Tutorial: Relational Algebra

Students at the National University of Ngendipura (NUN) buy books for their studies. They also lend and borrow books to and from other students. Your company, Apasaja Private Limited, is commissioned by NUN Students Association (NUNStA) to implement an online book exchange system that records information about students, books that they own and books that they lend and borrow.

The database records the name, faculty, and department of each student. Each student is identified in the system by her email. The database also records the date at which the student joined the university (year attribute).

The database records the title, authors, publisher, year and edition and the ISBN-10 and ISBN-13 for each book. The International Standard Book Number, ISBN-10 or -13, is an industry standard for the unique identification of books. It is possible that the database records books that are not owned by any students (because the owners of a copy graduated or because the book was advised by a lecturer for a course but not yet purchased by any student.)

The database records the date at which a book copy is borrowed and the date at which it is returned. We refer to this information as a loan record.

For auditing purposes the database records information about the books, the copies and the owners of the copies as long as the owners are students or as there are loan records concerning the copies. For auditing purposes the database records information about graduated students as long as there are loan records concerning books that they owned.

This tutorial uses the schema from "Tutorial: Creating and Populating Tables" including all the updates done during the tutorial.

Questions

Not all questions will be discussed during tutorial. You are expected to attempt them before coming to the tutorial. You may be randomly called to present your answer during tutorial. You are encouraged to discuss them on Canvas Discussion.

1. **Relational Algebra**.

   (a) Find the different departments in School of Computing.

   (b) Let us check the integrity of the data. Find the emails of the students who borrowed or lent a copy of a book before they joined the university. There should not be any.

   (c) Print the emails of the students who borrowed but did not lend a copy of a book on the day that they joined the university.

2. **Universal Quantification**.

   (a) Print the emails and the names of the different students who borrowed all the books authored by Adam Smith.

References

[1] S. Bressan and B. Catania. *Introduction to Database Systems*. McGraw-Hill Education, 2006. ISBN: 9780071246507.

[2] Raghu Ramakrishnan and Johannes Gehrke. *Database Management Systems*. 2nd. USA: McGraw-Hill, Inc., 2000. ISBN: 0072440422.