

Tentamen 2003-12-18

DATABASTEKNIK - 1DL116, 1MB025

DatumTorsdagen den 18 December, 2003
Tid8:00-13:00
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Hjälpmedelminiräknare

Anvisningar:

- Läs igenom hela skrivningen och notera eventuella oklarheter innan du börjar lösa uppgifterna. Förutom anvisningarna på skrivningsomslaget så gäller följande:
 - Skriv tydligt och klart. Lösningar som inte går att läsa kan naturligtvis inte ge några poäng och oklara formuleringar kan dessutom misstolkas.
 - Antaganden utöver de som står i uppgiften måste anges. Gjorda antaganden får förstås inte förändra den givna uppgiften.
 - Skriv endast på en sida av papperet och använd ett nytt papper för varje uppgift för att underlätta rättning och minska risken för missförstånd.
- För godkänt krävs det cirka 50% av maxpoäng.

1. **Database terminology:** 4pts

Concisely explain the following concepts (in a database context):

- (a) meta data
- (b) full functional dependency
- (c) transaction
- (d) candidate key

2. **Conceptual data modeling:** 4pts

Enhanced Entity-Relationship modeling, to various degree, supports features to group entities. Explain what information the following two features are representing and how they can be represented in EER:

- (a) specialization
- (b) aggregation

3. **Relational algebra and SQL:** 4pts

Assume that we have two relations (tables) with the following relational schemas, where *ID determines keys:

```
CIRCLE(CID,CNAME,RADIUS,POINTID)
POINT(PID,PNAME,X-COOR,Y-COOR)
```

- (a) Express in relational algebra the following query: Which keys, names, radii and x-coordinates of their centre do those circles have that have a radius under 50.0 (cm), and that have its centre point in the positive half plane $x > 0$. (1pt)

Assume that we in a database have one relation (table) with the following relation schema:

```
RECTANGLE(RID,RNAME,X1COOR,Y1COOR,X2COOR,Y2COOR)
```

where RID determine the key, RNAME is a name, and **COOR:s are x- and y-coordinates for the rectangle in the xy-plane. All edges to single rectangles are parallel to an x- or y-axis, i.e. no rectangle is rotated with respect to an xy-coordinate system. Formulate the following queries in SQL:

- (b) How big is the area of each rectangle? (1pt)
- (c) Which pair of rectangles (e.g. keys and names) overlap each other (duplicates are allowed in the result)? (2pts)

4. **Recovery:** 4pts

Describe the basic steps in the recovery procedure according to the deferred update model in a multi-user version.

5. **Database application interfaces:** 4pts

- (a) What is ODBC? (1 pt)
- (b) Describe the architecture of ODBC. Draw a picture. (2 pts)
- (c) What is the difference between JDBC and ODBC? (1 pt)

6. **Query optimization:** 4pts

A large company maintains a table of the effectiveness of their sales force:

```
SALES(SSN, SALES, ...)
```

containing the SALES (in \$) of each sales person identified with SSN (social security or 'person' number), primary clustered B-tree index on SSN and secondary unclustered B-tree index on SALES. There are 10000 sales persons and 10 rows fit in a disk block while 100 keys fit in each index node block. The management needs to regularly know the top ten sales performers and you are asked to design an application program to quickly get those stars. SQL nowadays provides an extension to express such top-10 queries and with it the query in this case would look like:

```
select ssn, sales
stop after 10 rows
from sales
order by sales descending
```

This means that the application will get at most the 10 first rows back from the query.

- (a) What is the advantage from a performance point of view to have such a 'stop after n rows' clause in select? (1 pts)
- (b) What execution plan is optimal? Show why it is optimal. (3 pts)

7. **Database integrity:** 4pts

- (a) Give examples of 3 kinds of actions that can be taken when referential integrity constraints are violated in SQL. (3 pts)

(b) What are 'domain constraints' in SQL? (1 pt)

8. Multi-media Databases:

4pts

- (a) Why is object-relational technology good for storing multi-media objects in databases? (2 pts)
- (b) What are BLOBs and what are they used for? (1 pt)
- (c) Why is RAID good for storing databases? (1 pt)

Good luck and Merry Christmas!

/ Kjell och Tore