

Metropolitan State University
ICS 311-50 Database Management System
Summer 2023 Exam1

Date: 6/15/2023

Duration: 150 minutes

Points: 75

Name: _____ Cindy Chen _____

A) (10 Points)

True/False

1. SQL has 2 parts: Data Manipulation Language and Data Demonstration language. T-----F
2. SQL is just a query Language T-----F
3. SELECT DISTINCT is used if a user does not want to see duplicate rows in a query.
T-----F
4. Database instance and schema refer to the same thing. T-----F
5. There is no database without a Database Management System. T-----F
6. Normalization is accomplished by means of functional dependency. T-----F
7. Consider the following SQL statement:
SELECT number1+number2 as sum FROM number_table;
The output of this query is a table with two columns. T-----F
8. The set of relation in a database must be specified to the system by means of:
 - a) The database management system
 - b) Data Manipulation Language
 - c) Data Desmonstration Language
 - d) Database schema
 - e) None of the above
9. All of the following terms represent the same concept, except:
 - a. Tuple
 - b. Data set representing a single item
 - c. Row
 - d. Entity
10. The following rule must be maintained by the DBMS to ensure data consistency:
 - a. Entity integrity constraints
 - b. Referential integrity constraints
 - c. Attribute domain constraints
 - d. All of the above

B) (15 Points)

- 1) Interaction with the file manager is one of the responsibilities of a database administrator. Explain the problems that would arise if this responsibility were not discharged. (2.5 points)

If there isn't file manager interaction, then nothing stored within the files can be retrieved.

- 2) Security enforcement is one of the responsibilities of a database administrator. Explain the problems that would arise if this responsibility was not discharged. (2.5 points).

If there isn't security enforcement, unauthorized users may be able to see contents that are restricted. It would allow common people to see private information restricted by small percentage of people.

- 3) Explain the concept of physical data independence and its importance in database systems. (5 points)

Physical data independence allows users to change the physical level of the database without interfering the logical aspect of the database. Its important because it allows users to modify their database without completely ruining or having to start a new one. Its flexible in expanding the capabilities.

- 4) List at least two reasons why database systems support data manipulation using a declarative query language such as SQL, instead of just providing a library of C or C++ functions to carry out data manipulation. (5 points)

- easier for all people to learn

- efficient, its a great language for the database to save queries and allowing it to be easier than compared with programming language functions

C) (16 Points)

Answer questions 1 to 5 based on the following schema. Note that primary keys are **BOLD**.

Note also that attributes with the same name in different tables are foreign keys. For example, branchName in the Account table is a foreign key that refers to Branch table.

Account(**accountNum**: integer, branchName: varchar(15), balance: integer)

Branch(**branchName**: varchar(15), street:varchar(30), city:varchar(10))

Customer(**customerSSN**: integer, street: varchar(30), city:varchar(10))

Deposit(**customerSSN**: integer, accountNum: integer, amount: integer)

1) Write SQL statements to create the Account table. Make sure to include entity integrity and referential integrity constraints (if any) in your statements.
(3 points)

```
CREATE TABLE Account(  
    accountNum int not null PRIMARY KEY,  
    branchName varchar(15) FOREIGN KEY REFERENCES  
Branch(branchName),  
    balance int,  
);
```

2) Devise a reasonable database instance by filling the tables with reasonable data of your choice. Make sure to have at least 3 tuples in each table. Make sure that all tables exhibits entity integrity and referential integrity constraints.
(4 points)

Branch

branchName	street	city
St.Paul	Dell street	Minneapolis
MN-002	Anderson street	Minneapolis
MN-003	Peterson street	Minneapolis

Account

accountNum	branchName	balance
1001	St.Paul	1000
1002	MN-002	2000
1003	MN-003	3000

Customer

customerSSN	street	city
011-01-1234	Washington ave	Minneapolis
011-01-4567	Delaware street	Minneapolis
011-01-7899	University ave	Minneapolis

Deposit

customerSSN	accountNum	amount
011-01-1234	1001	100
011-01-4567	1002	200
011-01-7899	1003	300

3) Write an SQL statement to decrease the amount of all deposits by 1% (3 points)

UPDATE Deposit

Set amount = amount*(1-0.01);

4) Write a SQL statement to increase by 5% the balances of all accounts that are created in a branch with name 'St. Paul'. (3 points)

UPDATE Account

Set balance = balance*(1.05)

Where branchName = 'St.Paul';

5) Write an SQL statement to select all Customers SSN's where the city has a null value. (3 points)

Select customerSSN

From Customer

Where city IS NULL;

D) (10 Points)

Answer questions 1, 2 and 3 based on the following schema (data types are not needed).

Product(pid, pname, type, manufacturer, price)

Buys(cid, pid, quantity)

Customer(cid, cname, age, gender)

Answer questions 1, 2 and 3 based on the following schema (data types are not needed).

(8 Points)

1) Find names and types of all products that are manufactured by 'Sears'. (2 Points)

```
Select pname, type
From Product
Where manufacturer = 'Sears';
```

2) Find names of all customers who have purchased a product that is manufactured by 'Acme' and have a gender of 'Coyote'. (3 points)

```
Select c.cname
from Customer c
Join Buys b
On c.cid = b.cid
Join Product p
On p.pid = b.pid
Where p.manufacturer LIKE 'Acme' AND c.gender LIKE 'Coyote';
```

3) Find type and price of all products that have been purchased by a customer who is older than 42 years old and quantity > 10. (3 points)

```
Select p.type, p.price
From Product p
Join Buys b
On p.pid = b.pid
Join Customer c
On c.cid = b.cid
Where c.age > 42 AND b.quantity >10;
```

4) Answer the question below based on the following SQL query. (2 Points)
SELECT P.manufacturer
FROM Product P, Buys B
WHERE P.pid=B.pid and P.pname='Stuffed Puppy Dog' and B.quantity < 11

Write an English sentence to explain the output of the query.

Display all manufactures that have product's name as "Stuffed Puppy Dog" and buyer has purchased less than 11 of the product.

E) (10 Points)

5.1) Given the following information, for each one of the **BOLD** words, specify whether the word will be mapped into an **entity**, **attribute**, **relationship**, or **value** in the corresponding database.

(3 points)

entity=table attribute=column relationship

a) The **make** of my Red **automobile** is **Ford**.

make=attribute

automobile=entity

ford=value

b) **Professor Smith teaches** three courses.

professor=entity

smith=value

teaches=relationship

Assume we have two relations R(a,b) and S(b,c). All three attributes (a, b, and c) are integer attributes. Assume that Relation R contains the following tuples: (1,2), (2,3), and (3,4). Assume that Relation S contains the following tuples (2,2), (2,3), (4,6) and (7,1).

R

a	b
1	2

2	3
3	4

S

b	c
2	2
2	3
4	6
7	1

a) Give an example of an attribute (or a combination of attributes) that cannot be a primary key for relation S, why? (4 Points)

Attribute b, because primary key values should be unique, individual to that column and table. But column b's data are repetitive towards S's b column.

c) How many tuples are in the result of Natural Join between R and S? (1 point)

1 tuple (2,3)

d) Show the output of the following query (2 points)

```
SELECT a
FROM R,S
WHERE R.b = S.b and S.c > 2
```

2

F) (3 Points)

Consider the relational database below:

employee (employee name, street, city)
works (employee name, company name, salary)
company (company name, city)
manages (employee name, manager name)

Give an expression in SQL for each of the following queries.

1. Give all employees of First Bank Corporation a 25 percent raise.
`UPDATE works`

`Set salary = salary * 1.25`

`Where companyName = 'First Bank Corporation';`

2. Give all managers of First Bank Corporation a 30 percent raise.
`UPDATE works`

`Set salary = salary * 1.30`

`Where employee_name IN(select employee_name from manages);`

G) (11 Points)

Consider the following database instance. Table name: **Students** Primary key: **sid**

Sid	sname
1	Monica
2	Chandler
3	Mary
4	Nina

Table name: **Courses** Primary key: **cid**

cid	cname
1	Database
2	Compiler

Table name: **Register** Primary key: **sid,cid**

Foreign key: **sid** references Students(sid)

Foreign key: **cid** references Courses(cid)

sid	cid
1	2
2	2

(7 Points) For each of the following statements, show whether the statement is correctly executed or no (**assume that the statements are executed in order, which means that if a statement is correctly executed, its effect is reflected in the following statement**).

If you say the statement is not executed, explain why.

a. `INSERT INTO Students VALUES (3, 'Rick');`

Unable to execute, as the value of Sid of 3 already exists inside the Student's Sid table. Because its a primary key, it won't be able to change.

b. `INSERT INTO Students VALUES (6, 'Rick');`

Unable to execute, as the students's Sid is a primary key while the insert statement only has one column value instead of two. When one column is the primary key, the insert statement needs to have the exact match of columns as the table column. Also because when no columns are specified inside the insert statement, SQL automatically takes all columns into consideration, even if one column is auto increment or vice versa, primary key.

c. INSERT INTO Register VALUES (1, 5);

Successfully executed

d. INSERT INTO Courses VALUES (5, 'Systems');

Unable to execute, same concept/explanation with b's answer. Would need to specify the columns in the INSERT statement. For example:
INSERT INTO Courses(cid, cname) VALUES (5, 'Systems');

e. INSERT INTO Register VALUES (1, 5);

Successfully executed

f. INSERT INTO Register VALUES (2, 4);

Successfully executed

g. INSERT INTO Register VALUES (2, 5);

Successfully executed

(4 Points) Show the output of each of the following queries. Assume that the queries are executed after executing the previous INSERT statements:

a. SELECT *
FROM Students;

1 Monica
2 Chandler
3 Mary
4 Nina

b. SELECT S.sname, C.cname
FROM Students S, Courses C, Register R
WHERE R.sid = S.sid and R.cid = C.cid

Monica Compiler

Chandler Compiler

