Exam SD-202 databases

2021-06-22, 8:30am-11:30am

Documents and Internet are authorized.
Website of the class : `https://clarus.github.io/telecom-database-course/`

1 General questions

5 points

1. How do we generaly choose the number of leafs per node in a B-tree ? Why do we make such a choice ?
2. Give two advantages in using a database system rather than directly using the file system to register data.
3. Which keyword do we use to filter the results from an aggregated request ?
4. Why is it not possible, in general, to update the data directly in a vue ? Give an example to illustrate the challenge.
5. Give an example of conceptual difference between the relational algebra set theory and SQL.

2 Relational algebra

1 point

1. Express the following request :
   SELECT DISTINCT NumAccident
   FROM Accident, Car
   WHERE
   Accident.NumCar = Car.NumCar AND
   Car.Size $>$ 6
   using the following operators of the relational algebra :
   — selection σ
   — projection π
   — join on a column $\bowtie_c$

3 Functional dependencies

7 points

1. By coming back to the definition, show that the transitivity rule holds :
   If $A \rightarrow B$ *and* $B \rightarrow C$ *then* $A \rightarrow C$.
2. How to represent an unordered list in first normal form ? Give an example, with some clients having each a list of phone numbers.
3. Does the BCNF form imply 2NF and 3NF ?
4. Given the following attributes :

   Address, Cat, Account, Datecorder, Label, Place, NCli,
   NOrder, Name, NPro, Price, QOrder, QStock

   with the following functional dependencies :
   — NCli → Name, Address, Place, Cat, Account
   — NPro → Label, Price, QStock
   — NOrder → NCli, Datecorder
   — NOrder, NPro → QOrder
   Decompose this relation into a BCNF form.
5. On the tables given by the BCNF decomposition from the previous question, write the SQL requests to obtain :
   — the list of the places for which there exists at least one client,
   — the places of the clients who order the product named "FOO-BAR",
   — the sum of all the prices of the products in stock,
   — the places of the clients who ordered at least one item,
   — the places from which no clients ordered something.
6. Propose a minimal cover for the following set of functional dependencies :

   $\{D \rightarrow B, BE \rightarrow C, DA \rightarrow D, C \rightarrow F, DE \rightarrow F, FGH \rightarrow C, A \rightarrow B, AD \rightarrow G\}$

   We suppose that the attributes are the letters A, B, ..., H.

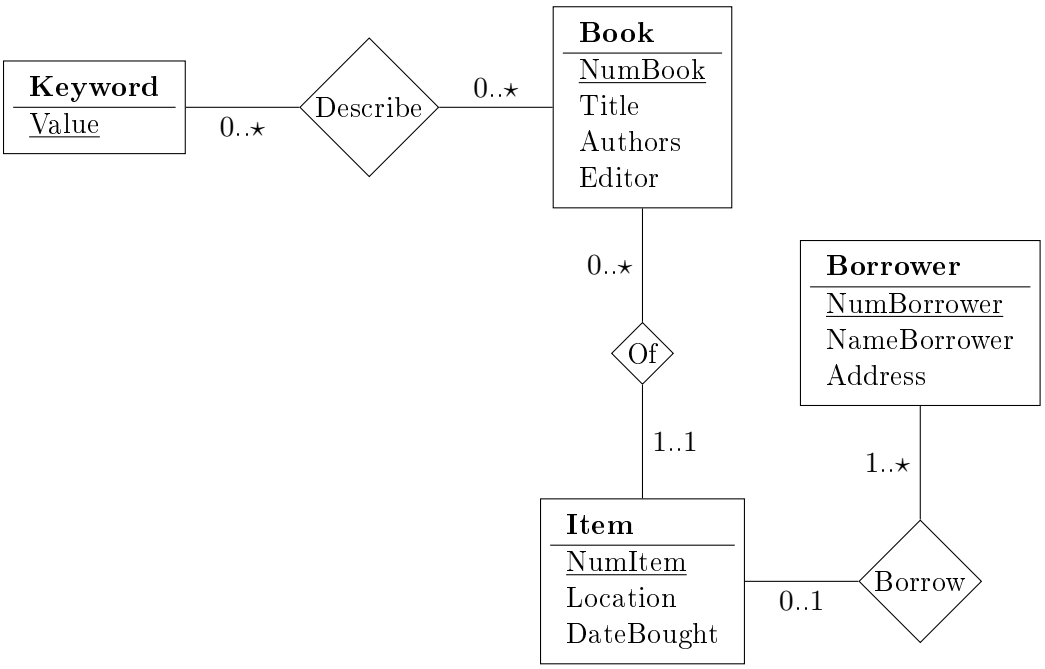
4 Entity-relationship model

7 points

1. Given the following relational schema :
   — Folder(NumFolder, Title, DateRecording, #NameDirection, #NameDepart, #NameService)
   — Service(NameService, Manager, #NameDepart)
   — Employee(NumEmp, NameEmp, Address, #NameService)

— Departement(NameDepart, Localisation, #NameDirection)
— Direction(NameDirection, President, Address)
give a corresponding entity-relationship diagram. We suppose that the attributes with a # are foreign keys.

2. Give an extension of this diagram so that the date of arrival of an employee in a service is also stored.
3. Give a relation schema corresponding to the following ER-diagram :



4. Write the SQL requests to obtain :
   — the number of occurences of each keyword,
   — the items corresponding to a given keyword "foo",
   — people who borrowed an item from each editor,
   — the borrower having the largest number of items of the same book.