

CGS 2545: Database Concepts Spring 2014

FINAL EXAM REVIEW

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Material Covered On Exam

- **FINAL EXAM – Friday April 25th – starting at 10:00 am**
- The material covered on the exam is taken only from the on-line lecture notes. There will be no questions on the exam which are Access specific.
- Much of this material also appears in the textbook, however, material that appears **only** in the textbook will not appear on the exam.
- The exam is comprehensive. Emphasis is placed on the material covered since Exam 1.
- The exam covers the material found in Chapters 1, 2, 3, 4, 6 7, and 9.
- Format of the exam will consist of mostly multiple choice and true/false questions with a few work type problems.



Introductory Material

Introduction To Database Systems

- Know definition of a database and DBMS.
- Components of a database system.
- Architecture of a database system.
- Various advantages and disadvantages of a database system.
- Levels of abstraction in a database system: external, conceptual, and physical.
- Schemas and instances.
- Data independence.
- DDLs and DMLs.
- Data models.



Chapter 1 Details

Database Development Process

- Enterprise data model.
- SDLC and prototyping.
- Basic project management issues.

- Not a lot of specific details in this chapter to worry about, just get a general overview of the database design as a project that requires management.
- Know the basic phases in SDLC and prototyping.



Chapter 2 Details

Modeling Data In The Organization

- Business rules and characteristics of good business rules.
- How to obtain business rules.
- Good data naming conventions.
- ER model.
 - Entities and attributes of entities. What is an entity and what is not.
 - Relationships between entities. Attributes of relationships.
 - Attributes. Simple, composite, derived, and multi-valued.
 - Strong entities and weak entities. Identifying relationships for weak entities.
 - Unary, binary, and ternary relationships.
 - Relationship cardinality. 1:1, 1:M, and M:M.
 - Participation constraints. Mandatory and optional.
 - Associative entities.



Chapter 3 Details

EER Model And More On Business Rules

- Supertype – subtype specifications.
 - Attribute inheritance
 - Relationship participation inheritance.
- Generalization – specialization.
 - Completeness constraints. Total and partial specializations.
 - Disjointness constraints. Disjoint and overlapping specializations.
 - Subtype discriminators.
- Entity clusters.
- Expanded ER to incorporate business rules.
 - Derivations, structural assertions, action assertions.



Chapter 4 – Part 1- Details

Logical Database Design And The Relational Data Model

- Relation, attribute, domain, tuple, degree, cardinality, and related terminology.
- You can ignore the more mathematical definition of a relation.
- Be familiar with the definition of a relation as shown on page 11.
- Know the difference between a schema and an instance.
- Be able to convert basic ER diagrams into a set of relational tables.
 - Strong entities with simple, composite, and multi-valued dependencies.
 - Weak entities.
 - Binary 1:M and M:M relationships.
 - Binary 1:1 relationships.
 - Associative entities both with and without defined identifiers.
 - Unary relationships.
 - Supertype/subtype hierarchies.



Chapter 4 – Part 2 - Details

Normalization

- Know what normalization is and how it is achieved.
- Concept of a functional dependency.
- Normal forms based upon functional dependencies: (1NF), 2NF, 3NF, and BCNF.
- Insertion, deletion, and update anomalies.
- Be able to convert N2NF tables into 2NF tables.
- Be able to convert N3NF tables into 3NF tables.
- Denormalization.



Chapter 6 Details

Introduction To SQL

- Table creation in SQL.
- Referential integrity constraints in tables in SQL.
- Inserting, deleting, and updating rows in tables in SQL.
- Queries in SQL.
 - Basic SELECT statement.

SELECT (attributes)

FROM (tables)

WHERE condition

GROUP BY

HAVING

ORDER BY

Also see “SQL – In class exercises” for more SQL query examples.



Chapter 7 Details

Advanced SQL – SQL Join Operations

- Table joins in SQL queries.
 - Cross Joins
 - Natural Joins
 - Joins with USING and ON clauses
 - Outer Joins
- Subqueries
 - Correlated
 - Non-correlated
- Set operations in SQL queries

Also see “SQL – In class exercises” for more SQL query examples.



Chapter 9 Details

Data Warehousing Systems - Details

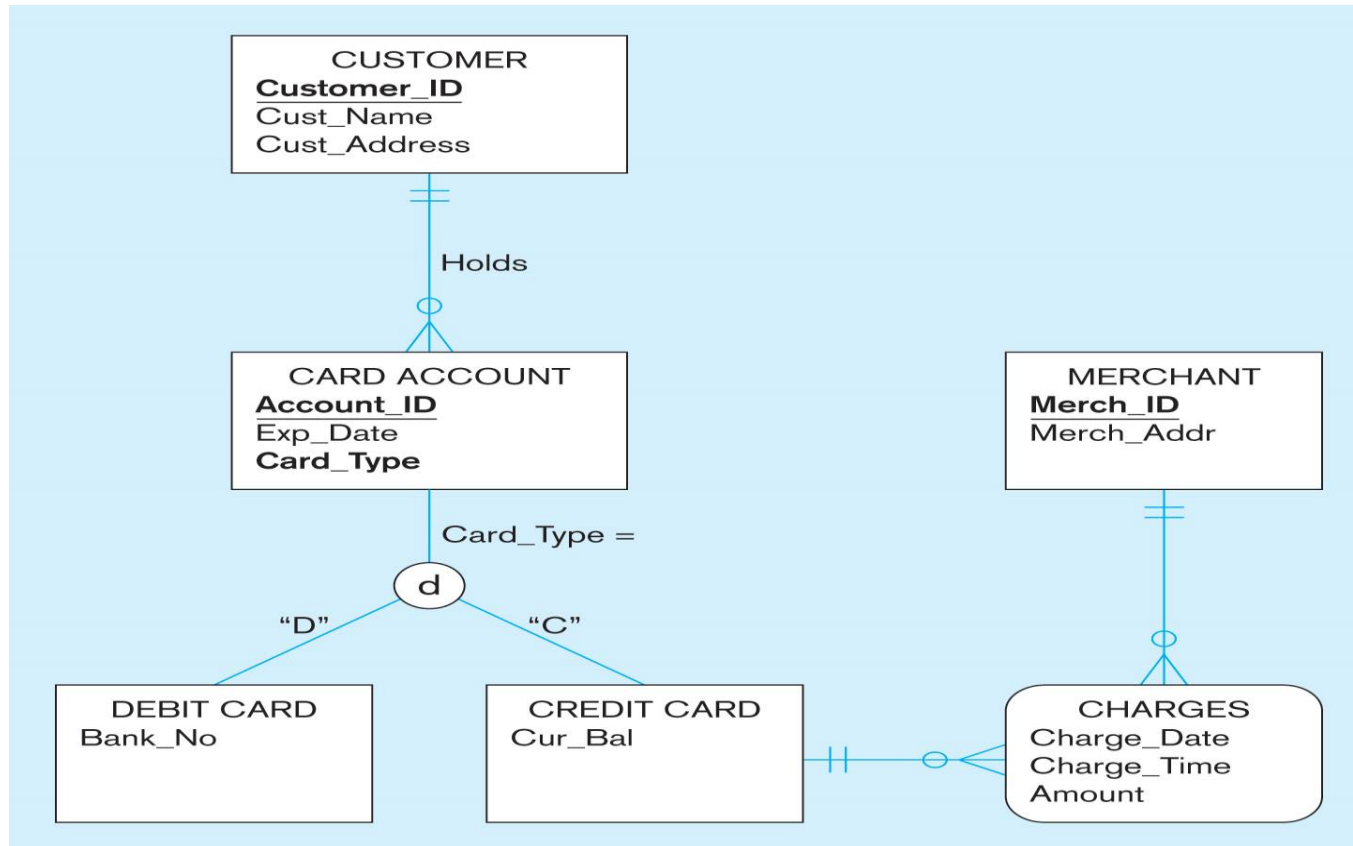
- Know different reasons for parallel and distributed database systems.
- Know the definition of a data warehouse.
- Differences between a data warehouse and a data mart.
- Know the basic steps involved in ETL (Extraction-Transformation-Loading) for a warehouse.
- Basic types of data mining operations.

Ignore pages 63-82 for the exam.



Some Example Problems

1. Convert the following ERD into a set of relations (tables) using the guidelines outlined in the notes for Chapter 4.



Some Example Problems

2. The relation scheme

CLASS (course-number, section-number, room-number, capacity)

is in which normal form given the functional dependency
room-number \rightarrow capacity?

- a) 1NF
- b) 2NF
- c) 3NF

If the relation scheme is not in 2NF, decompose it into a set of relation schemas that are in 2NF. If the relation scheme is not in 3NF, decompose it into a set of relation schemas that are in 3NF.



Some Example Problems

3. Using the relation schemas shown below create table definitions in SQL for each of the tables listed.

STUDENT (STUDENT_ID, STUDENT_NAME)

<u>STUDENT_ID</u>	STUDENT_NAME
38214	Letersky
54907	Altvater
66324	Aiken
70542	Marra
...	

QUALIFIED (FACULTY_ID, COURSE_ID, DATE_QUALIFIED)

<u>FACULTY_ID</u>	<u>COURSE_ID</u>	<u>DATE_QUALIFIED</u>
2143	ISM 3112	9/1988
2143	ISM 3113	9/1988
3467	ISM 4212	9/1995
3467	ISM 4930	9/1996
4756	ISM 3113	9/1991
4756	ISM 3112	9/1991
...		

FACULTY (FACULTY_ID, FACULTY_NAME)

<u>FACULTY_ID</u>	FACULTY_NAME
2143	Birkin
3467	Berndt
4756	Collins
...	

SECTION (SECTION_NO, SEMESTER, COURSE_ID)

<u>SECTION_NO</u>	<u>SEMESTER</u>	<u>COURSE_ID</u>
2712	I-2006	ISM 3113
2713	I-2006	ISM 3113
2714	I-2006	ISM 4212
2715	I-2006	ISM 4930
...		

COURSE (COURSE_ID, COURSE_NAME)

<u>COURSE_ID</u>	COURSE_NAME
ISM 3113	Syst Analysis
ISM 3112	Syst Design
ISM 4212	Database
ISM 4930	Networking
...	

REGISTRATION (STUDENT_ID, SECTION_NO, SEMESTER)

<u>STUDENT_ID</u>	<u>SECTION_NO</u>	<u>SEMESTER</u>
38214	2714	I-2006
54907	2714	I-2006
54907	2715	I-2006
66324	2713	I-2006
...		



Some Example Problems

4. Using the relation schemas shown in Problem 3 construct an SQL expression to answer the following queries:
 - a) “Which students have an ID number that is less than 50000?”
 - b) “What is the name of the faculty member whose ID is 4756?”
 - c) “What is the smallest section number used in the first semester of 2001”?



Some Example Problems

5. Consider the relation instance shown below. For each functional dependency listed indicate whether the dependency holds on the instance or not.

A	B	C	D
1	2	3	4
3	4	2	1
4	4	3	2
2	4	3	2
1	1	4	5
2	4	3	2

<u>HOLDS</u>			
1.	$B \rightarrow C$	YES	NO
2.	$D \rightarrow A$	YES	NO
3.	$BC \rightarrow D$	YES	NO
4.	$D \rightarrow B$	YES	NO



Some Example Problems - ANSWERS

1. Customer

<u>Customer ID</u>	Cust_Name	Cust_Address
--------------------	-----------	--------------

Card Account			
<u>Account ID</u>	Exp_Date	Card_Type	Customer_ID

Debit Card	
<u>D Account ID</u>	Bank_No

Credit Card	
<u>C Account ID</u>	Cur_Bal

Charges				
<u>Merch ID</u>	<u>Account ID</u>	Charge_Date	Charge_Time	Amount

Merchant	
<u>Merch ID</u>	Merch_Addr



Some Example Problems - ANSWERS

2. The relation scheme

CLASS (course-number, section-number, room-number, capacity)

is in which normal form given the functional dependency
room-number \rightarrow capacity?

- a) 1NF
- b) 2NF since there are no partial dependencies**
- c) 3NF

The relation scheme is not in 3NF since the following holds:

course-number section-number \rightarrow room-number \rightarrow capacity

which is a transitive dependency. Decompose CLASS into:

CLASS (course-number, section-number, room-number)

ROOM (room-number, capacity)



Some Example Problems - ANSWERS

```
3. CREATE TABLE STUDENT
    (STUDENT_ID          NUMBER          NOT NULL,
     STUDENT_NAME       VARCHAR2(25),
     CONSTRAINT STUDENT_PK PRIMARY KEY (STUDENT_ID));

CREATE TABLE FACULTY
    (FACULTY_ID          NUMBER          NOT NULL,
     FACULTY_NAME       VARCHAR2(25),
     CONSTRAINT FACULTY_PK PRIMARY KEY (FACULTY_ID));

CREATE TABLE COURSE
    (COURSE_ID          CHAR(8)          NOT NULL,
     COURSE_NAME        VARCHAR2(15),
     CONSTRAINT COURSE_PK PRIMARY KEY (COURSE_ID));

CREATE TABLE SECTION
    (SECTION_NO         NUMBER          NOT NULL,
     SEMESTER           CHAR(7)         NOT NULL,
     COURSE_ID          CHAR(8),
     CONSTRAINT SECTION_PK PRIMARY KEY(COURSE_ID,SECTION_NO,
                                     SEMESTER),
     CONSTRAINT SECTION_FK FOREIGN KEY (COURSE_ID)
     REFERENCES COURSE (COURSE_ID));
```



Some Example Problems - ANSWERS

```
CREATE TABLE IS_QUALIFIED
(FACULTY_ID          NUMBER          NOT NULL ,
 COURSE_ID           CHAR(8)         NOT NULL,
 DATE_QUALIFIED      DATE,
 CONSTRAINT IS_QUALIFIED_PK PRIMARY KEY (FACULTY_ID, COURSE_ID),
 CONSTRAINT QUALIFIED_FACULTY_FK FOREIGN KEY (FACULTY_ID)
    REFERENCES FACULTY (FACULTY_ID),
 CONSTRAINT QUALIFIED_COURSE_FK FOREIGN KEY (COURSE_ID)
    REFERENCES COURSE (COURSE_ID));
```

```
CREATE TABLE IS_REGISTERED
(STUDENT_ID          NUMBER          NOT NULL,
 SECTION_NO          NUMBER          NOT NULL,
 SEMESTER            CHAR(7)         NOT NULL,
 CONSTRAINT IS_REGISTERED_PK PRIMARY KEY (STUDENT_ID,
    SECTION_NO, SEMESTER),
 CONSTRAINT STUDENT_IS_REGISTERED_FK FOREIGN KEY(STUDENT_ID)
    REFERENCES STUDENT(STUDENT_ID),
 CONSTRAINT COURSE_IS_REGISTERED_FK FOREIGN KEY (SECTION_NO,
    SEMESTER)
    REFERENCES SECTION(SECTION_ID, SEMESTER));
```



Some Example Problems - ANSWERS

4. Using the relation schemas shown in Problem 3 construct an SQL expression to answer the following queries:

a) “Which students have an ID number that is less than 50000?”

```
SELECT STUDENT_ID, STUDENT_NAME  
FROM STUDENT  
WHERE STUDENT_ID < 50000;
```

b) “What is the name of the faculty member whose ID is 4756?”

```
SELECT FACULTY_NAME  
FROM FACULTY  
WHERE FACULTY_ID = 4756;
```

c) “What is the smallest section number used in the first semester of 2001?”

```
SELECT MIN(SECTION_ID)  
FROM IS_REGISTERED  
WHERE SEMESTER = '1-2001';
```



Some Example Problems - ANSWERS

5. Consider the relation instance shown below. For each functional dependency listed indicate whether the dependency holds on the instance or not.

A	B	C	D
1	2	3	4
3	4	2	1
4	4	3	2
2	4	3	2
1	1	4	5
2	4	3	2

<u>HOLDS</u>			
1.	$B \rightarrow C$	YES	<input checked="" type="radio"/> NO
2.	$D \rightarrow A$	YES	<input checked="" type="radio"/> NO
3.	$BC \rightarrow D$	<input checked="" type="radio"/> YES	NO
4.	$D \rightarrow B$	<input checked="" type="radio"/> YES	NO

