



## Tutorial: Entity-Relationship Model

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 his/her email. The database also records the date at which the student joined the university. If a student has graduated, the database record the date of graduation. A department in NUN must belong to exactly one faculty.

The database records the title, authors, publisher, language, year as well as the ISBN-10 and ISBN-13 for each book. A book can have several authors but it must have at least one author. The database also records author that currently has no book. It should also record the format of the book (i.e., if the book is hardcover or softcover). 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 (e.g., 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).

A student may own multiple copy of the same book. We differentiate the copy by its copy number. For instance, John may own two copies of the book Database Systems with ISBN-13 number of 9780131873254. The first copy has a copy number of 1 while the second copy has a copy number of 2. The copy number should be a consecutive number starting from 1.

The database also 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. Obviously, a student can only borrow or lend book after he/she is enrolled.

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.

### Questions

*Not all questions will be discussed during tutorial. You are expected to attempt them before coming to the tutorial. You are encouraged to discuss them on Canvas Discussion.*

**1. Entity-Relationship Design.**

- (a) Identify the entity sets.
- (b) Identify the relationship sets.
- (c) For each entity set and relationship set, identify its attributes.
- (d) For each entity set, identify its identifying attributes.
- (e) Draw the corresponding entity-relationship diagram with the key and participation constraints. Indicate in English the constraints that cannot be captured, if any.

**2. Logical Design.**

- (a) Translate your entity-relationship diagram into a relational schema. Give the SQL DDL statements to create the schema. Declare the necessary integrity constraints. Indicate in English the constraints that cannot be captured, if any.

## References

- [1] S. Bressan and B. Catania. *Introduction to Database Systems*. McGraw-Hill Education, 2006. ISBN: 9780071246507.
- [2] Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom. *Database Systems: The Complete Book*. 2nd ed. Prentice Hall Press, 2008. ISBN: 9780131873254.
- [3] Raghu Ramakrishnan and Johannes Gehrke. *Database Management Systems*. 2nd. USA: McGraw-Hill, Inc., 2000. ISBN: 0072440422.
- [4] W3schools Online Web Tutorials. <https://www.w3schools.com/>. [Online; last accessed 2025].