

# **MidTerm Project**

## **Part II**

### **Instructions for Students**

You begin this MidTerm project by rewriting most of the anonymous blocks you created in MidTerm Project I to become Procedures, Functions and Packages, with input parameters and exceptions. You then add more programs to these packages, and finally you create a new package and create a couple of database triggers. Whenever the anonymous blocks used bind variables, you must change these to be IN parameters in the stored subprograms.

#### **Project Setup: The Data**

This project will build on the case study called STUDENT ADMINISTRATION or SA. A set of database tables is used to manage schools' course offerings as delivered by instructors in many classes over time. Information is stored about classes that are offered, the students who take classes, and the grades the students receive on various assessments. The school administrators can use the SA database to manage the class offerings and to assign instructors. Teachers can also use the SA database to track student performance. The database objects for this project are already in your account and they are as follows:

Tables:

- INSTRUCTORS
- SECTIONS
- COURSES
- CLASSES
- ASSESSMENTS
- STUDENTS
- ENROLLMENTS
- CLASS\_ASSESSMENTS
- ERROR\_LOG
- GRADE\_CHANGES

Sequence:

- ASSESSMENT\_ID\_SEQ

Synonyms:

- dept FOR sections
- instr FOR instructors
- enroll FOR enrollments
- stu FOR students
- cl\_assess FOR class\_assessments
- cl FOR classes
- cour FOR courses
- assess FOR assessments

## Part 1: Procedures, Functions and Packages

### The Assignment and Deliverables:

In this section you start by re-writing the anonymous blocks from MidTerm I to become procedures, functions and packages.

1. Find the file saved from called *enroll\_student\_in\_class.sql* from MidTerm I. Convert this to a procedure and have it accept a STU\_ID and CLASS\_ID as input parameters. Use “today’s date” for the ENROLLMENT\_DATE and the string ‘Enrolled’ for the STATUS. Raise an exception if the accepted student is already enrolled in the accepted class. In your exception handler, display a message stating the student is already enrolled in the class.
2. Find the file called *drop\_student\_from\_class.sql* from MidTerm I. Convert it to a procedure that accepts a STU\_ID and CLASS\_ID as input parameters. If the DELETE fails because the student is not in the class, raise a user\_defined exception to display a message stating the student is not in the class.
3. Find the file called *student\_class\_list.sql* from MidTerm I. Rewrite it to be a procedure that displays all of the classes a student has been enrolled in within the most recent 6 years. For example: If you run your procedure on May 10, 2006, you should display all enrollments between May 10, 2000 and May 10, 2006. Accept the STU\_ID as an input parameter. For each enrollment, display the ENROLLMENT\_DATE, CLASS\_ID and STATUS.
4. Find the file called *add\_new\_classes.sql* from MidTerm I. Rewrite it as a Procedure and have it accept the following IN parameters:
  - a. Number of new classes required. Set a default value of 1.
  - b. Course id; For each new class, use “today” as the START\_DATE.
  - c. Period, to specify what days the class meets.
  - d. Frequency, to specify how often it meets.
  - e. Instructor id, to specify who is teaching the class(s).
5. Find the file called *course\_roster.sql* from MidTerm I and rewrite it as a procedure. Accept the INSTR\_ID and COURSE\_ID as input parameters. For each ENROLLMENT, display: CLASS\_ID, STATUS, Student FIRST\_NAME and LAST\_NAME.
6. Find the file called *convert\_grade.sql* from MidTerm I and rewrite it to be a function. Use an IN parameter to enter the number grade. RETURN a CHAR value. Use the following rules: A:90 or above, B: >=80 and <90 , C: >=70 and < 80, D: >=60 and < 70, F:<60.
7. Find the file called *student\_count.sql* and rewrite it as a function that will RETURN the number of students in a particular class. Accept a CLASS\_ID as an IN parameter.

8. Create a package called *enrollments\_package* which will contain the procedures you created in A, B, and C. Make all procedures public. Comment your procedures to explain their purpose and functionality.
9. Find the program saved in the file *create\_assignment.sql*. Rewrite it as a procedure that accepts the assignment description as an input parameter.
10. Find the file called *enter\_student\_grade.sql* and rewrite it as a procedure that a teacher can run to insert the student's grade on a particular assignment. Accept a NUMERIC\_GRADE, CLASS\_ASSESSMENT\_ID, CLASS\_ID, STU\_ID and ASSESSMENT\_ID as IN parameters. Use "today's" date for the DATE\_TURNED\_IN.
11. Rewrite the program stored in the file *show\_missing\_grades.sql* to be a procedure. Accept a start\_date and end\_date to establish a date range. Display only enrollments between those two dates. Write your procedure so the start\_date and end\_date are optional. If both dates are not entered, display all applicable enrollments for the past year, and include a note about the date range. For each enrollment, list the CLASS\_ID, STU\_ID, and STATUS. Order the output by ENROLLMENT\_DATE with the most recent enrollments first.
12. Find the file called *compute\_average\_grade.sql* and rewrite it as a function. Accept a CLASS\_ID. Return the average grade.
13. Find the file called *count\_classes\_per\_course.sql* and rewrite it as a function. Accept a COURSE\_ID. Return the number of classes offered for that course.
14. Convert the file *show\_class\_offerings.sql* to a procedure. Accept a start date and end date. For each class found, display the CLASS\_ID, START\_DATE, instructor FIRST\_NAME and LAST\_NAME, course TITLE and SECTION\_CODE, and average grade. Find the average grade by a call to the function *compute\_average\_grade*.
15. Create a package called *admin\_tools\_package* incorporating procedure and functions you wrote in steps K to N. Make the following public: *show\_missing\_grades*, *show\_class\_offerings*, *count\_classes\_per\_course*. Make the following private: *compute\_average\_grade*.

## Part 2: Managing Students and Grades

The *enrollments\_package* you created in Part 1 contains the following public procedures:

1. Procedure *enroll\_student\_in\_class* (p\_stu\_id IN enrollments.stu\_id%TYPE, p\_class\_id IN enrollments.class\_id%TYPE)
2. Procedure *drop\_student\_from\_class*(p\_stu\_id IN enrollments.stu\_id%TYPE, p\_class\_id IN enrollments.class\_id%TYPE)
3. Procedure *student\_class\_list* (p\_stu\_id IN enrollments.stu\_id%TYPE)

### The Assignment and Deliverables:

Modify the *student\_class\_list* procedure in the package, to add the following functionality:

1. Utilize the overloading feature of the PLSQL package, to overload the *student\_class\_list* procedure as follows:
  - When the STU\_ID parameter is passed, the procedure should display a list of classes in which the student has been enrolled, within the most recent 6 years.
  - When the procedure is called without a parameter, the procedure should display a list of classes for all students in which they have been enrolled, within the most recent 6 years.
2. Create a procedure *read\_external\_file*, to read an external text file stored outside the database as an operating system text file. Use DBMS\_OUTPUT to display the content of the external file.

The external file is named '*student\_class\_list.txt*' and is stored in the operating system directory referenced by the Oracle directory object 'WF\_FLAGS'.

Your output should look something like this:

```
Enrollment Report
Student Id  Enrollment Date  Class id
101         12-AUG-04          1
102         12-AUG-04          1
103         12-AUG-04          1
104         12-AUG-04          1
*** END OF REPORT ***
```

- Hints: The Exceptions used with UTL\_FILE.GET\_LINE:
  - INVALID\_FILEHANDLE
  - INVALID\_OPERATION
  - READ\_ERROR
  - NO\_DATA\_FOUND
  - VALUE\_ERROR
- Directory object name is: 'WF\_FLAGS' and must be referenced in capital letters.

### Part 3: School Administrator's Tools (admin\_tools\_package)

The *admin\_tools\_package* you created in Part I contains the following programs:

1. Procedure *show\_missing\_grades* (p\_start\_date IN DATE DEFAULT ADD\_MONTHS (SYSDATE,-12), p\_end\_date IN DATE DEFAULT SYSDATE)
2. Procedure *show\_class\_offerings* (p\_start\_date IN DATE, p\_end\_date IN DATE)
3. Function *count\_classes\_per\_course* (p\_course\_id IN classes.course\_id%TYPE) RETURN NUMBER
4. Function *compute\_average\_grade* (p\_class\_id IN enrollments.class\_id%TYPE) RETURN NUMBER

This function is private in this package.

#### The Assignment and Deliverables:

1. Utilize the forward declaration concept to be able to move the body of the private function *compute\_average\_grade* to anywhere in the package body. Recompile and test the package.

## Part 4: Create `manage_triggers_package`

### The Assignment and Deliverables:

1. Create a package `manage_triggers_package` that contains two overloaded functions called `manage_triggers`. The functions are invoked to disable/enable all triggers for a table, or to compile a trigger.
  - Use Native Dynamic SQL to execute the DDL commands programmatically.
  - Code an exception handling block to display a message if the DDL command fails.

Use the following guidelines:

- When the function is called with two parameters: `manage_triggers (p_tablename, p_action)`
  - Pass a table name to `P_TABLENAME` parameter.
  - Pass 'disable' or 'enable' string to `P_ACTION` parameter.
- When the function is called with only one parameter `manage_triggers (p_trigger_name)`
  - Pass a trigger name to `P_TRIGGER_NAME` parameter.

Hints:

- Use the `ALTER TABLE` command to disable/enable all triggers of a table programmatically.
- Use the `ALTER TRIGGER` command to compile the trigger programmatically.

## Part 5: Create Database Triggers

### The Assignment and Deliverables:

1. Create the *grade\_change\_history* table as follows:

```
CREATE TABLE grade_change_history
(time_stamp      DATE,
stu_id           NUMBER(7,0),
class_id         NUMBER(6,0),
enroll_date      DATE,
old_final_grade  CHAR(1),
new_final_grade  CHAR(1));
```

2. Create a row level trigger *audit\_grade\_change* to keep a history of all the changes made to students' final letter grade. The grade change is recorded every time the FINAL\_LETTER\_GRADE field is updated in the ENROLLMENTS table.
  - Every time the trigger is fired, it should insert a record in the GRADE\_CHANGE\_HISTORY table, recording the old grade and the new grade for each student.
  - Test your trigger by updating the final\_letter\_grade for a student, in the ENROLLMENTS table.