Database Systems, CSCI 4380-01
Homework #1 Solutions
Due Thursday February 3, 2011 at 2 pm

Please submit your answers as a text or PDF file via RPILMS assignment drop box function.

Question 1 (20 points). For the following relations, based on your understanding of the meanings of these attributes, describe the best keys for these relations. Write down a single sentence the justification for your choice of key.

(a) User(username, name, email, address)

   Answer:username or email. Both username or email can be a key.

(b) UserPhone(*keyForUser*, phoneNo, type)

   Users can have multiple phones of any given type. People can share phone numbers.

   Answer:keyForUser, phoneNo. Because phoneNo decide the phone type, we also need to know who use this phone to identify the relation.

(c) Posting(day, time, content, *keyForUser*)

   Users post various type of content on this site.

   Answer:day,time,keyForUSER. Each user might post the same type of content more than once, but not at the same time and date, which makes the posting unique.(povided by James McMillan)

(d) Link(date, time, link, *keyForPosting*)

   Users can add multiple links to their postings.

   Answer:Key1:date,time keyForPosting. Key2: keyForPosting, link. For key1, The date/time for posting is not the same as the date/time for adding the link, no one can add more than one link at the same time and date. For Key2, No one will add more than one same link in one posting.

Question 2 (50 points). You are given the following simple relations (for simplicity, we are using unique integer ids as identifiers in this example):

Person(id, name, countryOfBirth, yearOfBirth)
Topics(id, title)
Books(id, title, publisher, isbn)
BookAuthor(book_id, person_id)
BookEditor(book_id, person_id)
BookTopic(book_id, topic_id)

Write the following queries using relational algebra.

(a) Find books published by 'Morgan Kaufman'. Return the id and title.

Answer:

$\pi_{id,title}(\sigma_{\texttt{publisher='Morgan Kaufman'}} Books)$

(b) Find people who were born in 'France' before 1900. Return id and name.

Answer:

$\pi_{id,name}(\sigma_{\texttt{countryOfBirth='France' and yearOfBirth<'1900'}} Person)$

(c) Find the id of all people who are both book authors and editors.

Answer:

$\pi_{person\_id}(BookAuthor) \cap \pi_{person\_id}(BookEditor)$

(d) Find books on topic 'Open Source Software'. Return their id and title.

Answer:

R1:= $\pi_{id}(\sigma_{\texttt{title='Open Source Software'}} Topics)$

R2:= $\pi_{book\_id}(R1 \bowtie_{\texttt{id=topic\_id}} BookTopic)$

$\pi_{id,title}(Books \bowtie_{\texttt{id=book\_id}} R2)$

(e) Find people who are not book authors (i.e. who never appeared as a book author in the database.) Return their id.

Answer:

R1:= $(Person \bowtie_{\texttt{id =person\_id}} BookAuthor)$

π_{id} (Person) - π_{id} (R1)