Practice Problem (PP9)

Class Diagrams

Prepare traditional class diagrams for the following problems showing at least 10 relationships among the following object classes, including associations, aggregations, and generalizations. Show multiplicities in your diagrams. Your model should have 3-5 attributes and 3-5 operations per class. Use association and role names when needed. As you prepare the diagrams, you may add additional object classes.

1. A database is being constructed to keep track of the teams and games of a sports league. A team has a number of players, not all of whom participate in each game. It is desired to keep track of the players participating in each game for each team, the positions they played in the game, their performance in the game, and the result of the game. **The purpose of this database is to keep track of the performance of each player per season and per his or her entire career.** Design a Class Diagram for this application, starting any assumptions you make. Choose your favorite sport (e.g., soccer, baseball, football, basketball).

2. Design a Class Diagram for a web-based tool called MyBus for the ACME Transportation Authority (ATA). This tool will help users plan a trip on ATA routes. It will allow users to enter the starting and destination location and will give the complete schedule for the bus route from the given starting point to the destination point. It will also calculate the total fare and time for the trip. MyBus will assume that the AVL (Automated Vehicle Location) system is installed on each bus. AVL system will continuously transmit the current location data to the central server at a refreshing rate of 1 minute. Based on this data, MyBus will allow users to see the bus’s current location and will be able to calculate the actual arrival time of the bus at a given destination. It will also allow users to see the adverse weather (or road conditions – you may add this feature later on) on these routes. Below is the list of the basic relations that you may use for this assignment. You may delete or add more relations if needed, based on ‘real-world’ specifications. Modularity and maintainability will be the key objectives in designing the database.

Main Relations:
Routes(street_name, x, y, -1, city_name, rno)
City(city_name, x, y)
BusStation(stationID, x, y, -1, parking_flag)
Fare(distance, fare)
Disclaimer: ACME Transport Authority (ATA) is an imaginary Transport corporation and could be assumed for an agency such as Santa Clara’s Valley Transportation Authority.

3. Problem Statement: Online “Senior Checks” System

Abstract

OSCS-Online Senior Checks System is an interactive, user-friendly system that will enable the SJSU Administrators to perform Degree audits efficiently. It also helps students to find the necessary course requirements needed for advancement towards their Degree. The system helps both the administrators and the students to identify the course requirements, report the deficiencies and advise students in taking classes to meet the requirements, choosing a major, and determining a graduation date. The system also performs administrative tasks, like updating the bulletin information and archiving the audit results.

Background

The San Jose State University (SJSU) regularly performs what it calls “Senior Checks” to make sure that students that will be graduating in the immediate future have met the necessary requirements for graduation. Those requirements include the requirements of any major(s) or minor(s) as well as the general requirements of the college the student is enrolled in, all according to the undergraduate bulletin the student is following. At the present time, this process is conducted by hand and takes several months to process a single student’s request. Immediately before graduation, a student must complete a second check to finalize their status. SJSU is looking to automate this process to increase the speed, accuracy and efficiency of the senior checks. Specifically, SJSU would like to see this process available with a web-based interface that would allow University administrators quick and easy access to the program without the need for specific software, as well as giving students access to the program to check their own progress towards graduation.

Existing Resources

In the recent past, SJSU has developed several automated web-based tools related to this problem. The two most relevant resources are the WAM system and the online schedule of classes. The WAM system provides students secure access to their record of classes. The online schedule of classes provides students with access to a searchable database of the classes offered during a given class term. These two resources will most likely be helpful in the implementation of any solution to this problem.

Description of the program that is wanted
SJSU is looking for the development of a program to perform the following main tasks:
1. Match the classes a student has taken against the major, minor, and general requirements.
2. Report any deficiencies in the student’s requirements.
3. Show a list of classes that would fulfill the deficiencies.
4. Store the results of the check for possible future reference by administrators.
5. Each time the bulletin’s requirements are updated the program needs to be able to function with the new requirements.
6. An aiding tool for students in choosing their classes.
7. Obtain statistical information on students and classes.

**Detailed Description**

In order to compare the classes a student has taken with those classes that are required, the program must first retrieve the student’s transcript as well as the requirements for the student’s major, minor, and college. The requirements depend on the bulletin year being followed by the student. A student is allowed to follow any bulletin from the academic years during which they attended SJSU. Additionally, there are several classes that may possibly count for several different requirements, such as a class that is both an IS and ES class.

Once both the student’s transcript and all their requirements are retrieved, deficiencies can easily be determined. Any requirement that could not be fulfilled by any of the student’s classes are reported to the user and recorded in a file. With a list of deficiencies, the program should be able to give a list of suggested classes that will fulfill those efficiencies. That will involve searching through the schedule of classes for classes that will meet certain requirements. For example, if a student from the College of Arts and Sciences has not taken a class that meets the college’s Ethnicity and Gender requirement, the program should give a list of all available classes that fall into that category.

The results of the inquiry need to be stored so that they are available to make any future check quicker and easier. Additionally, this will allow access to other users who may possibly need the information again in the future. This is also important as a record keeping measure. If a graduate school should ever inquire about a student’s undergraduate record here at SJSU, the record will be readily accessible.

Finally, as a matter of maintenance of the program, any time the requirements in the undergraduate bulletin are changed, the program needs to be able to adapt to these changes. In order to accomplish this, there needs to be a way to easily set the requirements for a new academic year, updating any requirements as needed. These updates may come from individual departments or from the colleges themselves.

**Use Cases**

1. **Identifying the Course Requirements in the Major, Minor and General Subjects for Undergraduate/Graduate Students.**

   Here, the user will be asked to provide the student’s details, like Social Security Number or Student ID, in order to find the course requirements for the student to complete. Additional information like the Major/Minor/General, Bulletin Year, etc may be required from the user. The system will look into the database containing the relevant data and display all the relevant requirements (depending on the selection criteria). This will help
the University to carry out the audit in an efficient and easy manner. This will also help the students to plan their selection of courses both efficiently and prudently.

2. **Reporting Deficiencies in the Students Requirements**

Due to the diversity of the courses that are being offered and also the complexity that is involved in satisfying the course requirements, it will be very helpful to have a system that will be able to identify all the deficiencies that are to be covered in order to complete the graduation requirements. When the User provides the relevant student information for which the deficiencies need to be identified, the system navigates through the database to check the classes that the student has taken. The system will then match the classes up with the requirements that have been generated earlier. If the system detects a requirement that is not fulfilled, it will report the requirement that will contain details like number of hours need to be covered in each area.

3. **A Tool for Undergraduate Advising**

This OSCS system could also be used to help supplement the current undergraduate advising system. Once the student’s academic deficiencies are found, the student has several schedule choices to make for the upcoming semester. When registering for classes in the upcoming semester it would be very beneficial for a student to know what courses are available in the areas they are lacking. This system, integrated with the enroll system, would analyze the results of the audit, review the areas that the student is lacking, and provide a list of courses that would fulfill these requirements.

4. **Storing the Audit results**

After satisfying all the course requirements, the student may decide to graduate from the school. According to the Federal audit rules, the audit reports of the students should be preserved for a specified number of years for future reference. Hence, an archive of audit reports need to be created separately and made available on a demand basis. When an administrator has finished with a senior check of a student, he/she will have a choice to save the result. When he/she needs to create paperwork, he/she will be able to access the archive and print the report for a student or a number of students.

5. **Updating the Bulletin information**

As we know, the policies and requirements of the department or the course are subjected to change. When these changes occur, an administrator would enter his/her login and password. The system will then check for validation of whether or not he/she has an authority to create a new bulletin year entry on the system. The system will import the policy and requirements from the previous year’s bulletin to avoid redundant key entry. When the system has finished, the administrator will then be able to make changes in the current bulletin year.

6. **Final Senior Checks**

The first senior check is done the semester prior to a student’s graduation. Before a student can be allowed to graduate, a second check must be done to make sure that any deficiencies that were reported in their senior check have been fulfilled. This is done as soon as the student’s grades are reported in order to have the results before the graduation ceremony, which is generally the Saturday after finals week. Because the results of a student’s report are archived, this process involves checking only the student’s deficiencies against those classes that he/she took in their last semester. Additionally,
because graduates are required to apply for graduation, this process can be automated
because the required information will be known for each graduate.

7. Help Students Choose a Major

Several graduate programs require specific courses to be taken as undergraduates in order
to be admitted. For example, students wanting to enter Medical School must take a set of
courses known as the Pre-Med sequence. However, SJSU does not have a Pre-Med
major, but Pre-Med students are required to have a major to graduate. This can lead to an
awkward decision for the Pre-Med students, because their desired course of study does
not fit into any majors. Using this system, students can see which how well the courses
they have already taken fit into the requirements of a certain major by examining the list
of deficiencies reported and comparing them to the additional courses they are planning
to take that are graduate school requirements. This will help students choose their major
so that there is a relatively high occurrence of overlapping requirements, allowing them
to graduate with a lesser amount of course work.

8. Help Students Deciding to Add or Change Majors

Many students do not keep the same major throughout their entire undergraduate career.
Several more add additional majors along the way. The decision to change majors can be
a hard one, because it is difficult for a student to see exactly how much further work will
be caused by the change in majors. Given access to this program, a student will be able
to see exactly how many courses they will have to take if they switch majors. This
information will certainly be helpful to students contemplating changing their major.
Students will also be able to see how many classes are needed to complete an additional
major, which will give them an accurate picture of how realistic it is to pursue that major
in addition to the major(s) that they have already declared.

9. Determining Graduation Date

Students in senior standing often would like to know when they would be graduating so
they can make plan for the future. Using OSCS system, they would find out how many
more classes that they would need to take and when they are available. This information
can then be used to see how many semesters they have remaining and they would be able
to find out for sure when they can graduate.

10. Retrieving Statistical Information

Using OSCS, the administrators will be able to obtain details like

- the number of students that have majored in each subject area
- the number of students planning to graduate in the future years
- the number of students graduated in the past few years
- the total number of transfer students from other universities
- the number of drop-out students

This information is considered vital by the administrators in helping each department to
plan their course structure and finding out ways to improve the functioning of the
department, etc.

Reference: None.