Midterm Exam

Due Oct 27 at 11:59pm **Points** 150 **Questions** 8
Available Oct 27 at 1:30pm - Oct 27 at 11:59pm about 10 hours
Time Limit 75 Minutes

Instructions

CS/DSA 4513 – Online Sections 995-999-Database Management - Fall 2021 - Dr. Le Gruenwald

MIDTERM EXAM

- **Exam Window:** 1:30 PM (CST) to 11:59 PM (CST) on 10/27/2021 on the Class Website on Canvas, which means you cannot take the exam before 1:30 PM (CST) and cannot submit your answers on Canvas after 11:59 PM (CST).
- **Total Exam Time:** 75 minutes.
- **Maximum Score:** 150 points.
- **Open Books and Open Notes.**
- **Once you opened the exam, you have 75 minutes to submit your answers on Canvas.** After 75 minutes, the exam will be closed, and you will not be allowed to submit your answers after that time.
- *We will not accept your answers submitted using any other means (e.g., email, snail mail) under any circumstances.*

This exam is individual work; it must be done by you alone. You must not collaborate with anyone on this exam. You must not receive help from any person or provide help to any person on this exam. You must not share the exam questions or your answers with anyone during or after the exam.

A violation of any of these rules will result in action as specified in the Academic Integrity Code at OU - http://integrity.ou.edu/files/Academic_Misconduct_Code.pdf (http://integrity.ou.edu/files/Academic_Misconduct_Code.pdf)

Consult also the following web page for a Student's Guide to Academic Integrity at OU - **http://integrity.ou.edu/students_guide.html (http://integrity.ou.edu/students_guide.html)**

This quiz was locked Oct 27 at 11:59pm.

ⓘ Correct answers are hidden.

Score for this quiz: **145** out of 150

Submitted Oct 27 at 4:20pm

This attempt took 75 minutes.

Question 1

39 / 45 pts

Given the following ER diagram for a database application:

A. Using the same description format as that of Problem 1 in **Graded Homework 1** **(https://canvas.ou.edu/courses/215306/files/38955209/download?download_frd=1)** , write a description for the given ER diagram.
B. Convert the given ER diagram to a set of relational schemas.
C. The database application now has the following new requirement:
   - *There are two types of customers: Tax Exempt and Non-Tax Exempt; the database stores the TaxID for each Tax Exempt customer and the discount rate for each Non-Tax Exempt customer.*

   Describe how you would modify the ER diagram to express this new requirement.

Your Answer:

A - description for the given ER diagram.

Given any firm that sells goods, there exists a flow from the supplier all the way to the customer. With that, there must be an efficient database that will track the product from the supplier all the way to the customer.

- When a customer makes an order, the webpage will keep track of the unique customer ID, their name (first and last name), their multiple addresses, and their single phone number. One customer can buy many goods, and every order must be associated with a customer.

- An order has a unique order number, a date, and a cost.
- For each combination of orders made by customers, security monitors them. The database keeps track of the security staff's unique name and their agency's name. Many security guards can monitor many combinations of orders and customers.
- All orders contain an item. The database keeps track of the quantity of the item. Many orders can have many items. The database keeps track of the unique item number, item name, and the price of the unit.
- Every item ships from a distribution center. Many items can ship through many distribution centers. The database keeps track of the distribution center's ID (which weakly defines the center), its location, and the contact name.
- Every distribution centers have one center supplier. Many distribution centers can have one supplier. The database keeps track of the unique supplier number, the name, and the single address it has.

B - Convert the given ER diagram to a set of relational schemas.

Security(StaffName: string, AgencyName: String)

Monitors(StaffName: string, CustID: int, OrderNo: int)

Customer(CustID: int, lname: string, fname: string, {address}, phone)

CustAddress(Adress1: string, Address2: string)

Buys(CustID: int, OrderNo: int)

Order(OrderNo: int, date: date, cost: real)

Contains(OrderNo: int, ItemNo: int, quantity: int)

Item(ItemNo: int, ItemName: string, UnitPrice: real)

Ships(ItemNo: int, CenterID: int)

DistributionCenter(Center_ID: int, location: string, ConstactName: string)

CenterSupplier(CenterID: int, SuplNo: int)

Supplier(SupNo: int, SupName: String, address)

C -

- Add two new relations (tax_exempt and non_tax_exempt).
- Store taxID as int for the exempt in the tax_exempt relation
- Store discount rate as real for non_exempt relation)

A) "which weakly defines the center" - what does that mean? -0.5 Security only monitors some of the orders placed by the customer. -1 B) CustAddress schema is wrong. -0.5 OrderNo is a primary key of Buys. -0.5 Order primary key? -0.5 CenterID is a part of primary key of Ships. -0.5 No need for CenterSupplier schema. -1 DistributionCenter primary key? C) Those two entity sets (not relations) are the total disjoint specilaizations of the customer. -1.5

Questions 2-6 Header

For each of the following multiple-choice questions (2- 6), select the most correct answer. If you do not select any answer for a question, you will get zero credit for that question.

Question 2

6 / 6 pts

When users use a DBMS to manage their databases, they can modify their physical schemas without changing their logical schemas.

● True

○ False

Question 3

6 / 6 pts

Ensuring the atomicity and durability properties is the responsibility of the Authorization and Integrity Manager component of a DBMS.

○ True

● False

Question 4

6 / 6 pts

When converting a one-to-one relationship set that has an attribute *A* associated with it from an ER diagram to a relation schema *R*, *A* will be an attribute of *R*, but *A* will not be a part of the primary key of *R.*

● True

○ False

Incorrect

Question 5

0 / 6 pts

A primary index of a relational database table is always sorted in the increasing order of the primary key of the table.

● True

○ False

Question 6

6 / 6 pts

A relational table *BOOK (ID, Title, Author, Year)* has been organized as a hash file using the hash function with the hash key *Title: h(Title)***.** This file organization is good for random search queries on BOOK with the search key in the queries being *Title*:

● True

○ False

Question 7

33 / 35 pts

Given the following relational schemas for a relational database storing the software development information at a company, where each tuple in PROGRAMMERS stores the information about a programmer, each tuple in SOFTWARE stores the information about a software package, and each tuple in ASSIGNMENTS stores the information about the assignment of a programmer to a software package:

- PROGRAMERS (ProgrammerID, LastName, FirstName, age, salary)
- SOFTWARE (SoftwareName, SoftwareVersionID, ManagerName, CompletionDate)
- ASSIGNMENTS (SoftwareName, SoftwareVersionID, ProgrammerID, AssignmentDate)

Answer the following questions:

A. Write SQL statements to create all the tables for the database with all the necessary integrity constraints.

B. Write an SQL statement that for each software package, displays its name and the total number of its versions.

C. Write an SQL statement that displays the IDs and names of all programmers assigned to the software package named “Azure SQL” managed by the manager named “Johnson”.

Your Answer:

A - CREATE TABLES

```
CREATE TABLE PROGRAMERS (
   ProgrammerID    INT PRIMARY KEY,
   LastName        VARCHAR(64) NOT NULL,
   FirstName       VARCHAR(64) NOT NULL,
   age             INT NOT NULL,
   salary          REAL NOT NULL
)

CREATE TABLE SOFTWARE (
   SoftwareName        INT PRIMARY KEY,
   SoftwareVersionID   INT NOT NULL,
   ManagerName         VARCHAR(64) NOT NULL,
   CompletionDate      DATE NOT NULL
)

CREATE TABLE ASSIGNMENTS (
   SoftwareName        INT PRIMARY KEY,
   SoftwareVersionID   INT NOT NULL,
   ProgrammerID        INT FOREIGN KEY REFERENCES PROGRAMERS,
   AssignmentDate      DATE NOT NULL
)
```

B - Write an SQL statement that for each software package, displays its name and the total number of its versions.

```
SELECT
   SoftwareName
   COUNT(SoftwareVersionID) AS VersionCount
FROM SOFTWARE
GROUP BY SoftwareName
```

C - Write an SQL statement that displays the IDs and names of all programmers assigned to the software package named “Azure SQL” managed by the manager named “Johnson”

```
SELECT
   ProgrammerID,
   FirstName,
   LastName

WHERE
      SoftwareName = 'Azure SQL' -
- assumes the name is the package name
   AND ManagerName  = 'Johnson'

FROM
   PROGRAMERS [prog]

   LEFT JOIN ASSIGNMENTS [assn]
      ON [prog].ProgrammerID = [assn].ProgrammerID

   LEFT JOIN SOFTWARE [soft]
      ON [assn].SoftwareName = [soft].SoftwareName
```

A) SOFTWARE and ASSIGNMENTS primary key is wrong. -1 ASSIGNMENTS foreign key to SOFTWARE is missing. -0.5 B) Looks good. C) One additional join condition (on SoftwareVersionID) is missing. -0.5 WHERE and FROM clauses order is switched.

Question 8

34 / 40 pts

Given the following relational table:

- ITEMS (ID, Name)

and the following series of insertion operations:

INSERT INTO ITEMS VALUES (9, ‘shirt‘)

INSERT INTO ITEMS VALUES (11, ‘table’)

INSERT INTO ITEMS VALUES (20, ‘curtain’)

INSERT INTO ITEMS VALUES (35, ‘bed’)

INSERT INTO ITEMS VALUES (13, ‘pillow’)

INSERT INTO ITEMS VALUES (39, ‘cup’)

INSERT INTO ITEMS VALUES (22, ‘glass’)

Answer the following questions (8.1-8.3):

8.1) Assuming that ITEMS is organized as a sequential file with the search key being Name and assuming that each disk block can store up to 2 ITEMS records, show the contents of the file after all the seven insertions have been executed as follows: for EACH block in the file, write its block address and the data stored in the block**.**

8.2) Assuming that ITEMS is the sequential file described in Question (8.1) and ITEMS has the following B+tree index of order 3 on Name where B_x (for example, B_{cup}) is the address of the block in the ITEMS sequential file where the record that has Name ‘x’ is stored:

Answer the following questions (A-B):

A. Describe how the given index is used to answer the following query:
   - *SELECT ID*

     FROM ITEMS

     WHERE Name = ‘curtain’

B. Describe the changes that need to be made to the given index due to the execution of the following insertion:
   - *INSERT INTO ITEMS (100, ‘comb’)*

8.3) Assuming that ITEMS is organized as a static hash file with the following hash function: *h(ID) = ID MOD 5* (note that MOD is the MODULO function), and assuming that each hash bucket can store up to 3 ITEMS records and a total of 5 buckets with the bucket addresses 0, 1, 2, 3, and 4 are reserved for the file, show the contents of the file with appropriate bucket addresses after all the seven insertions have been executed (not including the one from 8.2.B).

Your Answer:

8.1:

35bed
39cup
20curtain
22glass
13pillow
9shirt
11table

8.2:

A: First, the query would look at the root (B_Glass). Then the query would look at the left node since B_curtain < B_glass. Since the query finds the pointer of curtain (which the pointer is B_curtain), it goes to the leaf node to get the value of B_curtain which is curtain, or the desired value.

B: Since B_comb is less than B_curtain, B_comb would take its place, then then the leaf node comb would go to the left of the leaf node curtain (which are now both under B_comb). This is okay since it is still balanced.

8.3 (please note that a comma is used the delimiter of the bucket)

0	20, 35
1	11
2	22
3	13
4	9, 39

8.1: What are the blocks of the file? -2 8.2: a) Looks good. b) This solution is arbitrary, it doesn't follow the algorithm described in class. -2 8.3: Hash file stores entire records, not just their fragments. -2

Quiz Score: **145** out of 150

This quiz score has been manually adjusted by +15.0 points.