**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** | CONTRACT STAFF | A Staff is a contract staff if they are employed on a contract basis via third party. |
| **11** | PERMANENT STAFF | A Staff is a permanent staff if they are employed as a Full Time Employee. |
| **12** | CONTRACT PROFESSOR | A professor is a contract professor if he is employed on a contract paid hourly. |
| **13** | PERMANENT PROFESSOR | A professor is permanent if he is employed as a Full Time Employee. |
| **14** | TEACHES | A professor teaches a course or more than one course which can be viewed by students in the Course Offerings. |
| **15** | BUILDING | University Campus has a number of Buildings and Buildings contain various Departments. |
| **16** | COURSE CATALOG | Students can view the Course Catalog. Course Catalog is a part of Course Offering and is structured by the University Campus. |
| **17** | 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 A STAFF can be hired either on a PERMANENT or a CONTRACT BASIS.
* A STUDENT must belong to at least one SECTION. A SECTION consists of multiple STUDENT.

## **Key Design Ideas**

* Used Subtype discriminators for PROFESSOR and STAFF i.e., used disjoint rule and Total Specialization.
* Taking an Associate entity – TEACHES between COURSE OFFERINGS AND PROFESSOR. A professor may or may not teach a particular course for that term and semester, but a course must at least have one professor.
* Taking an Associate entity – COURSE REGISTRATION between COURSE OFFERINGS AND STUDENT. It will tell us about the popularity for the course based on number of students registering for that course.
* Taking an Associate entity – GRADES between COURSE OFFERINGS AND STUDENT. It will tell us about the overall performance of students for that course.