

# INFS2200/INFS7903 ASSIGNMENT

Semester 1/2013

Marks:	100 marks (15%)
Due Date:	11.59 pm 23-May-2013
What to Submit:	SQL script file in addition to a short report
Where to Submit:	Electronic submission via blackboard

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The goal of this project is to gain practical experience in applying several database management concepts using the Oracle DBMS.

Your task is to first populate your database with appropriate data, then design, implement, and test the appropriate queries to perform the tasks explained in the next sections.

You must work on this project individually. The standard academic honesty rules apply.

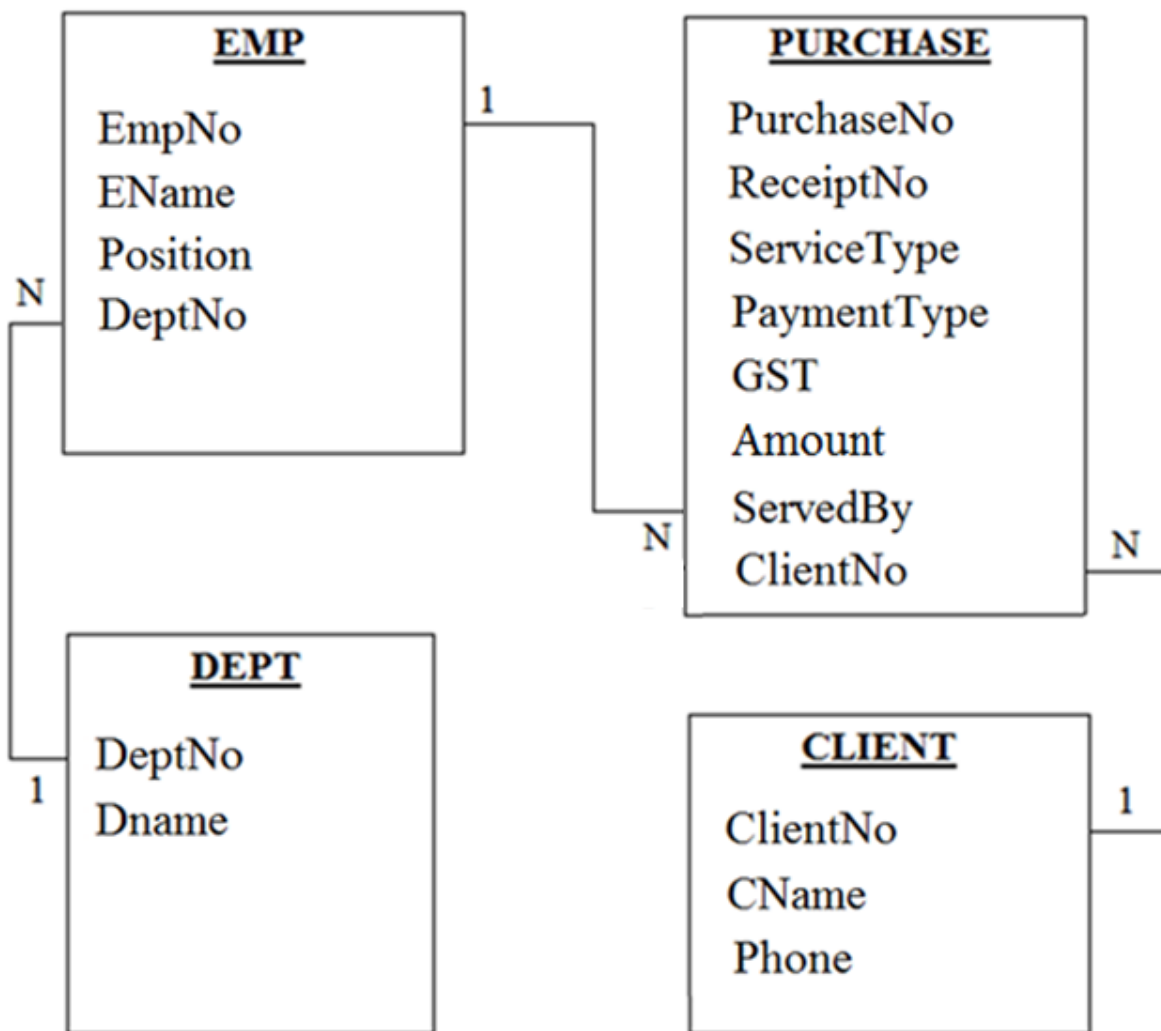
**Roadmap:** Section 1 describes the database schema for your project and it also provides instructions on downloading the script file needed to create and populate your database. Section 2 describes the tasks to be completed for this project. Finally, Section 3 provides you with all the necessary submission guidelines.

Enjoy your Project!

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## SECTION 1. THE SALES DATABASE

**The Database:** The SALES database (Figure 1) captures the sales information in a company that provides IT services. The database includes four tables: CLIENT, PURCHASE, EMP, and DEPT. CLIENT stores information about all the company's clients. PURCHASE keeps track of the service purchases made by the clients. EMP stores information about the employees who work directly with the clients and serve their purchase requests. Those employees work in different departments and the information about these departments is stored in the DEPT table. Figure 1 presents the database schema.



*Figure 1 Database schema*

**The Script File:** Please go to the following web page and download the supplementary script file:

<http://itee.uq.edu.au/~info2200/pracs/prjScript.sql>

**The Database Constraints:** The following table lists all the constraints applied to the SALES database.

No	Constraint Name	Table.Column	Description
1	PK_EMPNO	EMP.EmpNo	EmpNo is the primary key of EMP
2	PK_DEPTNO	DEPT.DeptNo	DeptNo is the primary key of DEPT
3	PK_PURCHASENO	PURCHASE. PurchaseNo	PurchaseNo is the primary key of PURCHASE
4	PK_CLIENTNO	CLIENT.ClientNo	ClientNo is the primary key of CLIENT
5	UN_DNAME	DEPT.Dname	Dname values are unique
6	CK_AMOUNT	PURCHASE.Amount	Amount (in dollars) must not be empty (not null)
7	CK_ENAME	EMP.ENAME	ENAME must not be empty (not null)
8	CK_DNAME	DEPT.DName	DName must not be empty (not null)
9	CK_CNAME	CLIENT.CName	CName must not be empty (not null)
10	CK_RECEIPTNO	PURCHASE.ReceiptNo	ReceiptNo must not be empty (not null)
11	CK_SERVICETYPE	PURCHASE. ServiceType	Service type must be one of the following: 'Training', 'Data Recovery', 'Consultation', 'Software Installation', or 'Software Repair'
12	CK_PAYMENTTYPE	PURCHASE. PaymentType	Payment type must be one of the following: 'Debit', 'Cash', or 'Credit'
13	CK_GST	PURCHASE.GST	GST must be either 'Yes' or 'No'
14	FK_DEPTNO	EMP.DeptNo and DEPT.DeptNo	EMP.DeptNo refers to DEPT.DeptNo
15	FK_EMPNO	PURCHASE.ServedBy and EMP.EmpNo	PURCHASE.ServedBy refers to EMP.EmpNo
16	FK_CLIENTNO	PURCHASE.ClientNo and CLIENT.ClientNo	PURCHASE.ClientNo refers to CLIENT.ClientNo

*Table 1. Constraints*

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## SECTION 2. ASSIGNMENT TASKS

### Task 0 – Database

- a. You need to execute the script file to create and populate your database before working on the following tasks.

### Task 1 –Constraints

- a. After running the script file, you will notice that only some of the constraints given in Table 1 were created. Write the necessary SQL statements to find out which constraints have been created on the tables EMP, DEPT, PURCHASE, and CLIENT.
- b. Write the necessary SQL statements to create all the missing constraints.

### Task 2 –Triggers

- a. Write a SQL statement to find the company's top client. A top client is the one who has purchased the most (i.e., the one with the highest total purchase amount (in dollars) among all the company's clients). Your statement should display: client number, client name, and the total purchase amount by that client.
- b. Write a SQL statement to create an Oracle trigger that applies a 15% discount to any future purchases made by the top client found in Task 2a.  
*Hint: Your trigger should use the value obtained from Task 2a. In particular, it should apply a 15% reduction to the purchase amount whenever a new purchase made by that top client is inserted into the PURCHASE table.*
- c. The SALES – Sunshine department has unfortunately run into a technical issue and are temporarily unable to process any Credit or Debit transactions. As a result, they are only making Cash transactions. Additionally, the department is offering a 30% discount on 'Data Recovery' at the moment. Write an SQL statement to create an Oracle trigger that will set the PaymentType to always be 'Cash' for any purchases where the client was served by an employee of this department, and if the ServiceType is 'Data Recovery', give the customer a 30% discount. Note that this discount is exclusive to the Sunshine department.

### Task 3–Views

- a. Write a SQL statement to create a (regular) view called V\_DEPT\_AMOUNT that lists the names and numbers of all the company departments together with the

maximum, minimum, average, and total purchase amount contributed by each of those departments.

- b. Write a SQL statement to create a materialized view called MV\_DEPT\_AMOUNT that lists the same information as in Task 3a.
- c. Execute the following two SQL statements and report their query execution time. Is there any difference between the reported execution times of Q<sub>1</sub> and Q<sub>2</sub>? Please give the reasons for that.

```
Q1: SELECT * FROM V_DEPT_AMOUNT;  
Q2: SELECT * FROM MV_DEPT_AMOUNT;
```

- d. Write an SQL statements to create both a regular and materialized view called V\_DEPT\_TOP\_EMPS and MV\_DEPT\_TOP\_EMPS. These views should list the ten top ten employees in each department. For each of those employess, the view should include: the total number of purchases, the average amount of purchases, the highest amount of purchase, and the total amount of purchases. The view should list the departments in order, and within each department the employees should be ordered according to the total amount of purchases.
- e. Execute the following two SQL statements and report their query execution time. Is there any difference between the reported execution times of Q<sub>3</sub> and Q<sub>4</sub>? Please give the reasons for that.

```
Q3: SELECT * FROM V_DEPT_TOP_EMPS;  
Q4: SELECT * FROM MV_DEPT_TOP_EMPS;
```

#### **Task 4—Indexes I**

- a. Each receipt is issued from a receipt book whose number is encoded in the first three digits of the ReceiptNo field in the PURCHASE table. For example, the receipt numbered 454333 was issued from receipt book number 454. Write a SQL statement to count the number of purchases for which there has been at least 10 other purchases issued from the same receipt book.  
*Hint: for each purchase p in the PURCHASE table, you will need to go over all the other purchases and find the ones with a ReceiptNo that starts with the same 3 digits as in p's ReceiptNo.*
- b. In order to attempt to speed up the query in Task 4a, a function-based index is to be created on the ReceiptNo field. Write a SQL statement to create an index that best fits that task and justify your choice. Report the execution time of the query statement you wrote in Task 4a before and after creating this index. Did the index speed up the query (look at both the elapsed time and the costs in the execution plan)? Explain your answer.

- c. The manager of department 50 wants to see the total amount of sales for his department for all purchases for services that do not contain the word 'Software' – eg not 'Software Repair', 'Software Installation' or any other ServiceType containing the word 'Software'. Write an SQL query to return this amount. To make your query general enough, assume that Constraint #11 is not in place and there could be many services that are offered by the department beyond the ones listed in Constraint #11.
- d. In order to speed up the query in Task 4c, a function-based index is to be created on the ServiceType field. Write a SQL statement to create an index that best fits that task and justify your choice. Report the execution time of the query statement you wrote in Task 4c before and after creating this index. Did the index speed up the query (look at both the elapsed time and the costs in the execution plan)? Explain your answer.

### **Task 5 –Indexes II**

- a. Write a SQL statement to count the number of purchases for which there are at least 1000 other purchases with the same ServiceType, PaymentType, and GST values.
- b. In order to speed up the query in Task 5a, indexes should be created on the ServiceType, PaymentType, and GST columns. In your opinion, what is the most suitable index type to create on those columns and Why?  
*Do not include any SQL to create these indexes (6b) in your script file.*

### **Task 6 – Execution Plan**

- a. Write a SQL statement to list the information for purchase number 9989. Report and explain the plan chosen by the Oracle optimizer for executing your query.
- b. Now, drop the primary key constraint from the PURCHASE relation and re-execute the query you wrote in Task 6a. Report and explain the plan chosen by the Oracle optimizer for executing your query. In your opinion, what are the main differences between this plan and the one obtained in Task 6a?

### Marking Scheme:

Tasks	Marks
0	2
1a	4
1b	4
2a	6
2b	6
2c	8
3a	4
3b	4
3c	4
3d	8
3e	4
4a	6
4b	8
4c	4
4d	4
5a	4
5b	4
6a	2
6b	4
Presentation & Readability	10
<b>Total</b>	<b>100</b>

## SECTION 3. Deliverables

The project is due **11:59PM, 23rd May 2013**. No late submission is allowed.

You are required to turn in two files (use studentID to name your files):

1. studentID.pdf:  
A report answering all the questions in Section 2 including all the necessary SQL statements and their outputs (maximum 8 pages).
2. studentID.sql:  
A script file that includes all your SQL statements.

Your **report** file should include the following content:

- Answers to all the questions in Section 2.
- If you are asked to write SQL statements, you need to include those statements in your report.
- When you execute a SQL statement, if SQL\*Plus responses with any output (e.g. query results, query execution time, query plan, etc), you need to include the output as well. For example, in Task 2a, you need to include a SQL statement to find the client who purchased the most and you also need to show the response of SQL\*Plus when you execute that statement. Your entire answer for Task 2a should look similar to the text below (the actual result might be different).

```
SELECT ... [your statement comes here] ...
```

CLIENTNO	CNAME	TAMOUNT
21244	John Smith	126789

Your **script** file is in plain text format. You must make sure that your script file can be executed on the ITEE lab machines. The same SQL statements in your script file should also be copied and pasted into your report file (as explained above). Even though the script file does not introduce any new information in comparison to the report file, it is intended to help the lecturer/tutors to quickly check the correctness of your SQL statements before checking the details in your report file.

*Enjoy your project!*