Midterm – Thurs. Oct. 21st

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- 50 minutes, 1:30-2:20pm
- Online
- Topics covered…

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Relational Model

3

- Logical model, physical model
- Constraints, keys (superkey, PK, FK)
- Referential integrity, ways of enforcement

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E-R Model

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- Read and interpret an ER diagram
- How to translate English requirements to an ER diagram
- Different types of relationships
- Weak entities
- ISA hierarchies
- Constraints

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SQL

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- DDL, DML
- Relational predicates, clauses, operators, joins, aggregation, grouping, etc.
- Keys: PKs, FKs, referential integrity (ways of enforcement)
- Bag semantics vs. set semantics
- Given a schema:
  - Evaluate the results (output) of an SQL query
  - Translate English statement to an SQL query

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Views

6

- View definition
- Distinction between virtual vs. materialized views
- Insertions and updates on views

6

Question 1

7

For each of the following statements, indicate whether they are true or false:

a) In SQL, there can be multiple primary key declarations in one create table statement. **False**

b) A relation R(A, B, C) may have at most three (minimal) keys (not superkeys). **True**

c) Let R be a bag over the attributes A, B . If A is a key for R, then R is necessarily a set. **True**

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Question 1 (cont'd)

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d) In SQL, there can be multiple unique (key) declarations in one create table statement. **True**

e) The value of any arithmetic operation involving a null value (e.g., '5-Null') is null. **True**

f) In SQL, DDL stands for Data Definition Language and DML stands for Data Management Language. **False**

g) A weak entity set has one or more many-many relationships to other (supporting) entity sets. **False**

h) An update to a virtual view must eventually be synchronized to its base tables. **False**

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Question 2: Create an ER diagram modeling the same information. If the ER diagram cannot capture all dependencies, explain.

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```
create table Books (ISBN   char(10) primary key,
                    author char(30) foreign key references Authors,
                    title  char(50),
                    qty    int)

create table Authors (name char(30) primary key,
                      institution char(30))

create table Borrowers (cardno  int primary key,
                        name  char(30))

create table Loans (cardno int foreign key references Borrowers,
                    isbn   char(10) foreign key references Books,
                    due    date,
   primary key (cardno,isbn,due))
```

Entity Set Books with attributes ISBN (Key), title, qty. No author attribute!
Entity set Authors with attributes name (key), institution.
Entity set Borrowers with attributes cardno(key), name.
Binary Relationship set Wrote between Books and Authors that is many:one (solid arrow on Author side).
Binary Relationship Loans between Books, Borrowers with attribute due date.

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Question 3

- Product(maker, model, price)
- PC(model, speed)
- Printer(model, type)

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- model is the primary key for all relations.
- The only possible values of type are "laser" and "ink-jet".
- Every PC model and every printer model is a Product model (that is, every PC or printer must be referenced in the relation Product).
- The price of a product should not be more than 10% higher than the average price of all products.

```
create table Product (
model integer not null primary key,
maker char(20),
price integer (check price =< (select avg(price)*1.10 from Product))
)

create table PC (
model integer not null primary key,
speed char(20),
model foreign key references Product
)

create table Printer (
model integer not null primary key,
type char(20),
check (type in \{'laser', 'ink-jet'\}),
model foreign key references Product
)
```

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Question 3(b)

- Product(maker, model, price)
- PC(model, speed)
- Printer(model, type)

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Write in SQL: Find makers from whom a combination (PC and printer) can be bought for less than $2000 .

```
SELECT distinct p.maker
FROM Product p
WHERE EXISTS (
   SELECT *
   FROM PC pc, Printer t, Product p1, Product p2
   WHERE p1.model = pc.model and p2.model = t.model and
         p1.price + p2.price < 2000 and p1.maker = p.maker and
         p2.maker = p.maker )
```

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