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INFSCI 2710 "Database Management" — Example for Midterm Exam II —

Instructions

- This is the midterm exam from the Summer 1999 edition of this course.
- There were 2 hours, 30 minutes time for solving the exercises.
- The midterm exam in this course may contain some new types of exercises, e.g. multiple choice questions.

Exercise 1 (ER Design) 12 Points

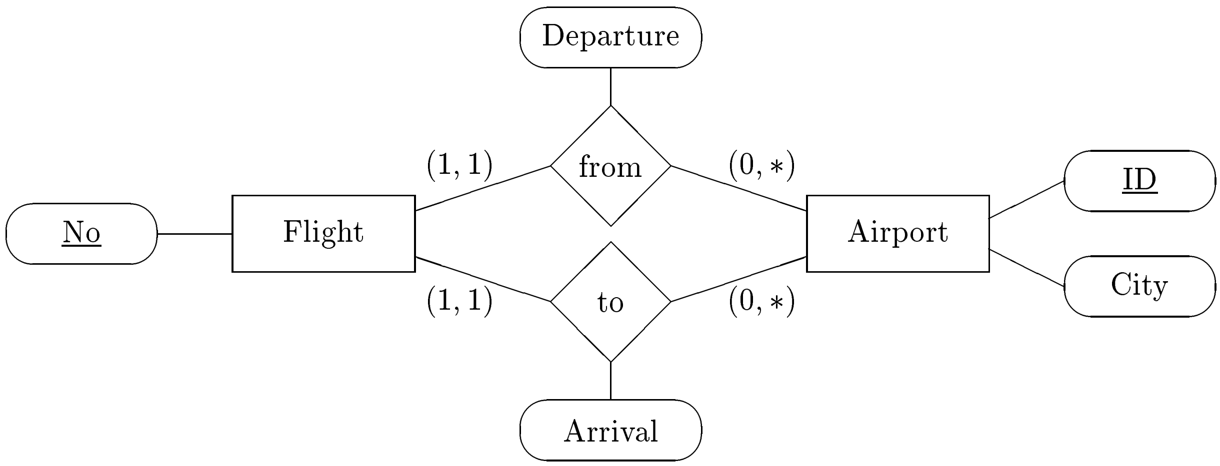
Please design an ER-Schema for a database of a canteen/cafeteria.

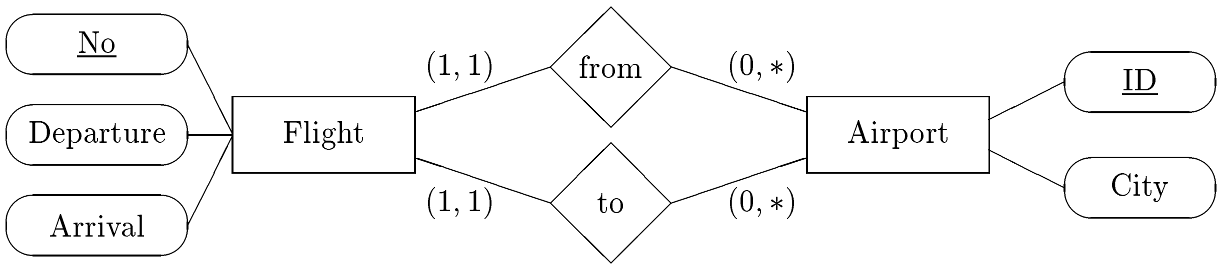
- The canteen has a certain repertoire of menus it can produce. Each menu has an identifying number, a name, and a price. The name is used for advertising the menu, menus which differ only slightly can have the same name.
- Each day, the canteen offers several menus from its repertoire. It wants to store which menu was offered on which day and how often it was sold.
- Internally, the menus are constructed from a main course (usually meat) and several side dishes (e.g. soup, salat, vegetables, dessert). In this canteen the customer cannot choose the side dishes. The composition of a menu is used only for the preparation, because every component can be prepared independently. Also, if some component is used in different menus, the information about it does not have to be stored redundantly.
- For every menu component, the recipe has to be stored (how to cook this part of the meal). It is important that the type distinction (main course or side dish) is represented and that every menu consists of exactly one main course.
- Finally, the ingredients of the menu components have to be stored (e.g. potatos, carrots, cheese, ...). For each ingredient, the name and the number of calories per 100g are stored. An ingredient can be used for several menu components.
- You also have to store how many grams of each ingredient are used for a menu component.

Please define also keys and cardinalities. If other constraints should be needed, it suffices to sketch them in natural language.

Exercise 2 (Comparison of ER-Schemas) 3 Points

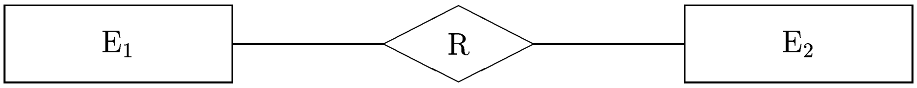
Is there an essential difference between these ER-schemas? The departure and arrival times are once represented as attributes of the relationships "from" and "to", and once represented as attributes of the flight. Please explain your answer.



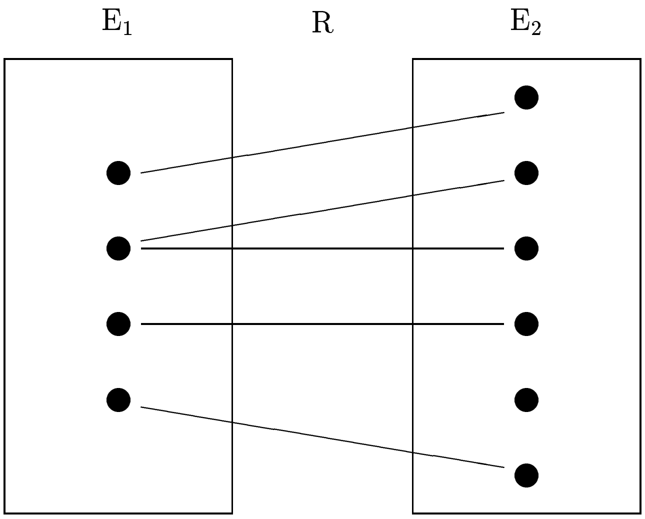


Exercise 3 (Cardinalities) — 2 Points

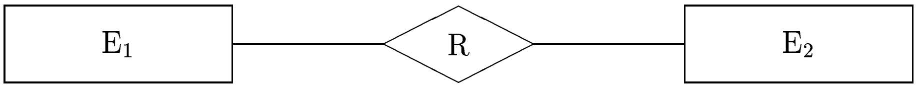
Suppose you want to define cardinalities for a relationship:



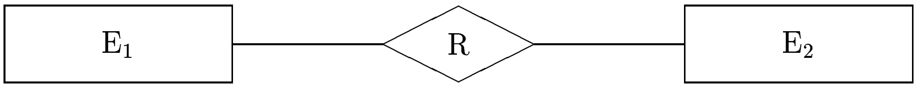
You have developed an example state for your schema which looks like this:



a) What would be the strongest cardinalities (most restrictive) you can define such that this state would be valid?

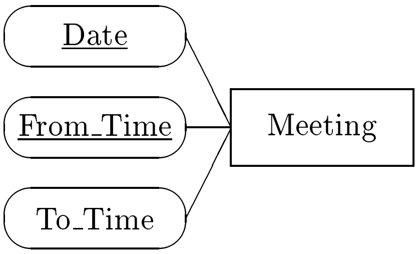


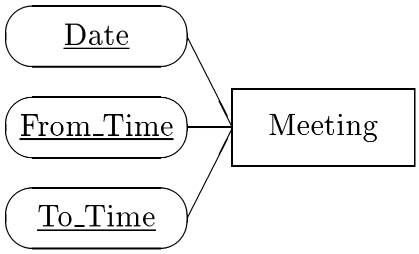
b) Please give an example of weaker cardinalities, which this state satisfies, but which also allow very different states?



Exercise 4 (Keys) 3 Points

Which key is more restrictive?





Give an example of a database state which is valid with the less restrictive key, but invalid with the more restrictive key. You don’t have to use any special notation for the database state. You can sketch it in natural language or with a small drawing.

Example Database for Exercises 5 to 8

Consider a shop for flowers on the world wide web (like 1800flowers.com). It offers a selection of different bouquets (bunches of flowers) described in the table “Flowers”:

Flowers			
Prod	Name	Description	Price
12	Spray Roses	... 10 stems ... freshest flowers ...	19.99
14	Sunflower Vase Arrangement	... 12 mini sunflowers ...	44.99
15	Love’s First Bloom	... multicolored roses ...	49.99
16	Garden of Grandeur	... magnificant arrangement ...	84.99
⋮	⋮	⋮	⋮

The table “Customer” contains information about customers:

Customer								
Cust	CName	CAddress	CCity	CZip	CState	Card	CardNo	Exp
1010	S. Brass	135 Bellefield	Pittsburgh	15260	PA	Visa	000	7/99
3005	Romeo	Main Street	Lexington	40506	KY	Visa	001	8/99
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

Next, there is a table with information about orders and recipients (to whom the flowers should be delivered):

Order								
Ord	Prod	Cust	Date	RName	RAddress	RCity	RZip	RState
23050	15	1010	07/14/99	N. Brass	Centre Ave	Pittsburgh	15213	PA
78901	16	3005	06/30/99	Julia	Broad Str	Stanford	94305	CA
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

"Prod" identifies the product, i.e. which bouquet should be delivered, "Cust" identifies the customer (who ordered the flowers). "Date" is the date when the flowers should be delivered. Some of the flowers are sent via FedEx:

Mailed		
Ord	MDate	Tracking_No
34700	06/29/99	23456789
⋮	⋮	⋮

Other orders are given to local flower shops:

Subcontracted		
Ord	Shop	Phone
23050	Pittsburgh Flowers	(412)123-4567
⋮	⋮	⋮

Exercise 5 (Relational Algebra) 15 Points

Formulate the following queries in relational algebra. Your queries must work with any database state, not only with the example. You get three points for every correct query.

a) Give all information about flower bouquets which cost over $50.

b) Print the recipient name and address of all orders to be delivered in Pittsburgh after 10/07/99. You can compare date values by the standard operators <, >, <=, >=.

c) Print the name and city of all customers who ordered product number 12.

d) Print the numbers of all orders ("Ord") such that the person who ordered the flowers lives in the same city as the recipient of the flowers.

e) Print the cities and states to which orders were mailed via FedEx.

Exercise 6 (Relational Algebra Errors) 2 Points

What is the error in this relational algebra query? Please give a short explanation.

$$\pi_{\text{Description}}(\text{Customer} \bowtie \text{Order})$$

Exercise 7 (SQL) 9 Points

Formulate these queries in SQL. Note that the queries are not the same as in Exercise 5. Each correct query earns you 3 points.

a) Give all information about flower bouquets which contain the substring “roses” in their description. (You must use the `LIKE` operator of SQL for this.)

b) Print the recipient name and address of all orders to be delivered in Pittsburgh or Philadelphia on 10/07/99. (Note that the date restriction applies to deliveries in both cities.) Date values are normally written in Oracle as `'10-JUL-99'`.

c) Print the order number, recipient name, city and state of all orders for flowers which cost over $50.

Exercise 8 (SQL Errors) 6 Points

Each of the following three SQL queries contains an error. Please mark it and give a short explanation.

a)
```
SELECT CAddress, CCity, CZip, CState
FROM   Customer
WHERE  CName = "S. Brass"
```

b)
```
SELECT Ord
FROM   Orders, Subcontracted
WHERE  Orders.Ord = Subcontracted.Ord
AND    RCity = 'Pittsburgh'
```

c)
```
SELECT *
WHERE  Name = 'Spray Roses'
```