SWitCH Dev 2024/2025

Database

Project requirements

ISEP is hiring SWitCH Dev (SWD)to develop the next generation of its academic management system, called Portal AI (PAI). The development of this new system leverages ISEP 30 years' plus experience on academic management software. The project is big in ambition and short on resources, thus ISEP management expects SWD students to develop a prototype covering some of the main features it wants to implement in the future.

This prototype must cover, the following areas: students, teachers, classrooms and labs, programmes, including their courses, student enrolment in programmes and courses, including grades, timetables, student and teacher attendance.

Programmes and courses

Every active student at ISEP must be enrolled in at least one programme. After graduating from a programme, it becomes an alumni of that programme. A student graduates when asks for a certificate of completion of the programme and fulfils all its requirements. The certificate includes the student's final grades on every course of the programme.

A programme may change over time, but there can be only one valid study plan of the programme at a time. When a study plan changes, the students enrolled in the programme are automatically moved to the new study plan, according to the equivalence map, which describes the relation between the courses in the previous plan and the new one. Course names may not change between plans. Each programme has a Programme Director (a teacher) and has a type: Bachelor, Master, Doctorate or Post-graduate. It is also assigned to a department.

A course has a name and an acronym, which are unique in the programme, but not across programmes. Also has a number of ECTS credits. Each course edition has a responsible teacher (RUC) and a course information sheet (FUC) (please see the example of LABPROJ1 https://portal.isep.ipp.pt/intranet/education/visualiza_ficha_uc_v10.aspx?cde=67139).

Grades in a course must be in the [0, 20] range, by Portuguese law. 10 is the passing grade. A student that has 10 or more in the final grade of a course is approved on that course.

A student cannot be enrolled in a course it has approved before, unless it is for grade improvement, and can only do this once. If the final grade he gets is less than the original one, he keeps the original one.

Students

ISEP is required to keep some basic information about its students: name, NIF, address, phone and email contacts. The students have the possibility to change this information.

When a student is enrolled in a programme, the access method is registered. Some examples: CNA, M23, Transfer, C1, C2, etc. They can change over time.

A student enrolled in a programme in a school year is also enrolled in a set of courses. There are limits for them minimum and maximum number of credits a student may be enrolled.

Teachers

A teacher belongs to a department, but he can teach courses in any programme. A teacher has a category and a working percentage (it is usually 50% or 100%, but it can be other).

Classrooms

A classroom may be a lecture room, a plain classroom or a Lab. It is on a building (currently, A to H).

A course class take place in a classroom and either starts at 10 minutes after the hour or 40 minutes after the hour. A class must have at least 1 hour. Each class has a set of programme classes assigned to it. At least one.

A classroom may be also assigned to a programme class without being assigned to a course.

Timetable

Each student has a timetable, i.e. the set of classes he has in a given week. Timetables can change along the weeks of the semester, but a course is assigned to a given semester. It cannot encompass multiple semesters. Each class has a course, a set of classrooms, a set of teachers, a beginning and an end. It may no encompass multiple days.

ISEP has classes from 08:10 to 23:40. The programme Director is responsible for defining the programme's semester, i.e. the days there are classes in the programme.

Attendance

There must records of student and teacher attendance of classes. There are rules for punctuality.

Project tasks

Part I

1.1. **Develop the relational data model** – This involves identifying the entities, attributes and relationships related to the problem. It must be clear in the model, which attributes constitute the primary keys, foreign keys and the relationships between entities and their cardinalities. The model must be in the **third normal form (3FN).** Your choices should be well justified. All integrity constraints that can't be represented in the model should be described. The restrictions of Integrity must be properly numbered. All non-trivial decisions must be justified.

1.2. **Creation of the Relational Data Model in the DB** - create tables, and apply trivial restrictions (e.g. NRCC, email, minimum and maximum values, default values, etc.) based on the data model developed.

Part II

Present the SQL command for the following queries:

(1) List the name(s) of the student(s) who have the highest number of subjects in arrears compared to any of student in the Switch programme.
(2) List the students with more enrolments than any student in the "Civil Engineering" course.
(3) List the name(s) of the students who have had courses with a workload of less than 60 hours, as well as the respective teachers who taught them.
(4) List the number, name, and course average of the top 20% of students and the bottom 20%. The average should be calculated considering only students who have passed all courses in their programme. The best students should be marked with "Top 20%" and the worst with "Bottom "20%".
(5) List the number and names of the students of Professor Angelo Martins in 2021 or 2023 who took classes with Professor Rosa Reis.
(6) List the names of teachers who only taught courses with a workload of more than 60 hours and less than 80 hours.
(7) List the name, category and department of teachers who have never taught more than two courses per academic year.
(8) List the names of the teachers, the names of their courses and, their respective grade average in 2021. Only consider courses where the professor is RUC.
(9) List the code of students who had a grade in the BDDAD course lower than the average grade for the subject, in the year 2023.
(10) For each programme, list the names of all courses that have prerequisites. For courses without prerequisites, include a column titled "Observations" with the message "No prerequisites".
(11) List the name, date and time of students who have enrolled in more than 2 courses after 12:30 p.m. for more than 3 years ago. Display the day of the week and the respective month (in full). The result must be presented in descending order of enrollment date and ascending order of time.
(12) For the first semester of the 2022-2023 academic year, list the classrooms where lecture classes were taught most often.
(13) For each professor in the computer engineering department, list the classrooms where they taught classes, as well as the type of class and the respective classes. Only professors who taught courses in the second semester of the 3rd curricular year should be considered.
(14) Considering the current academic year, list for each department the names of the teachers who have classes in rooms B106 and B109, on Mondays, Wednesdays and Fridays from 8 a.m. to 1 p.m. , and who have never been absent in the last 2 months.
(15) For the courses that had a failure rate higher than the failure rate of the LABPROJ1 course in the 2019-2020 academic year, list the name and total number of absences of the students who, in the last two months, had the highest number of absences in 2nd-year courses.
(16) Create a View that finds the students who had a higher number of attendances than the average attendance of the students in their class. Include the students' names and the difference in attendance between the student and the class average.

Part III

Deadline for delivery: January 26, 2025 - 23:59

Remarks:

The name of the zip file to be submitted in Moodle should be formatted as follows:

Group_XX.zip where,

XX – Represents the group (e.g. group xxx)

Note that the zip file to be delivered must contain the following files:

- report (.doc or .pdf) – the report must be concise and present the justification of all decisions taken for the development of the relational model. It should:
  - identify the work by title;
  - indicate the composition of the group, the curricular unit;
  - contain the relational model (image);
  - show the queries developed and describe the functional of each of them;
  - layout of each of the queries executed (screenshot of the results);
  - Conclusions.
- Relational model elaborated in a tools of design RM.
- Database creation script and data insertion. The data insertion script must contain at least 30 tuples of each table.