Date: Oct 12, 2021

Database Design

Addressing Business Problems

The goal of this database is to reduce the data redundancy and improve data consistency by merging all the databases and data descriptions(metadata) into one central repository. For Example, in a university, departments have their own isolated databases, which is just catering to their own needs. If personnel from administration needs to access the information on a student, they need to login into a department specific database and retrieve the information. In another scenario, if a student from an IT department wishes to opt for a course from the Journalism department, the administration will register a separate student record in the Journalism department. This will lead to data redundancy as the database in the Journalism department may hold the same metadata as the IT department. If a student needs to update his phone number or address, he needs to reach out to both the departments to ensure data consistency. This is one of the major objectives we are trying to resolve in this project. We are also trying to address few more business problems in a University Database Model:

- Using a centralized database to track overall student's academic performance regardless of the department they belong to and determine the list of students with lower grades. This will help the University and the Professors to focus more on these students and look at ways to assist them.
- Determine the number of courses handled by Professors and ensure that sections per course is evenly split between Professors. Also, determine the number of sections required based on course registrations.
- Making course registration easier. Suppose a student wants to opt for a course from a different department, he can do so by accessing the course registration system which is in sync with the central database.
- Making sure each student is assigned an advisor. Having a centralized database, gives the student flexibility to choose an Academic Advisor (from any Department) or a counsellor they are comfortable with.

Decoding the ER Diagram

Defining Entities

S. No.	Entity Type	Description
1	UNIVERSITY CAMPUS	An educational organization with multiple campuses and departments. Ex: Northeastern University
2	COURSES	Lists all the courses offered by the University from various departments. Ex: Database Management and Database Design
3	DEPARTMENTS	A component of a University which offers a set of courses applicable to an industry or field. Ex: College of Engineering
4	PROFESSORS	Faculty responsible to teach one or more courses in a department.
5	STUDENTS	A candidate enrolled into the University and has taken a course within the department.

6	GRADES	Scores secured by students. It is a measure of overall academic performance of the students within a Department or the University.
7	STAFF	Staff who are either a full-time or contract employees, they take care of administrative tasks within the University.
8	ADVISOR	An Advisor is a person who guides the students on academic matters
9	SECTIONS	Students are divided into batches based on the enrolment size. There is often a threshold on the number of students per section. More than one course can be assigned to one section.
10	COURSE REGISRATION	Students register for their courses at the start of the semester. They will need to access the course registration platform which is in sync with centralized database.

Business Rules (Relationships between Entities)

- A University can have many campuses. A campus will offer *at least one* COURSE. A COURSE *may or may not* be offered by a UNIVERSITY CAMPUS.
- A DEPARTMENT can be common to *one or many* UNIVERSITY CAMPUSES. UNIVERSITY CAMPUS will have *at least one* DEPARTMENT.
- A SECTION can be assigned to *at least a* COURSE. A COURSE will always be assigned to *one* SECTION.
- A student should register for *at least one* course. There should *one or more instances* within COURSE REGISTRATIONS per student. The ‘Course Name’ is a multi-valued attribute.
  Only one COURSE can be registered (in COURSE REGSITRATION) per STUDENT.
- STUDENT has secured *a* GRADE per course. GRADES *may one or more* STUDENTS
- Many PROFESSORs *may or may not be* assigned to a COURSE. But a COURSE can be assigned to *at least one* PROFESSOR. The PROFESSOR can be hired either on a PERMANENT or a CONTRACT BASIS.
- DEPARTMENT will have *at least one* PROFESSOR. Each PROFESSOR is assigned to *a* DEPARTMENT.
- DEPARTMENT will have *at least one* ADVISOR. Each ADVISOR is assigned to *a* DEPARTMENT.
- A STUDENT is assigned *one* ADVISOR. An ADVISOR *may have more than one* STUDENTS.
- Each STAFF *may or may not belong* to a UNIVESITY CAMPUS. A person from STAFF *may or may belong* to a specific campus.

Key Design Ideas

- Keeping an Associate entity – COURSE REGISTRATION between STUDENT and COURSES. A student can register for multiple courses per term (Fall/Spring/Summer) and a course can be assigned to many students per term.
- Adding ‘Course Name’ as Multivalued Attribute in COURSE REGISTRATION entity as there can be many courses a student may register for. One ‘Reg ID’ can have many Courses Names.
- COURSE REGISTRATION entities have two primary keys – Reg ID and Course ID. Both the keys are combined to form a composite key of the table. This ‘Reg ID + Course ID’ from STUDENT entity acts as foreign key which references this composite key.