CSE-A1200 Databases

Exam May 19th, 2015 **No calculators or extra material allowed**

Students whose mother tongue is not Finnish may use a dictionary, if it does not contain any markings. Those students may also obtain both Finnish and English exam sheet, if they want.

Please write your name, your student ID, the name and the code of this course, the date, and the total number of the papers you submit on top of each paper you submit.

1. a) (8 p) A firm has several branches and it often has to transport various items from one branch to another. It is possible that the same item has to be transported several times (for example, at first from Branch A to Branch B and a few days later from Branch B to Branch C). Construct an E/R diagram for the database to describe the transportations based on the following information. Use the notation used in the course text book and underline the key attributes.

   The branches of the firm have an id (unique), name and address. Each branch has employees, who have an id, a name, a title, and phone number. The ids of the employees are unique within a certain branch, but employees from different branches may have the same ids. Each employee works at just one branch.

   The same transportation may include several various items. Each item has an id (unique), a name and a weight. The transportations are carried out by vehicles, which have a license number (unique), brand, model and capacity.

   The transportations have a unique id. In addtion, they have information about the date, the starting time, the branch where the transportation leaves, the branch where the transportation arrives, the items belonging to the transportation, the vechile used and the employee who is the driver. For the sake of simplicity, we assume the the transportations always go directly from one branch to another and do not visit any other branches between them. The driver may work in any branch.

   b) (2 p) Convert the E/R diagram from part (a) into relations. Write the relation schemas and underline the names of the key attributes.

2. Consider the following database schema which presents information on a chain of shops: its customers, shops, purchases of the customers, various campaigns and how the customers take part in the campaigns.

```
Customer(nro, name, address, yearofbirth)
Shop(id, name, address)
Purchase(custnro, shopid, time, value)
Campaign(code, name, description)
Takenpart(custnro, campaignid, time)
```

   Relations `Customer` and `Shop` contain basic information on customers and shops. A tuple in relation `Purchase` includes information about one purchase (which may contain several items) of a certain customer in a certain shop. Attribute `time` includes the date and the time of the purchase and attribute `value` the total value of the purchase. Relation `Campaign` includes information on the sales and other advertising campaigns and relation `Takenpart` includes information that a certain customer has taken part in certain campaign (by buying an item in a sale, for example).

   The values of the purchases are decimal numbers. Other attributes are strings. You may assume that the tuples of the relations do not contain NULL values.

   Write the following SQL queries:

   a) (2 p) The numbers and the names of the those customers who have made a purchase with the value of over 200 euros from any shop of the chain. (We consider the value of a single purchase, not the total value of several purchases.)

   b) (2 p) The numbers, the names and the years of birth of those customers who were born before year 1960 and who have taken part in the campaign with name Big Craziness. Order the results by the name of the customer.

   c) (2 p) The numbers, the names and the addresses of those customers who have made at least one purchase in the shop with the name Tuppuraisen Valinta, but who have never bought anything from the shop with the name Market Huippu.

   d) (2 p) Find the customers whose address contains the string 'Espoo' and whose total value of purchases in all shops of the chain is at least 4000 euros (this means the total value of all purchases of one customer). For those customers, the query should produce the customer id, the name and the total value of the purchases of this customer.

Continues!

Write the following queries as expressions of the relational algebra:

e) (2 p) The name of the shop, the value of the purchase and the time of the purchase of all purchases which are made by a customer with name Matti Lahti (or by customers, if there are several with the same name) and having the value of over 150 euros.

f) (2 p) The numbers and the names of those customers who have taken part in exactly one campaign (not in two or more campaigns).

3. Consider a relation R with schema $R(A, B, C, D, E)$ and functional dependencies $AB \rightarrow C$, $B \rightarrow E$, and $D \rightarrow E$.

   a) (1 p) Explain why this relation is not in Boyce-Codd normal form (BCNF).

   b) (6 p) Decompose the relation using the BCNF decomposition algorithm taught in this course and in the text book. Give a short justification for each new relation. Continue the decomposition until the final relations are in BCNF. Explain why the final relations are in BCNF.

4. (7 p) What are the four important properties of the transactions in a database managament system? Use a few sentences to explain each of these properties. Just listing the names of the properties and writing 1-2 sentences about each are not enough for 7 points.

5. (4 p) Consider the following XML document:

```
<?xml version = "1.0" encoding = "utf-8" standalone = "yes"?>
<Webstore>
    <Order status = "delivered">
        <Customernro>556689</Customernro>
        <Product group = "photography">
            <Productnro>T-845786</Productnro>
            <Name>Canon Ixus 145 </Name>
            <Price>75.00</Price>
        </Product>
    </Order>
    <Order status = "in post">
        <Customernro>599689</Customernro>
        <Products>
            <Product group = "tableware">
                <Productnro>T-774477</Productnro>
                <Name>Arabia Teema plate 15</Name>
                <Price>12.95</Price>
                <Amount>6</Amount>
            </Product>
            <Product group = "photography">
                <Productnro>T-149856</Productnro>
                <Name>Nikon D3200</Name>
                <Price>359.00</Price>
            </Product>
        </Products>
        <Additionalinfo>
            <Payment>Invoice</Payment>
            <Delivery>Matkahuolto</Delivery>
        </Additionalinfo>
    </Order>
    <Campaign>
        <Campaignname>Winterbang</Campaignname>
        <Product group = "photography">
            <Productnro>T-663399</Productnro>
            <Name>Sony Alpha 5000</Name>
            <Price>390.00</Price>
        </Product>
        <Leaflets>30000</Leaflets>
    </Campaign>
</Webstore>
```

Continues!

What are the results of the following XPath queries? Give the complete results. If the result is empty, state it in your answer.

a) `/Webstore/Order//Product/Name`

b) `/Webstore/Order/Product/Name`

c) `/Webstore/Order/Additionalinfo`

d) `/Webstore//Product[@group = "photography"]/Price`

Please fill the course feedback form before May 26th. The link has been sent to the registered students by e-mail.