CPS352 - DATABASE SYSTEMS

Professor:	Russell C. Bjork russell.bjork@gordon.edu	Spring semester, 2020-2021 MWF 12:40-1:40 pm Synchronous Online
Hours:	I will be available immediately after class and by appointment	Canvas course site plus public site: http://www.cps.gordon.edu/ courses/cps352

SYLLABUS

CATALOG DESCRIPTION:

Explores database technology; various data models, query languages, and application program-DBMS interface. Prerequisites: CPS122, CS221 and MAT230.

COURSE OBJECTIVES:

In general, this course is designed to introduce you to basic database management system concepts and applications.

In particular, upon completion of this course, you should be familiar with:

1. The entity-relationship and relational data models and alternatives.
2. The use of SQL.
3. Design and normalization principles for relational databases, including the various normal forms.
4. Underlying file structures used to implement databases, and their performance implications.
5. Multi-user database concerns such as crash recovery, concurrency control, security and integrity
6. Various applications of database systems.

TEXT: Silberschatz, Abraham, Henry F. Korth and S. Sudarshan. *Database System Concepts* (7th ed). (New York: McGraw-Hill, 2020).

AVAILABLE ONLINE: Selected tutorial material on SQL and IBM documentation for Db2 will be accessible from the Canvas site.

COURSE TECHNIQUES AND PROCEDURES:

This is a survey course, in which we will attempt to gain a general familiarity with a large volume of material. For this reason, textbook reading and problem sets will play a larger-than-usual role in the course, with a proportionately reduced emphasis on actual programming. Homework exercises and two projects (one focusing on database design and the other on programming with commercial DBMS software) will provide an opportunity for you to experience practical application of the theoretical material.

COURSE REQUIREMENTS AND EVALUATION:

1. You will be expected to read most of the textbook, as assigned in the topic schedule below. Reading assignments should be completed **BEFORE** the class hour in which the topic is discussed. Lecture presentations will assume that you have read the text, and it is expected that your participation in the class will reflect that fact. However, our classroom discussion will not rigidly follow the order of material in the text, nor will it be confined to material covered there.

2. Homework will be assigned for most classes. Homework assignments will be posted on the course Home Page in Canvas, and will be turned in under Assignments on Canvas. Solutions to homework problems will be discussed in class, and will eventually also be posted on Canvas.

    All together, homework will be worth 30% of the final course grade, with the weight assigned to each assignment based on the number and difficulty of the problems.   (The size of the assignments, and hence the weight, will tend to be higher in the first part of the course.) Credit for homework will be awarded on the basis of the completeness and correctness of your solutions, with significant credit given for a reasonably complete attempt at solving each problem, even if the final answer is not correct.

    - Homework must be turned in **BEFORE** the start of class on the date indicated. Late problem sets will **NOT** be accepted unless an extension is granted **IN ADVANCE**.

    - Homework will be turned in electronically via Canvas or email.

    - You may work together with another student on a problem set provided each of you works on each problem, and each turns in his/her own work.

    - Where a problem calls for writing a program, it is sufficient to write it out by hand; you need not enter it into the computer unless you are explicitly told to do so.

    - For some of the problems (designated "Practice Exercises" in the book), the textbook authors have posted solutions. You may not refer to these until after you have done the problem yourself, and your answer is expected to be your own work.

    - Often, solutions to other problems in the book has been posted illicitly or by "cheat" sites on the web. You may **NOT** use these for homework. If homework is turned in that is obviously derived from such a source, it will be treated as a form of plagiarism.

3. Structured Query Language (SQL) is the standard language for querying databases - even those based on some model other than the relational model for which it was developed. For this reason, it is important that you become thoroughly familiar and comfortable with using SQL. Several homework assignments will include questions that can be answered by performing a query and/or an update on an example database; you will be required to turn in a copy of the queries/updates and the answers that you got from them as part of the homework, and in some cases results will be checked in the actual database. Learning how to formulate the required queries and updates may require some searching of relevant SQL tutorial resources and reference materials; not everything needed will be presented in class.

4. Working as part of a team of 2 students (One team of 3 will be allowed with advance permission from the professor if needed due to there being an odd number of students in the class), you will apply what you are learning to designing a relational database for an application of your own choice, requiring on the order of a dozen tables.   You will be responsible for turning in (1) a description of the requirements for this system; (2) an E-R diagram; and (3) a relational schema and an actual database with simulated data.   (You are <u>not</u> responsible for building the application - only for designing the database for it.)   Specific requirements for the project will be posted on the course Home Page on Canvas, and things that need to be turned in will be turned in under Assignments on Canvas. All parts of this project, together, will be worth 15% of the final course grade.

5. Working as part of a team of 2 (One team of 3 will be allowed with advance permission from the professor if needed due to there being an odd number of students in the class) students, you will do a major programming project involving the development of a DBMS application using SQL embedded in Java, using a database design and GUI furnished by the professor.   Specific requirements for the project will be posted on the course Home Page on Canvas, and things that need to be turned in will be turned in under Assignments on Canvas. This project will be worth 20% of the final grade.

6. There will be a midterm and a final examination (both take home) given as shown in the course schedule below. The midterm will account for 15% and the final 20% of the final course grade (total 35%). Exams will be open book, open notes.

Summary:	Homework	30%
	Database design project	15%
	Programming project	20%
	2 Exams	35%
		100%

7. Your final grade will be computed on the basis of a weighted sum of the items listed above.
   The following are minimum guaranteed grades for the percentages indicated:

	93% - 100%: A	90% - 92.9%: A-
87% - 89.9%: B+	83% - 86.9%: B	80% - 82.9%: B-
77% - 79.9%: C+	73% - 76.9%: C	70% - 72.9%: C-
67% - 69.9%: D+	63% - 66.9%: D	60% - 62.9%: D-

ACADEMIC DISHONESTY

From the Gordon College Student Handbook: "Academic dishonesty—which occurs chiefly in the form of cheating and plagiarism—is regarded by Gordon College as a major violation of both the academic and spiritual principles of this community. A student who commits an act of academic dishonesty will receive disciplinary sanctions, which may include a failing grade on an assignment or failure of the course; in extreme cases and/or a repeat offense, the student may also face academic suspension or expulsion from the College. Given the serious consequences of

academic dishonesty, students are encouraged to discuss any difficulties openly with their instructors instead of resorting to dishonest conduct. The handbook also defines plagiarism as "presenting another person's words, work or opinions as one's own. "

Academic dishonesty will not be tolerated. You know better. Just don't!

POLICY STATEMENT ON EXTENSIONS AND INCOMPLETES:

1. Extensions of the due dates for homework or projects <u>MAY</u> be given in the event of extenuating circumstances (such as illness, personal emergency) <u>IF</u> you submit a brief written request to the professor as soon as possible after the circumstances arise.

2. A grade of Incomplete <u>MAY</u> be given without penalty <u>IF</u> you are unable to complete the course work by the last day of the term due to major illness or other similar emergency. You must apply for this using the form provided by the registrar. Such a request will only be granted if you are substantially up-to-date with your course work and were making good progress in the course up to the time that the difficulty arose. Of course, you must complete all work for the course by the midpoint of the next semester in accordance with College policy.

ATTENDANCE POLICY:

Regular class attendance is expected of all students, and class attendance will be recorded. Absences from class will be classified as "excused" or "unexcused". An excused absence is one where the student misses class for a compelling reason (such as sickness, a field trip for another course, or an athletic competition, but not something like alarm clock issues) and has requested an excused absence. A student may request an excused absence up to three times in the semester by simply notifying the professor via email of the reason for the absence - prior to missing the class if possible. If it is necessary to miss more than three classes, the student must provide written documentation (such as a health center or doctor's note, or a notification from an athletic coach) for additional absences - otherwise they will be considered unexcused. A student who anticipates the need to miss multiple classes due to athletic competitions or other student activities must furnish written documentation, should review the college's attendance policy in the catalog, and must then discuss alternatives to class attendance with the professor at the start of the semester.

Normally homework or other written work due at a class where the student has an excused absence must be turned in prior to the class, but the professor may choose to allow work to be turned in late without penalty in the case of an unanticipated absence.

At the end of the semester, the student's final average will be reduced 1% for each unexcused absence after the first. A student who has more than 12 unexcused absences will fail the course automatically.

A student who is habitually late will have late arrival for class counted as a half absence for that class, and a student who sleeps through most or all of a given class session will be counted as absent for that class.

STUDENTS WITH DISABILITIES:

Gordon College is committed to assisting students with documented disabilities (see Academic Catalog Appendix C, for documentation guidelines). A student with a disability who may need academic accommodations should follow this procedure:

1. Meet with a staff person from the Academic Success Center (Jenks 412 X4746) to:
    a. make sure documentation of your disability is on file in the ASC,
    b. discuss the accommodations for which you are eligible,
    c. discuss the procedures for obtaining the accommodations, and
    d. obtain a **Faculty Notification Form**.

2. Deliver a Faculty Notification Form to each course professor *within the first full week of the semester;* at that time make an appointment to discuss your needs with each professor.

Failure to register in time with your professor and the ASC may compromise our ability to provide the accommodations. Questions or disputes about accommodations should be immediately referred to the Academic Support Center. See Grievance Procedures available from the ASC.

TENTATIVE SCHEDULE OF TOPICS:

Date	Topic(s)	Reading	Homework/ Exams / Projects Due
M 2/1	Course Introduction; Fundamental DBMS Concepts		**Start Design Project**
W 2/3	(continued)	ch. 1	
F 2/5	The Relational Model; Relational Algebra	§ 2.1-2.4	
M 2/8	(continued)	§2.5-2.6.5	
W 2/10	(continued)	§2.6.6-2.7	
F 2/12	Entity-Relationship Data Modeling	§6.1-6.7	
M 2/15	Oral Presentations / Class Discussion of Design Project Requirements; ER Modeling (continued)		**DESIGN PROJECT REQUIREMENTS**
W 2/17	SQL	§3.1-3.2; Skim/review § 3.3-3.7, 3.9-3.10 as necessary	
F 2/19	(continued)	Read § 3.8, 4.1, 4.3, 5.4 carefully	
M 2/22	(continued)	§ 4.4-4.5	

W 2/24	(continued)	§ 5.3; 4.2	
F 2/26	(continued)	§ 4.7	
M 3/1	Oral Presentations/Discussions of Design Project E-R Diagrams; (Start Relational Calculus if time)		**DESIGN PROJECT E-R DIAGRAM**
W 3/3	Relational Calculus; QBE	§ 27.1-27.3; briefly look at 27.4 (available online at db-book.com)	
F 3/5	Database Normalization	§ 7.1-7.2	
M 3/8	(continued)	§ 7.3	
W 3/10	(continued)	§ Read § 7.4.1, 7.4.2; Skim § 7.4,3, 7.4.4;	
F 3/12	(continued)	§ 7.5	
M 3/15	(continued)	§ 7.6-7.7, 7.9; § 28.1 (available online at db-book.com)	
W 3/17	Review and Catch-up		**MIDTERM EXAM (TAKE HOME) MADE AVAILABLE [THROUGH NORMALIZATION]**
F 3/19	Database Application Development	§ 9.1-9.2; § 9.8-9.8.1; § 5.1;	
M 3/22	Oral Presentations/Discussions of Design Project Database Schema		**DESIGN PROJECT DATABASE SCHEMA/ IMPLEMENTATION; Start Programming Project**
W 3/24	*Reading Day (no class)*		
F 3/26	Oral Presentations (continued)		
M 3/29	Complex Data Types; Support for OO	§ 8.1-8.2	**MIDTERM EXAM DUE**
W 3/31	Big Data; Map-Reduce Paradigm	§10.1-10.2	
F 4/2	*Good Friday - no class*		
M 4/5	*Easter Monday - no class*		

W 4/7	Analytics; Decision Support Systems; Data Mining	§ 11.1-11.3; 5.5	
F 4/9	*Reading Day (no class)*		
M 4/12	Analytics (continued)	§ 11.4-11.5	**PROGRAMMING PROJECT PART I DUE**
W 4/14	DBMS Storage Devices and File Structures	ch. 12 (all); §13.1-13.2	
F 4/16	BTree and Hashed Indices	§ 14.1-14.6	
M 4/19	(continued)	§ 4.6	
W 4/21	Efficient Query Processing Strategies; Query Processing Optimization	§ 15.1-15.3; § 15.5-15.5.1	
F 4/23	(continued)	§ 16.1-16.3; § 16.5-16.5.1	
M 4/26	The Transaction Concept	§ 17.1-17.5	**PROGRAMMING PROJECT PART II MILESTONE DUE**
W 4/28	(continued)	§ 17.6-17.11	
F 4/30	Concurrency Control	§ 18.1-18.9	
M 5/3	Recovery	§ 19.1-19.6	
W 5/5	Review and Catch Up		**FINAL EXAM (TAKE HOME) MADE AVAILABLE (COMPREHENSIVE, WITH EMPHASIS ON MATERIAL THROUGH RECOVERY AND SINCE MIDTERM)**
F 5/7	NoSQL Database Systems	§ 10.3	
M 5/10	Database System Architectures	§ 20.1-20.2; § 20.3 intro; § 20.4-20.4.2; § 20.5-20.8	**PROGRAMMING PROJECT PART II EVERYTHING DUE**
W 5/12	TBA		**FINAL EXAM DUE**

NOTE: **A**ll reading assignments above are in the text by Silberschatz et al. (Chapters 27, 28 are only available online at www.db-book.com) Some of the homework assignments will also include suggested readings in Birchall - accessible on the Canvas site.