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Establishing A Database Track Within A Computer Information Systems Degree

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ABSTRACT

With a projected 2.26 million additional jobs to fill in various computer fields by the year 2010, there are and will continue to be ample job opportunities in the computer industry. However, the computer field is far too broad for one individual to be an expert in the entire field. Therefore it may be more useful for students to have the opportunity to concentrate their studies in a specific interest area within a broader information technology degree. This paper discusses the creation of a database track within a Computer Information Systems (CIS) degree program so that undergraduate students can choose to focus on this specialty area in their junior and senior years.

WHY THE TRACK SYSTEM STARTED

The Bureau of Labor Statistics reported 2.9 million computer-related jobs in 2000, with an expected 4.89 million computer jobs by the year 2010. Considering new jobs as well as replacements, over 2.26 million additional people will be needed to fill these jobs (Hecker, 2001, p. 9). With these projections, it is not surprising that computer-related degree programs are in high demand. After many years of accepting all qualified students who applied, our CIS program has been forced in recent years to turn away some highly-qualified candidates because our classes are full. In fall 2001 there were 664 students majoring in our program, whereas in earlier years we had stabilized at around 400 students.

For many years, we have offered a general CIS degree program that provides students with a broad background in systems analysis and design, application development and programming, computer networking, and database modeling and programming. Students had a few computer electives that they could use to develop one or more areas of interest. The curriculum was regularly evaluated and updated to respond to current industry needs and trends.

As the program grew, so did interest in specializations within the department. In 1997, our department created a Telecommunications and Networking specialization within the CIS degree. Students could choose between a general CIS degree or the telecommunications option. With the success of the telecommunications option, it was natural to expand the specialization options into the remaining areas of faculty expertise – application development, systems analysis and design, and database management. We felt these areas fit the requirements of our customers in industry who hire our students.

Students also had an interest in these areas, as indicated by our fourth year elective course enrollments (18-25 students). In the Spring 2001 senior-level data warehousing elective, all 18 students indicated an intention to get a database job, while in the Fall 2001 semester, 20 out of 26 students in the DBA course planned to get a job in the database area.

CREATING THE DATABASE TRACK

Need for a Database Track

The same data from the Bureau of Labor Statistics (Hecker, 2001, p. 9) indicates there were 106,000 jobs for database administrators (DBAs) in 2000, with a projected 176,000 openings to fill by the year 2010. In addition to DBAs, there are also database professionals who specialize in database architecture and database programming.

Topics Within the Database Track

During the first two years of our program, all students gain a broad overview of the Information Technology field, taking introductory courses in programming, internet technologies, architectures, telecommunications, database, and systems analysis and design. Students who elect to specialize in the database track can gain additional expertise in:

- Data and Database Analysis: Learn how to study a business area for purposes of developing business requirements and technical design of a subject database.
- Database Implementation: Write queries and programs to implement, populate, and maintain a subject database.
- Data and Database Management: Study the planning and management of the enterprise data resource, and install and support a distributed, relational database management system.
- Data Warehousing: Explore how to plan, design, and implement an informational data warehouse, or data mart, which extracts data and information from enterprise resources for the purpose of supporting the enterprise decision-making process.

Courses in the Database Track

Students specializing in the database area must complete 50 hours of computer-related courses, with 18 to 24 of these focusing specifically on database topics. Figure 1 shows the progression of database courses for a database-track student. A brief description of these database courses follows:

***Introduction to Application Development (all students)*:** Introduces the development of information systems through the use of a database. Topics include business information systems, system and application development, database management systems, problem solving, logic, data types, and programming using database technology. Given a database design and application requirements, students design, construct, and test a personal computer information system.

Database Fundamentals (all students): Looks at relational database concepts, including data design, modeling and normalization. Students use SQL to query, define, populate and test a database. Expands on previous courses by accessing databases from programs and the web, and discusses practical issues that database developers must handle.

Database Development: Explores some of the programmatic extensions to SQL supported by leading Relational Database Management Systems (RDBMS) vendors. Topics include stored procedure and trigger design and implementation; query optimization to enhance performance and data transformation to enhance interoperability of data.

Database Design and Implementation: Deals with advanced design techniques and physical issues relating to enterprise-wide databases. Topics include advanced normalization, data distribution, distributed database design and replication, storage estimation and allocation, usage analysis, partitioning of very large tables, metadata analysis, data conversion, and load techniques.

Database Administration: Explores tools and techniques for managing an organization's database technology. Topics include database

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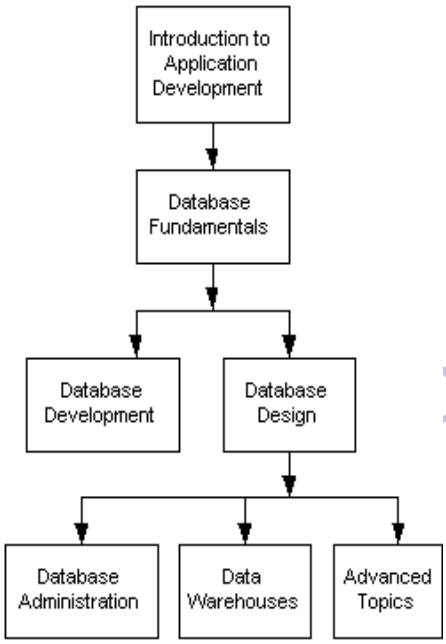
Figure 1: Database track



architecture, database technology installation, database creation and maintenance, RDBMS operations and troubleshooting, and database performance tuning.

Data Warehousing: Studies the design and implementation of data warehouses (including data marts and operational data stores) using current database technologies. Topics include data modeling for warehouses, data warehousing infrastructure and tool selection, data exploration, data synthesis and reduction, organizational metadata, and data warehouse administration.

***Advanced Topics in Database Technology*:** Explores contemporary issues in the database arena. These issues may be related to new or breakthrough concepts, technologies, or techniques.

Other Computer Courses Taken by Students in the Database Track

Because databases are used in large application development projects, students in the database track must also take courses in Requirements Discovery and Modeling, and Project Management. Additionally, they can choose two additional courses in programming, e-commerce and/or software development methodologies. These courses emphasize the interactions that database personnel have within an organization. The graduating database student who can communicate effectively with all levels of personnel involved with a project will be a valuable employee. In addition, the student has more flexibility to pursue positions in smaller organizations where they may have to perform multiple roles.

FACILITIES

The department has been successful in maintaining up-to-date software and hardware due to generous grants and donations from several companies, and by taking advantage of educational programs offered by many companies. Students have access to multiple database servers. Dual-screen monitors in one lab facilitate courses in database programming and administration. Students can readily view their code, data, data model and results simultaneously.

VMware is a newly-acquired tool that promises many benefits, particularly in the database administration course, where students can administer their database inside a virtual computer. This course requires that each student have administrative rights, which our networking personnel are reluctant to give to students. This obstacle is removed with the use of VMware, since having administrative rights in the virtual machine does not transfer onto the school's network.

FACULTY

The mission of our department is to provide the highest quality of information systems and information technology education to prepare practitioners for careers in the application of information systems and technology. Our faculty are hired on the basis of their industrial experience as well as their academic credentials. Faculty members are not required to hold a doctorate degree; however, a masters degree plus three to five years of industrial experience is typically expected of all faculty. Presently there are 2.5 faculty members and an Instructional Specialist (lecturer) supporting the database courses. They have spent time on projects and achieved various certifications and recognitions. Their experience covers the majority of topical areas in the database industry, from developing and deploying applications ranging from personal databases through large-scale, n-tier distributed systems and multi-terabyte data warehouses.

INDUSTRIAL ADVISORY BOARD

Currently the department has two Industrial Advisory Boards, one for the general CIS degree and one for the telecommunications specialization. The advisory boards are composed of leading information professionals from well-known companies with large IT or networking departments. These are also the employers of many of our graduates. The chosen representatives are in positions in which they are monitoring the marketplace and helping make decisions about future directions for their companies. This puts them in a unique position to help guide us on the employee skills they will need in the

Table 1: Comparison of model curricula to database track courses

IM Knowledge Areas	DB Track
IM1: Information Models and Systems (core)	In 1st year course
IM2: Database Systems (core)	In 1st year course
IM3: Data Modeling (core)	2nd year: Database Fundamentals 3rd year: Database Design
IM4: Relational Databases (elective)	2nd year: Database Fundamentals 3rd year: Database Design
IM5: Database Query Languages (elective)	2nd year: Database Fundamentals (not OO queries)
IM6: Relational Databases Design (elective)	2nd year: Database Fundamentals 3rd year: Database Design
IM7: Transaction Processing (elective)	2nd year: Database Fundamentals 3rd year: Database Development
IM8: Distributed Databases (elective)	3rd year: Database Design 4th year Data Warehousing
IM9: Physical Database Design (elective)	3rd year: Database Design
IM10: Data Mining (elective)	4th year Data Warehousing
IM11: Information Storage and Retrieval (elective)	4th year Data Warehousing (partial)
IM12: Hypertext and Hypermedia (elective)	Candidate for 4th year Adv Topics
IM13 Multimedia Information and Systems (elective)	Candidate for 4th year Adv Topics
IM14: Digital Libraries (elective)	Candidate for 4th year Adv Topics

future. Their suggestions are always carefully considered, and often incorporated into new courses and curricula. The goal is for each board to meet on a regular basis at one to two year intervals to provide this valuable feedback. The advisory board for the general CIS degree met in the past year to review and critique the proposed tracks. They were quite supportive of this new curriculum and were anxious to recruit our graduates. In fact they challenged us to implement the new curriculum in less than the typical 4-year window of a new curriculum.

MODEL CURRICULA

The IEEE and the ACM created a joint task force to update the 1991 curriculum recommendations. The most recent report, available at the ACM website, identifies Information Management (IM) as a knowledge area within their Computing Curricula 2001. The IM area of knowledge includes fourteen components. Three are considered core, and eleven are viewed as electives. The courses in our database track provide significant coverage of the IM areas identified. Additionally, we provide the Database Administration course that is beyond the model. Table 1 shows the mapping from the IM components to our DB-track courses.

FUTURE DIRECTIONS

The new curriculum implementing the track concept started in Fall 2001. In Spring 2003 the current Freshmen will be required to select their track of interest. At that time, we will monitor the demand for this track. Additionally, our young Masters program has proven to be quite popular. Database courses that advance and complement the undergraduate course offerings must also be identified and implemented.

REFERENCES

Hecker, D., (2001, November). Monthly Labor Review. *Occupational employment projections to 2010*. Retrieved January 6, 2002, from http://www.bls.gov/opub/mlr/2001/11/art4full.pdf

Joint Computer Society of IEEE and Association for Computing Machinery. (2001, August 1). *Computing Curricula 2001 – Steelman Draft (August 1, 2001)*. Retrieved January 6, 2002, from http://www.acm.org/sigcse/cc2001/steelman/