CSCI585 Midterm exam

2017-03-03

Duration: 1 hour

Last Name: _____

First Name: _____

Student ID: _____

Email: _____

Hi there! There are 9 questions below (8 plus a bonus), one question per page. Please read each question carefully before answering. There's need to elaborate on anything, so you shouldn't need extra sheets.

The exam is **CLOSED** book/notes/devices/neighbors(!) but 'open mind' :) If you are observed cheating, or later discovered to have cheated in any manner, you will get a 0 on the test and also be reported to SJACS - so please don't! **DO YOUR OWN WORK**.

When we announce that the time is up, you NEED to stop writing immediately, and turn in what you have; if you continue working on the exam, we will not grade it (ie. you will get a 0). So please stick to the limit of one hour, use time wisely!

Have fun, and good luck - hope you do well!

Saty

Q1 (4 points).
Suppose an online vendor maintains its customer list like so:

firstName	lastName	address	city	state	ZIP	phoneNumber	SkypeID	emailAddress
A	B	123 Main St	Los Angeles	CA	90089	213-543-6543		AB@mail.com
Fam	Act	222 Burton Way	Beverly Hills	CA	90210		RichNFamous	RNF@imdb.com
MoreFam	Act	108 Roxbury St	Beverly Hills	CA	90210	323-654-1002		TheBest@BevHills.us
Grad	Student	154 Adams St	Los Angeles	CA	90089			DontBugMe@usc.edu

What two problems do you see with the above scheme, and how would you fix them? Your answer can be in the form of E-R (using any notation), or in table format (like above) or even SQL. And, feel free to create any new attributes that might be necessary.

Repetition of data, with city and state names (so make a separate table of these, with ZIP as the PK); missing (NULL) values for contact info (so, make a separate ContactInfo table with (ContactID, ContactType, ContactValue) rows and move the contact data there (no NULLS will exist because we will have a new row for each contact type a person has).

Q2 (4 points). Parents in a wealthy family want to create a DB of all their assets. For each asset, they would like to name benefactors - some or all of their five children who would get the asset. Each asset has a financial value associated with it, and a maturity date (when the kid(s) can cash in). They'd like to track the following diverse set of assets they own: bank accounts, real estate, stocks, jewelry, life insurance. **What would be a good design (using an ER diagram) for this?** You can make any assumptions you want about the assets, create whatever descriptors (columns) you need, etc.

Make a superclass entity Assets, and a Benefactors one, link them as 1:M. Under Assets, create BankAccounts etc. as subclass entities.

Q3 (3 points). A reality company keeps track of its home sales like so:

Seller	Buyer	LendingBank
S1	B1	BofA
S2	B1	Chase
S1	B2	Chase

Things seem fine (redundancy and all), until they hire you to 'clean up' their table. After analysis, you come up with these three separate tables [all linked properly with FK/PK], which makes for good design:

Table 'SellerBuyer', with rows such as (S1,B1).

Table 'BuyerBank', with (B2,Chase) as a sample row.

Table 'SellerBank', eg. with (S2,Chase) as a row.

You write the following three-way 'join' query just for fun, to see if you can recreate the original triplets (eg. S1,B1,BofA):

```
SELECT SB.Buyer, SN.Seller, BN.LendingBank
FROM SellerBuyer as SB, SellerBank as SN, BuyerBank as BN
WHERE BN.Buyer=SB.Buyer
AND BN.LendingBank=SN.LendingBank
AND SN.Seller=SB.Seller
```

Question: what, if any, is the problem with the above query?

The query will result in correct triples such as (S1,B1,BofA) etc, but ALSO wrong ones such as (S1,B1,Chase) [because it will multiply all three tables].

Q4 (1+1=2 points). You pull out your smartphone, log on to your banking app, and proceed to transfer $7200 (to pay for a 4-unit 'SC course!) from your savings account into your checking account. Prior to the transfer, you had $20,000 in savings and $800 in checking. While you are in the middle of doing this, due to poor DB design, a report generator (that would produce a monthly statement to email you) runs on the bank's server. **What could go wrong, and what is such a scenario called?**

If the report generator grabs the 'After' value of saving ($12,800) and 'Before' value of checking ($800), it will show our balance incorrectly as $13,600 [instead of $20,800]. This is an 'Inconsistent Retrieval'.

Q5 (2+2=4 points). How would you optimize (by rewriting) the following two queries?

a. `SELECT * FROM TBL WHERE substr(STATE,1,1)='C'`
[we want to select all rows containing states CA, CO, or CT;
substr(<string>,1,1) returns the first character of a string]

WHERE STATE IN (CA,CO,CT) [or, can use OR]

b. `SELECT * FROM TBL WHERE AGE>21`
[the AGE column stores ages as 0..99 integers; assume it has been indexed]

WHERE AGE >=22 [the = will result in the index being used to fetch all entrie s that are >=22, no row-by-row comparison in the main table needed!]

Q6 (4 points). In the world of relational DBs, the 'ACID' properties ensure that a DB always preserves data integrity. In the newer world of Internet-enabled, distributed DBs, there is instead 'BASE'. **What two essential features of a DB are traded off, in BASE?** Explain using an example (or two).

Consistency (all copies of a fragment need to contain identical data), and Availability (a transaction should always be achievable, without 'downtime').

Q7 (4 points). What operation does the following SQL query implement?

```
SELECT DISTINCT c
FROM TABLE_A as t1
WHERE EXISTS (SELECT *
              FROM TABLE_B as t2
              WHERE t1.c = t2.c);
```

Finds the INTERSECTION of t1 and t2.

Q8 (5 points).

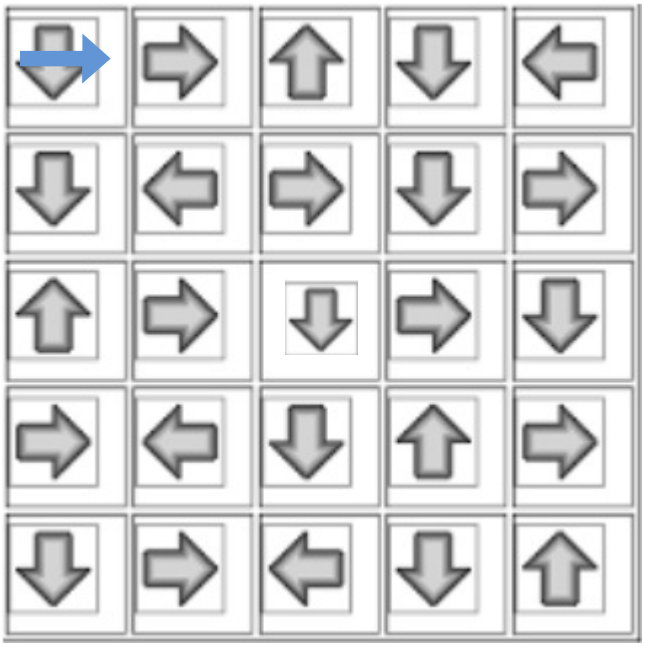
What does the following query do (:Name is simply a local variable)**?**

```
SELECT :Name, MAX(P1.reviewDate), P2.reviewDate
FROM EmpDB as P1, EmpDB as P2
WHERE P1.reviewDate<P2.reviewDate
      AND P1.EmpName=:Name
      AND P2.reviewDate = (SELECT(MAX(reviewDate) FROM
EmpDB)
GROUP BY P2.reviewDate;
```

Finds the 2 latest reviews for an employee.

Bonus question (1 point).

Complete the puzzle below..



Trace a clockwise spiral from the top-left, observe the sequence: down,right,up,down,left,right.. Repeat the sequence along our spiral path :) That makes the central square have a 'down' arrow.