in France and it was necessary therefore to introduce computing facilities within the engineerin school as a special purpose laboratory. The regulations permitting the establishment of such laboratories, which are mainly intended for research contract work, require that they be self supporting financially. Consequently there are few permanent posts. Only twenty of the staff of about one hundred at Grenoble are permanent and the teaching devolves mainly upon them; this is in addition to their function of advising and supporting the research work of the laboratory.

THE TEACHING PROGRAM

Only some aspects of this will be touched upon. A fundamental decision was to use Algol as the primary language throughout. The initial problem then is one of teaching Algol to large numbers of students (about 1750 per year currently). Two courses are taught, first an introductory course of two weeks so that the student has some idea of Algol. This is followed by a course on the use of Algol which replaces one which formerly used desk machines. The problems in the course stem from Numerical Analysis. There are six lectures after which the students write their onw programs and attempt to get a program working in three runs on the computer. The teaching staff for these courses consists of one professor, seven assistants (graduate students) and seven monitors (part time). Owing to the numbers, the courses are taught to 60 students at a time. To reduce the machine

time demands programs are vetted by an assistant before submission. Even so, to handle this workload a special compiler was constructed for the 7044. On the 360/67 and 360/40 currently in use a modified version of the OS 360 Algol compiler is used. Further modifications are under way to make the compiler better suited to this kind of work.

In the Polytechnic Institute students learn to handle a small computer, for this purpose a PDP 8 is used. It can be used in a variety of ways, for example when learning about the construction of computers the PDP 8 is used as a typical example for treatment in detail. It has been possible using the twenty typewriter terminals to set up a simple system which makes the PDP 8 available for 20 students at a time. This method is used to introduce assembly code programming although with only twenty terminals and classes of 60 students there are problems in scheduling work and some care is needed in the selection of problems.

At a higher level a simple conversational system was implemented for the PDP 8 - 7044 combination (DIAMAG). The design was a very simple one to teach the students. Unfortunately the 7044 is soon to depart to another University so little return will have been obtained from this system.

Turning now to the more advanced work, in the Engineering School 50% of a student's time in his last year is devoted to a project. The staff of the laboratory draw up a list of projects from which students may choose. The projects are rather time-consuming tasks; a staff member must spend about one week beforehand ensuring that the project is feasible in the time available and typically during the projects, one hour per week and several evenings in the machine room are needed for each project.

A recent project was a multi-pass Algol compiler. Multi-pass simply so that four teams of students could gain experience in synchronising their work in software production and obtain experience of the communication problem which arises.

The difficulties in such a project are similar to those discussed by Professor Freeman, namely, ensuring that if one group fails that their failure does not undermine the work of the others. Fortunately this does not often happen. Then there is the general reluctance of students to undertake a project, on which their degree depends, which is not entirely under their own control. The compiler was to be on the general lines of the GIER compiler but interpretive, the four phases being normaliser, block structure analysis, code generation and interpreter. About a week was spent in writing part of it to ensure feasibility - you need to allow at least ten times longer for the student, who does not know how to do it. To ensure that the groups were not too dependent on one another, the interfaces between the phases were specified. When the parts were completed and put together there were not many problems. The compiler worked, but it is not in use; it needs input/output procedures, extended debugging and a number of finishing touches, perhaps a further six months work which would not have been appropriate in such a project - the students would not have gained much more in doing it. They learnt something of working as a team discussing the project together and working to a fixed timetable.

The most interesting project under way this year is a Mini C.P. system. The idea is to provide paging facilities on a 360/67 for O.S. (MVT). To achieve this only one virtual computer is generated by the system. The drum is devoted exclusively to paging and is the only device allowed for paging. The channel programs are examined for page requirements at Start Input/Output time and pages are fetched from the drum in advance.

Two further problems of interest in the Grenoble installation which may make suitable projects are:

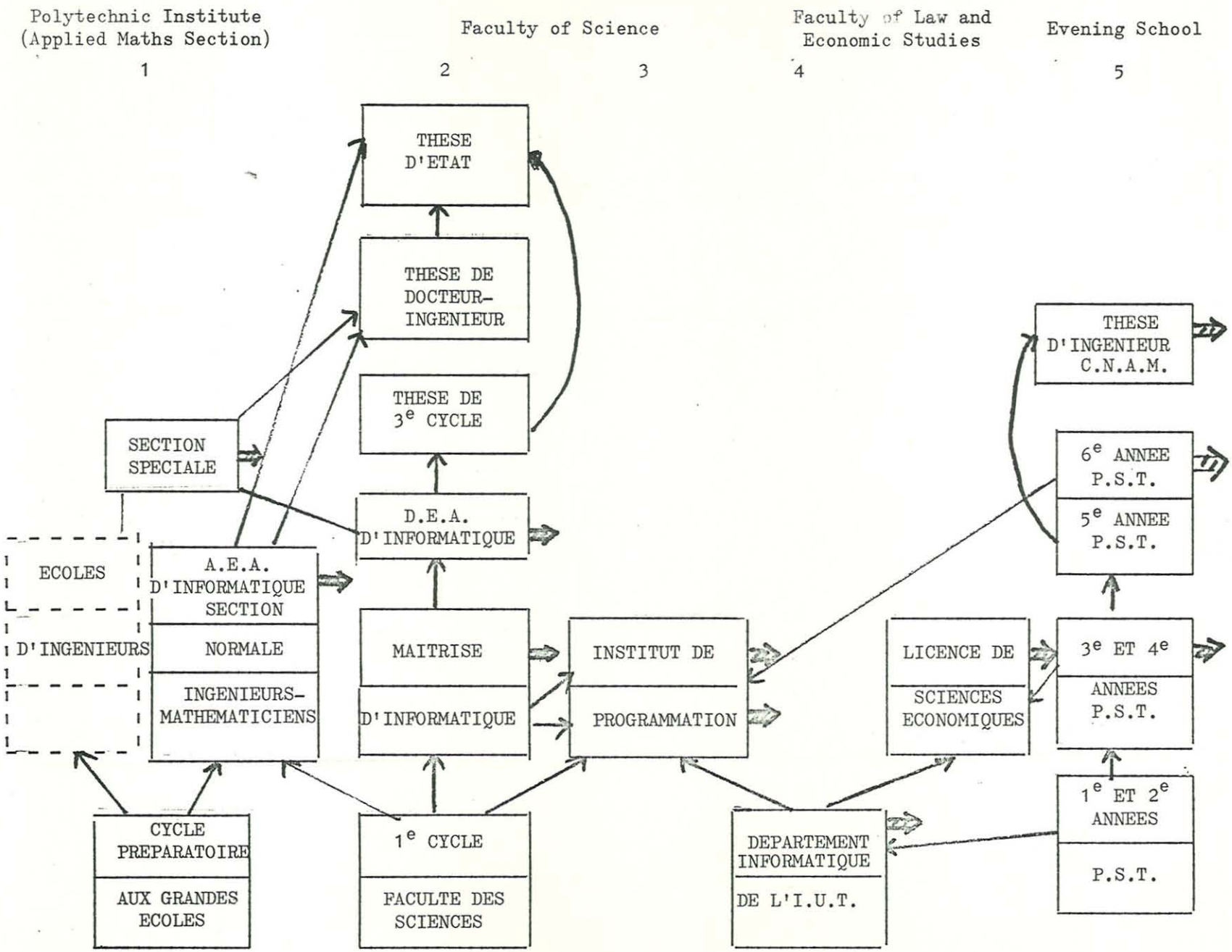
1) devising and implementing a channel to channel method of access whereby the 360/67 can interrogate the 2311 discs on the 360/40

2) implementing a statistics data acquisition system under OS - PCP to obtain guidelines for optimisation.

RESEARCH

Most of the research in software is carried out in conjunction with IBM at the Scientific Centre. The primary emphasis is on implementation of conversational compilers and display systems. More theoretical work, in formal linguistics, is carried out independently by the University staff. Finally, there is an investigation into the particularly challenging problem of how to teach and carry out the construction of guaranteed systems.

Teaching of Computer Science at the University of Grenoble



(⇒ indicates an exit point from the University)

Fig. 1

Courses in 1968/69

Introductory Courses

1. Introduction to Computers and Programming
2. Programming Languages and Systems
3. Algol and Elementary Numerical Analysis
4. Cobol and File Handling

Refresher Courses

5. Syntax Analysis and the Theory of Languages
6. PL1 Programming
7. Conversational Compilers and Interpreters

Advanced Courses

8. Numerical Control Algorithms
9. Computer Aided Design of electronic circuits and systems
10. Design and Use of Operating Systems.