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CSCI 4333.1
Design of Database Systems
Fall 2015

by K. Yue

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1. General Information

CSCI 4333.1 Class number: 22387 Monday 4:00-6:50pm **Delta 242**

1.1 Instructor

Dr. Kwok-Bun Yue, Professor of Computer Science and Computer Information Systems
Delta 163, 281-283-3864, yue at uhcl.edu; URL: http://dcm.uhcl.edu/yue/
Office hour: M 3-4, T 4:30-6, W 4-6, walk-in or appointment.

1.2 Teaching Assistant

To be determined

1.3 UHCL Quality Enhancement Plan (QEP) Motto: Applied Critical Thinking (ACT) for Lifelong Learning and Adaptability

This course has been authorized by UHCL as an Applied Critical Thinking (ACT) Course which means that in addition to learning about the specified course content, students will be engaged with some or all of the *Elements of Thought* and Universal Intellectual *Standards of critical thinking*. The objective of an ACT course is to develop the student's ability to become skilled at analysis and evaluation by applying a set of intellectual tools that may be effectively used across all disciplines (as well as to the student's personal life). Based on the Foundation for Critical Thinking model (http://www.criticalthinking.org/), critical thinking involves thinking for a *purpose*, *asking* questions, using i*nformation*, applying *concepts*, drawing *inferences* and *conclusions*, identifying *assumptions*, anticipating *implications* and *consequences*, and recognizing *points of view*. The Universal Intellectual Standards that are applied to these *Elements of Thought* of critical thinking in order to develop *Intellectual Traits* include *clarity, accuracy, precision, relevance, depth, breadth, logic, significance, and fairness*.

Critical Thinking In Computer Science in General and Design of Database Systems in Particular

Computer science is the scientific and practical study of computation and its applications. Its scope is well agreed upon. For example, in Wikipedia, it is "the systematic study of the feasibility, structure, expression, and mechanization of the methodical procedures (or algorithms) that underlie the acquisition, representation, processing, storage, communication of, and access to *information*." A thorough understanding and precise specification of the *problem* domain through modeling, with a clear understanding of all underlying *assumptions*, is a prerequisite for effectively using computer science to construct a computer-based *solution*. All elements of thought of critical thinking are essential in every step of the elaboration and modeling of the problem, and design, implementation, and maintenance of a computer-based solution.

In particular, *information* is usually stored permanently in database. In the design of database systems, critical thinking is integrated in the process. Database designers use principles of data modeling to thoroughly understand and specify the *problem*. *Concepts* of normalization theory and data manipulation are applied to *infer* and construct suitable logical design *solution*s. The *implications and consequences* of the design are realized through the effective uses of query languages. The *central question* in the design of database systems is how to store and retrieve permanent data effectively.

Fundamental and Powerful Concepts (FPC) of the Course

In ACT vocabulary, fundamental and powerful concepts form the foundation that permeates and unites a course. In this course, these concepts are:

1. *Data modeling* for thoroughly understanding and precisely specifying problem requirements, assumptions, and

constraints.
2. *Database design* for constructing database solution to satisfy the data model.
3. *Data manipulation* for updating and accessing information stored in the database solutions.

Please see Section 5 below for more details.

1.4 Laboratory Administrations

You may address account and software problems of the DCM server to the systems administrator, Ms. Krishani Abeysekera.

1.5 Other Useful Information

- UHCL emergency hot line (to check weather related closing, for example): 281-283-2221.

1.6 Textbooks

Ricardo., Katherine (2011) *Databases Illuminated*, 2nd Edition, Jones & Bartlett, Mississauga, Ontario, Canada.

1.7 Course Description

From Catalog: Prerequisite: CSCI 3333. Design of database systems, data description and manipulation languages, data models, entity-relationship model, relational model, SQL, relational algebra, normalization theory, DBMS, Internet, data base design, data flow diagrams and implementation of data base systems. Laboratory instruction.

1.8 Student Learning Outcomes (SLO)

After completing the course, the students are expected to be able to

1. Describe the stages of database design, various database architectures and data models.
2. Explain the concept of entity-relationship model, and relational model.
3. Explain the theoretical background of relational database: relational algebra and relational calculus.
4. Implement relational database systems using DBMS, SQL, including both data description and manipulation languages.
5. Explain the importance of normalization of databases, and convert a given relational database into different normal forms.

SLO #1, #2 and #4 are selected and restated using the vocabularies of Applied Critical Thinking (*ACT SLO*):

1. Describe the stages of database design, various database architectures and data models. *Clearly* elaborate the these fundamental relational database *concepts*.
2. Explain the concept of entity-relationship (ER) model, and relational model. *A*pply ER modeling *concepts* to *precisely* capture *problem* requirements.
3. Implement relational database systems using DBMS, SQL, including both data description and manipulation languages. Construct *accurate* SQL *solutions* to business queries.

Note: The italicized portion of the SLOs are related to critical thinking. These ACT SLOs will be assessed. Please see Section 5 for more details.

1.9 Prerequisites

The following courses or their equivalent are required:

- CSCI 3333 Data Structures

Languages: The course uses SQL and a high level language. No prior SQL language knowledge is assumed.

1.10 Course Format

Traditional lectures, homework and programming assignments.

2. Course Policies and Guidelines

2.1 General Policies

1. Classroom conduct:
   - You are encouraged to ask a lot of questions in the classroom. Active participation is an essential component in any kind of learning.
   - Be polite to your classmates. Please do not chat with your neighbors during classes.
   - Mobile phones and pagers should be turned off during classes.

- If you must multi-task, keep it quiet.
2. Assignments:
   - Assignments are due at the beginning of classes. No exception. Assignments turned in after the beginning of classes will be considered as late.
   - Late assignments are accepted with a penalty of *20% deduction* per week day after the due date. No late assignment will be accepted one week after the due date. The last assignment cannot be late.
   - Make sure that you follow the submission guidelines for programming assignments. Failure to do so will result in assignments not graded.
   - For consistency, if you have a dispute in homework or project grading, discuss it with the TA first.
3. Course management:
   - This is a Web-assisted course with no paper class notes. However, this course does not use Blackboard of UHCL.
   - You are encouraged to communicate with me using email. However, I do not respond to anonymous email.
4. Examinations:
   - No make-up exam except in *verified emergencies with immediate notification*.
5. Others:
   - No incomplete grade or administrative withdrawal under nearly all situations.
   - UHCL Information about withdrawals, appeals, GPA, repeated courses, the 6 drop rule, etc. can be found in the general program requirement section: http://www.uhcl.edu/XDR/Render/catalog/archives/125/06/%23A0110.
   - Students with disabilities and/or special requirements should discuss their needs with the instructor as soon as possible. See UHCL Disability Service.

Tips:

1. Check the course Web page regularly. Check the course Website frequently and read the class lectures beforehand.
2. I check email frequently during the week days. Be sure to write a good subject heading for your email so my email filter won't consider it junk and I can relate to it quickly. Check notes on managing email.
3. If you have problems with your accounts, you may want to contact the systems administrator directly by sending them an email and copying it to me. However, do not ask her questions about your homework. Instead, ask me.
4. Software development is *time consuming*. Start early and plan well ahead. Ask a lot of questions.
5. Procrastination usually results in poor grades.
6. If you expect any potential problems, consult me as soon as possible so I may help you.
7. Assignments and examinations will be thrown away one month after the final examination week. Be sure to claim them on time.

2.2 Attendance

Students are expected to attend class regularly and actively participate in classroom discussions.

2.3 Academic Honesty

Penalty on cheating will be *extremely severe*. Standard academic honesty procedure will be *strictly followed*. Use your best judgment. If you are not sure about certain activities, consult the instructor. See:
http://prtl.uhcl.edu/portal/page/portal/PRV/FORMS_POLICY_PROCEDURES/STUDENT_POLICIES/Academic_Honesty_Policy

The UHCL Academic Honesty Policy will be strictly adhered to. The honesty code section state:

The Honesty Code is the university community's standard of honesty and is endorsed by all members of the University of Houston-Clear Lake academic community. It is an essential element of the University's academic credibility. It states:

I will be honest in all my academic activities and will not tolerate dishonesty.

Academic honesty is integral to university education. Students are advised to thoroughly understand UHCL academic honesty policy.

2.4 Academic Adjustment Policy

The University of Houston System complies with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, pertaining to the provision of reasonable academic adjustments/auxiliary aids for students with a disability. In accordance with Section 504 and ADA guidelines, each University within the System strives to provide reasonable academic adjustments/auxiliary aids to students who request and require them. If you believe that you have a disability requiring an academic adjustments/auxiliary aid, please contact your University's student disability services center.

2.5 Assessment for Accreditation

The School of Science and Computer Engineering may use assessment tools in this course and other courses for curriculum evaluation. Educational assessment is defined as the systematic collection, interpretation, and use of

information about student characteristics, educational environments, learning outcomes, and client satisfaction to improve program effectiveness, student performance, and professional success. This assessment will be related to the learning objectives for each course and individual student performance will be disaggregated relative to these objectives. This disaggregated analysis will not impact student grades, but will provide faculty with detailed information that will be used to improve courses, curriculum, and student performance.

3. Grading Policy

Grades will be assigned based *solely* on homework and examination scores. *No other factors will be considered.* In particular, students have requested me to reconsider their grades using the following reasons in the past:

- Expected a higher grade
- Good course participation
- Good improvement during the semester
- Have put in extra efforts
- Need to avoid probation
- Financial needs
- Loss of scholarship
- Loss of job opportunity
- Loss of practical training opportunity
- Need to graduate
- Company relocation
- Immigration status needs
- Family needs
- Sickness during the semester
- and many other.

These requests had all been declined politely but firmly.

There will also be *no* 'special project' that you can work on to improve your grades after the final examination. Anything I offer to one student will be offered to the entire class.

Total score is computed using the following percentages:

Homework: 30%
Mid-Term Exam: 35%
Final Exam: 35%

Last Day to Drop/Withdraw: *November 10, 2014*

Grade Assignment Table

[92..100]	A
[90..92)	A-
[87..90)	B+
[83..87)	B
[80..83)	B-
[77..80)	C+
[73..77)	C
[70..73)	C-
[67..70)	D+
[63..67)	D
[60..63)	D-
[0..60)	F

4. Course Syllabus and Schedule

The syllabus is *tentative*. Actual contents and order of coverage may change. There will be around 9 homework assignments, the actual number is subjected to changes.

Date	Contents	Comments
Week #1: 8/24	Introduction and overview of database systems	Read Ricardo Chapter 1

Week #2: 8/31	An introduction to the relational database model An introduction to simple SQL and Oracle	Read Ricardo 4.1, 4.2.1, 5.1, 5.2, 5.4.1 and 5.4.2
Week #3: 9/7	Labor day	
Week #4: 9/14	Database planning and stages The relational database model	Read Ricardo Chapter 2, 4.2
Week #5: 9/21	An introduction to data model The Entity-Relationship model	Read Ricardo Chapter 3
Week #6: 9/28	The Enhanced ER model Conversion of the ER model to relational schema	Read Ricardo 4.7, 8.1 to 8.6
Week #7: 10/5	Relational algebra and the Tuple-Oriented Relational Calculus	Read Ricardo 4.5
Week #8: 10/12	SQL	Read Ricardo 5.3 to 5.4
Week #9: 10/19	Mid-term examination	
Week #10: 10/26	Advanced SQL and transaction management	Read Ricardo 5.6, 5.7, 10.1, 10.2
Week #11: 11/2	SQL Programming	Read Ricardo 5.5, 5.7, 5.8
Week #12: 11/9	Normal theory and normal forms	Read Ricardo Chapter 6
Week #13:11/16	Databases and the Internet	Read Ricardo Chapter 13
Week #14: 11/23	Advanced topics: to be determined.	
Week #15: 11/30	Advanced topics: to be determined.	
Week #16: 12/7	Final Examination	

5. Applied Critical Thinking (ACT)

5.1 Vocabulary of Critical Thinking

We use the vocabulary of critical thinking described by Drs. Richard Paul and Linda Elder, including the eight elements of thought and nine universal intellectual standards:

Eight elements of Thought of Critical Thinking:

1. Purpose
2. Question at Issue/Problem
3. Information
4. Interpretation and Inference/Solution
5. Concepts
6. Assumptions
7. Implications and Consequences
8. Point of View

Nine Universal Intellectual Standards for Critical Thinking:

1. Clarity
2. Accuracy
3. Precision
4. Relevance
5. Depth
6. Breadth
7. Logic

8. Significance
9. Fairness

For more details, see:

[1] Paul, R. and Linda Elder, L., The Miniature Guide to Critical Thinking-Concepts and Tools (Thinker's Guide), 7th edition, Foundation for Critical Thinking, 2014.

[2] Paul, R. and Linda Elder, L., Critical Thinking: Tools for Taking Charge of Your Learning and Your Life, 3rd Edition, Prentice Hall, 2011.

5.2 Critical Thinking Process (CTP)

According to the ACT vocabulary we used, there are four major aspects of the Applied Critical Thinking Process, termed as the 4 C's: *curiosity, connections, creativity and communication*. In this course, the C in the student learning objectives is *connections*:

- Making *connections* to a particular issue or problem: students will use established academic and industrial methodology to model a problem, design a database solution, and manipulate the data.

5.3 Critical Thinking Activities and Assessment

Critical thinking activities are integrated in the course. Lectures will include examples to highlight CT elements and standards, and their applications. Homework and programming assignments contain ACT components. Both the mid-term and final examinations include ACT-oriented questions.

In particular, data of two assessment activities (AA) on ACT will be collected to assess how well critical thinking is incorporated into the course. These assessments will be used as input to the UHCL Critical Thinking database for internal assessment of Critical Thinking, and will *not* affect your grade of the course.

1. Homework on ER (HW-ER): Students will construct an ER model to specify a given problem. This homework requires the students to have a *clear conceptual* understanding of the theory of data modeling (ACT SLO #1) to construct ER diagrams to *precisely* capture *problem* constraints and *assumptions* (ACT SLO #2).
2. Programming on SQL (HW-SQL): Students will develop SQL *solutions* to *accurately* implement a set of database queries (ACT SLO #3).

The course assesses *connections* out of the four C's. The related Student Learning Outcomes (SLO) and Fundamental and Powerful Concepts (FPC):

ACT Assessment Activity	ACT SLO	FPC
HW-ER	1,2	1,2
HW-SQL	3	3

The assessment criteria for the AA:

ACT Assessment Activity	Assessment Outcome		
	Unacceptable	Acceptable	Excellent
HW-ER	[0%,80%)	[80%,95%)	[95%,100%]
HW-SQL	[0%,80%)	[80%,95%)	[95%,100%]

Overall, if 70% or above of students are evaluated to be acceptable or excellent in each activity, as well as the average of all activities, the outcomes will be deemed acceptable. Overall, the instructor will evaluate the ACT content, activities, and assessment of the course and make necessary adjustment.