CS240 – Database Management

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SECTIONS MEET IN MACK 405

§A 09:00:09-13:49:57 §B 10:00:03-10:49:57 §C 11:00:03-11:49:57

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1 Course Description

A study of the concepts and structures necessary to design and implement a database management system. Various data models will be examined and related to specific examples of database management systems including Structured Query Language (SQL). Techniques of system design, system implementation, data security, performance, and usability will be examined. Prerequisite: C or higher in CS140.

2 Course Objectives

By the end of this course, students will be able to

- Define the term *database management system (DBMS)* and describe the functions of a DBMS
- Define the term *database* and describe what is contained within the database
- Define the term *metadata* and provide examples of metadata
- At a management level, describe database design from existing data, as new systems development and in database redesign
- Discuss at a management level the history and development of database processing
- Use Microsoft Access 2013 or MySQL 5.6 for simple database applications
- Use basic relational terminology, describe the characteristics of relations, identify functional dependencies, determinants, and dependent attributes, identify primary, candidate, and composite keys, identify possible insertion, deletion, and update anomalies in a relation, and normalize data tables
- Judge intelligently when to denormalize a database design
- Recognize and be able to correct common design problems such as the multivalue, multicolumn problem, the inconsistent-values problem, the missing-values problem and the general-purpose remarks column problem
- Use SQL queries to manipulate data in databases
- Apply a spiral approach to database design
- Use a consistent, generic Information Engineering Crow's Foot entity-relationship diagram notation for data modeling and database design
- Choose when and how to apply ID-dependent and other weak entities, supertype/subtype entities, strong-entity patterns, ID-dependent association pattern, the ID-dependent multivalued-attribute pattern, the ID-dependent archetype/instance pattern, the line-item pattern, the for-use-by pattern and recursive patterns
- Transform data models into database designs using primary keys, surrogate keys, referential integrity constraints, and tables representing weak entities, supertypes/subtypes, recursive relationships, and ternary relationships

- Implement referential-integrity actions required by minimum cardinalities
- Describe the role of database administration, concurrency control, security, and backup and recovery
- Use appropriate terminology and methods for concurrency control including optimistic and pessimistic locking, ANSI isolation levels, and rollback vs roll-forward recovery
- Describe at a management level the critical functions and considerations for DB-driven Web servers
- Discuss non-SQL databases used in data warehouses for big-data analysis and business-intelligence systems

3 Course Times & Locations

Mondays, Wednesdays & Fridays in MACK 405 and using NUoodle. *Students may come to any of these sections at will as long as they attend at least one of the sessions each day.* The sign-in sheet has everyone's name listed.

§A 09:00:03-09:49:57
§B 10:00:03-10:49:57
§C 11:00:03-11:49:57

4 Required Text

Kroenke, D. M. & D. J. Auer (2014). *Database Processing: Fundamentals, Design, and Implementation (13th Edition).* Prentice Hall (ISBN 978-0133058352). xxxii + 608 pp. AMAZON http://www.amazon.com/Database-Processing-Fundamentals-Implementation-Edition/dp/0133058352

5 Methods of Assessment

All assignments and exams are submitted using NUoodle. Deadlines for each assignment are posted in NUoodle and on the class syllabus. Generally, students have 14 days (Monday of the current week to Sunday of the following week) to complete the quizzes and assignments. Some exams and the term project have longer periods of accessibility.

Responding punctually to professional responsibilities is part of the maturation of students. To encourage promptness, late submissions for any of the assignments and quizzes are blocked and will result in **zero grades**.

There will be no grading on a curve. There are no predetermined numbers of A, B and other grades – which means everyone can get an A ☺ (or everyone can fail ☹). The instructor keeps meticulous records of all student submissions; NUoodle keeps detailed records of all student interactions with the learning platform (including viewing documents and assignments, taking and completing evaluations, and submitting assignments).

5.1 Weekly Homework: 40% of final grade

Students will respond in writing to specific assignments issued weekly for deepening competence in applying the principles discussed in the text and in class. Assignments are uploaded using the NUoodle facilities.

5.2 Term Project: 10% of final grade

Working in randomly-assigned teams of three (or two if necessary), students will design, create, test, document and demonstrate a database project during the semester.

The Project will be assigned 10% of the final grade and will be a simple database demonstrating normalized design, correct implementation in MS-Access, effective queries, and appropriate reports. Topic areas are suggested online. The project will be due by the end of Week 13. Projects will be discussed in class in Week 14 and posted online for all students to examine and learn from.

5.3 Multiple-Choice Quizzes & Exams: 50% of the final grade

Multiple-choice quizzes and exams have two minutes allocated per question. They generally have 15 to 30 questions.

5.3.1 Weekly Quizzes: 25% of final grade

Students will complete an open-book quiz after the week's work; deadline 23:55 of the second Sunday after the start of the material.

5.3.2 Mid-term Exam: 10% of final grade

Before the mid-point of the course defined by the Registrar's schedule for submission of mid-term grades, students will complete an open-book exam on all the material in the course assigned two weeks before the exam deadline. The mid-term exam usually has 90-120 questions.

5.3.3 Final Exam: 15% of final grade

At the end of the course students will complete an open-book exam on all the material in the course. The final exam will be posted at least two weeks before the end of the course and the deadline will be defined by the Registrar. **The Registrar's deadline is *not set to 23:55* and students must check carefully when planning their time.** The final exam usually has 90-120 questions.

5.3.4 AAC-versions of quizzes and exams

Every quiz and exam has versions to support students registered with the Academic Achievement Center. The AAC versions all use the suffix *a* to distinguish them; e.g., *q01* would have an AAC version named *q01a*. All *a* versions of quizzes and exams are identical to the standard version but have twice the allotted time. E.g., if *q01* were to have 20 questions and a time limit of 40 minutes, *q01a* would have exactly the same questions but would allow up to 80 minutes for completion. AAC-authorized students should ask the instructor for the password for AAC materials in the course.

5.3.5 Replacement quizzes and exams: replacement of lower score for each element

For students who have experienced difficulties in their weekly quizzes, midterm exam or final exam, there are opportunities to improve their specific grades by replacing a lower exam grade by a higher. Grades cannot be lowered by taking a make-up exam. Make-up exams are designed with *one* minute per question; thus if there were 30 questions in *q01* (with up to 60 minutes to complete them all), *q01r* might have 40 questions to complete in at most 40 minutes. The AAC version of *q01r* would be *q01ra*.

6 Extra-credit Work

6.1 Written submissions

Students may submit extra *written* reports not included in the textbook; e.g., analyses of real-world data or discussions of interesting articles involving database applications or interesting database applications. Good submissions will be posted for other students to read. These extra reports contribute points to the final-grade score and can compensate for less-than-perfect grades on required assignments, quizzes and exams. They are intended to encourage students to explore real-world reports and to strengthen their motivation and knowledge of database theory and applications.

- There is no limit to the word-count other than noting that even a perfect score on a paper with more than 5,000 words would generate no more than 10 final-grade points.
- The point-score is calculated using a ratio of up to *1* extra final-grade percentage point per *500 words* (not counting title page, tables and figures) on essays. Students may write less than 500 words in a submission,

receiving partial credit (e.g., 100 words could net up to 0.2 points on the final score) – which could, for instance, make the difference between an A- and an A grade).

- The maximum number of extra homework points achievable to increase the final grade percentage points in this way is 10% in all per semester. Thus a student with 84.5% who wrote 6,000 words of acceptable extra-credit assignments would receive a grade of 94.5% at the end of the course.

6.2 Extra-credit quizzes & homework

Opportunities for earning additional credits in the quiz and homework categories are offered throughout the course and clearly defined in the NUoodle classroom. Extra points are added to the appropriate total and are not limited.

7 Cheating and Plagiarism

- Students are graded on an individual basis and must therefore complete their own work. However, projects #1 & #2 are to be completed in teams and the collaborators must pool their work; all members of a specific team will receive the same grade.
- Although students are encouraged to collaborate in homework problems, every student must prepare and submit their own individual responses, not merely copy/paste someone else's.
- There is to be no collaboration on quizzes and exams.
- Students are reminded of the University's Policy against cheating and plagiarism (Chapter 2, Section V of the *Student Rules*): < http://www.norwich.edu/about/policy/StudentRulesRegs.pdf >.
    - Plagiarism consists of using someone else's text or ideas without using quotation marks to indicate exact duplication of the original and/or failing to indicate the source of reference materials and quotations.
    - If in doubt as to what constitutes plagiarism, ask the instructor for a review of your work before submitting an assignment.
- All instances of cheating and of plagiarism must be reported to the *Academic Integrity Committee* by the instructor or by students who have observed the dishonesty. Penalties include expulsion from the University.
- **Ignorance of the University's Rules is not a valid defense against accusations of academic dishonesty.**

8 Copyright Violations

- No materials from this course, including textbook exercises and files, quizzes, and exams, may be distributed to any Web-based site.
- Any violation of this restriction may result in charges before the Academic Integrity Committee and legal prosecution by state and federal authorities.
- In particular, any student found to be contributing pirated materials to plagiarism sites such as *CourseHero* may be prosecuted the full extent of the University regulations and of the laws of the United States, including civil lawsuits for copyright violation.

9 Additional Notes

- University regulations stipulate that "Unless stated otherwise, the maximum number of all permitted absences is twice the number of times the course meets per week. That's six unexcused absences as the maximum for this course.
- The seventh unexcused absence leads to removal from the course with an F grade.
- See < http://catalog.norwich.edu/residentialprogramscatalog/academicregulations/sectionviiclassroomprocedures/ > for complete details of the attendance regulations of the University.

- If you plan to be absent for an approved purpose, discuss the absence with the instructor in advance.
- Always explain a previous absence using the space available on the daily sign-in sheets. The instructor does NOT want to expel you!

10 Coordination with AAC

- The instructor routinely and willingly provides reasonable accommodations for students with documented disabilities on an individualized and flexible basis.
- For any student with a documented disability, the University's *Academic Achievement Center* (AAC) determines appropriate accommodations through consultation with each student.
- To receive accommodations in this or any other class, affected students need to make an appointment with the AAC, located on the 4th Floor of the Kreitzberg Library (phone ext. 2130).
- AAC will work with students to determine eligibility for services and, if appropriate, will provide an Educational Profile for each student to bring to their instructors.
- After making arrangements with the AAC, students should arrange a meeting with the instructor to discuss accommodations in this course.
- In keeping with the University's policy of providing equal access for students with disabilities, any student with a disability who needs academic accommodations is welcome to meet with the instructor privately. All conversations will be kept confidential (for example, the instructor's office door may be closed at the student's request).
- The instructor is willing to review the Profile with the student and to discuss accommodations in relation to this course.

11 Office Hours & Contact Information

- Office hours are posted online < http://www.mekabay.com/current_schedule.jpg > and on the instructor's office door in Mack 423.
- Students are welcome to drop in without an appointment. The usual greeting is, "Hi! What can I do for you?" Like other professors in our School, the instructor, with his many years in industry, considers students his *clients*.
- Students are also welcome to call the instructor at (802) 479-7937 at any time (that number rings in his office or his cell phone but cannot disturb him at home); leave a voice-mail message with a return number if necessary. SMS (text) messages are also acceptable at (802) 479-7937.
- Students may also use Skype (mekabay) or Facebook Messaging (Mich Kabay) any time.
- Email should be addressed only to the NU address < mkabay@norwich.edu > to respect FERPA.Students should put the string *CS240* in the subject line of email and in the first Skype message of a conversation for easier identification so the instructor (whose memory is getting worse every year) doesn't have to look up what class they are referring to.

ADDITIONAL NOTES

You are not required to read the biographical details on the next page. You will never be tested, interrogated, or subject to the Comfy Chair of the Spanish Inquisition (see Python, M.) about this information.

These notes are available for any students who are curious about their instructor's professional background.

For more details about his career, read "On a Life of Teaching: Reflections on five decades of helping people learn."

< http://www.mekabay.com/opinion/teaching.pdf >

***Students may (or may not) enjoy exploring his publications, other course materials, and commie-pinko-radical opinion pieces on his Website,* < http://www.mekabay.com > and his Facebook page (Mich Kabay). To protect student privacy, Prof Kabay *unfollows* student pages until after thee students graduate.**

12 More Than You Need (or May Want) to Know About Prof Kabay

M. E. Kabay began teaching his high school classmates how to use the slide rule in 1963 (NOT the best way to be popular). He was also a math tutor for seniors having trouble with matriculation exams in high school. He began programming IBM 1401 computers in assembly language in 1965 and tutored students in FORTRAN IV G when he was a freshman at McGill University.

He studied molecular genetics at McGill (BSc 1970). His MSc from McGill (1972) consisted of extensive statistical analysis of data on embryological development in mice.

In 1976, he completed his PhD from Dartmouth College in applied statistics and invertebrate zoology (he studied rotifer developmental responses to environmental factors). He also listened to Monty Python recordings for four years and consequently has many of their skits burned into his neuronal engrams.

He began teaching applied statistics at Dartmouth College in 1975 in a course for Biology graduate students. He taught applied statistics and programming at the Université du Rwanda in Africa from 1976 through 1978 and at Université de Moncton in 1978-79, and eventually served as adjunct faculty in the John Abbot College *Programmers' Course* and their *Technical Support Program*, the University of Ottawa *Institute for Government Informatics Professionals*, and the McGill University *Management Institute* before joining Norwich University.

In 1979, he joined a compiler team as a programmer for a new compiler and relational database language in the U.S. and then joined Hewlett-Packard Canada in 1980 as an operating-systems and database- performance specialist, winning the *Systems Engineer of the Year* Award in 1982 and teaching MPE operating system, IMAGE/3000 database and VPLUS/3000 GUI-design courses as well as serving as support engineer to HP's hospital and university customers and managing HP's bilingual call center *(Phone-In Consulting Service)* for Québec and the Maritime provinces.

He served as Director of Education for the National Computer Security Association (NCSA, later ICSA and then TruSecure) from 1991 to 1999 and then worked with Adario/AtomicTangerine where he supported the *International Institute for Information Integrity*® (I-4®). He collaborated in the committees defining the *Common Body of Knowledge* for the *Certified Information Systems Security Professional* (CISSP) designation in the mid-1990s and earned his CISSP in 1997.

Since 1986, he has published over 2,000 articles in operations management and security, written a college textbook on enterprise security (McGraw-Hill, 1996), and served as Technical Editor of the 4th (2002), 5th (2009) and 6th (2014) editions of the *Computer Security Handbook* (Wiley). He wrote two security-management columns a week distributed by *Network World* < http://www.mekabay.com/nwss/ >from February 2000 to September 2011 and one per week for *InfoSec Perception* < http://www.mekabay.com/perception/ > from October 2011 to the end of 2013. His Website has a total of over 2,000 PDF files and over 250 PowerPoint files freely available to anyone.

He has been an invited lecturer at the United States War College, the Pentagon, NATO HQ in Brussels, and at NATO Counterintelligence training in Germany. He was inducted into the Information Systems Security Association (ISSA) *Hall of Fame* in December 2004 and earned his *Information Systems Security Management Professional* (ISSMP) designation in November 2005.

From 2002 to 2009, he was the creator and Director of the *Master's Program in Information Assurance* (MSIA) in the College of Graduate and Continuing Studies (CGCS) at Norwich University, Northfield, Vermont where he was also the Chief Technical Officer of the CGCS from 2007 to 2009. Returning to the School of Business & Management in 2009, he was promoted to Professor of Computer Information Systems in May 2011 and was appointed Associate Director of the Norwich University Center for Advanced Computing and Digital Forensics from July 2011 to June 2015.

His LinkedIn page is < http://www.linkedin.com/mkabay/ >, kis Website is < http://www.mekabay.com > and his Facebook page is for "Mich Kabay."

Students are welcome to *friend* him on Facebook (but to protect their privacy, he generally does not follow students until after they graduate) for a stream of links to interesting information security and high-technology articles (mostly from *The Guardian, BBC News, National Public Radio, Science News, Washington Post*) with occasional forays into politics (with strict rules for civility), culture, science, funny cartoons, pictures of cute animals, and horrible puns.

He is looking forward to retiring on 30 June 2021 so he can write six novels about the Parkerian Hexad, give concerts of Mahler song-cycles as a bass-baritone soloist, read stories and poems for audiences at public libraries, and generally have a good time not grading anything!