EDUCATION IN DATA BASE MANAGEMENT

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In our educational environment at the University of Toronto we are trying to educate students in four ways. First, prospective data base users get some expertise in what DBMS's are all about and how they can be used. Second, prospective data base administrators acquire some experience in generating data bases and how to administer them properly. Third, prospective DBMS implementors learn how to put the systems together and how to generate application systems on them. Finally, data base thinkers are exposed to the more esoteric aspects of theory of data bases and data base models.

For prospective data base users a course is taught at the fourth-year undergraduate level. The course has been taught for more than five years and it is currently being attended by 150 students per semester. The course is completely packaged and can be taught by many different persons in our institution. The textbook is "Data Base Management Systems" by Tsichritzis and Lochovsky. A set of exercises gives students real hands-on experience in using DBMS. As a training environment we use a DBMS education tool called EDBS which was developed at the University of Toronto. EDBS is available interactively from APL and it supports a hierarchical, a network and a relational interface. In this way, students get a balanced view of different approaches. EDBS is available at nominal cost from CSRG, University of Toronto. Our biggest achievement in terms of educating DBMS prospective users is our ability to run a course for more than 100 students giving all of them some hands-on experience of what DBMS's are all about.

For prospective data base administrators there is no specified course. There is, however, much activity in data base design primarily led by F. Lochovsky. Graduate students who have already attended data base courses work on data base design by constructing realistic tools for capturing data base requirements. In addition, there is much activity in data base performance evaluation primarily led by K. Sevcik. Participating in seminars, experiments and research projects, graduate students learn how to install and analyse data bases. Practical experience relating to real data bases is obtained by working with outside organisations which make available their systems for experimentation with the hope of getting some help in their problems. This aspect of providing practical experience is a major challenge and it can only be obtained effectively outside the University.

For prospective DBMS implementors there is a series of projects which over the years have designed and implemented at least four prototype DBMS's, namely EDBS, ZETA, LSL and MRS. Graduate students

participating in these projects work in teams to implement a realistic system which can later be used for some application. At any moment we actively support only two systems: EDBS, which is a training tool, and the latest developed prototype which at this point is MRS, an LSI-11 based relational system. We are currently introducing this type of implementation experience in our undergraduate courses. A mini/micro lab is being organised which will train undergraduate students in building access methods, file structures and rudimentary DBMS's which can later be used for building application systems, for example, inventory control, accounts payable.

For data base thinkers we are running an advanced graduate course which covers topics in data base management but having nothing to do with their implementation. Under the general topic of data models concepts relating to data bases and their properties are taught including their utilisation in abstracting out real data base problems. The course is being taught from a set of lecture notes by Tsichritzis and Lochovsky which eventually will appear in book form. The emphasis of the course is to point out many unresolved problems in data base theory in which the graduate students can carry out research leading to a Ph.D. thesis.

In summary, our effort is geared to produce ideas and educate persons. Systems are built to test and support ideas. Prototype systems are built to train persons either in building systems or in using them. We export the ideas in terms of papers, books and technical reports. We export the persons in terms of Bachelors, M.Sc. and Ph.D. students. Our prototype systems are available. We do not export them on a large scale, because we do not have adequate marketing and support facilities.