University of Technology, Sydney
Faculty of Engineering and Information Technology
Autumn 2015

Database Programming (31253)
Assignment 2
(30 Marks)

This assignment is due at **18:00 on Wednesday 27 May 2015**. The assignment should be submitted in electronic form in PDF format via the UTSOnline Turnitin Assignments before the above deadline. The file name should have the format surname_firstname (i.e. concatenation of your surname and first name). Please, refer to the subject outline for the academic standards statement. Assignment feedback will be provided in the lecture and assignments will be available for collection two weeks following the due date. If you need any clarifications of the assignment ask in the lecture. This assignment supports the following subject objectives: (4) students should be able to understand the current development methodology in modern database systems and (5) students should be able to describe the use of supplied packages in the Oracle database. Assessment will be based on correctness and completeness of your answers to individual questions. The assignment accounts for 30% of the marks for the subject and should require approximately 35 hours of work. Assignments in this subject should be your own original work. The inclusion in assessable work of any material such as code, graphics or essay text obtained from other persons or sources without citation of the source is plagiarism and is a breach of University Rule 16.2.2. Assignments that contain copied material will be given zero marks.

INSTRUCTIONS

1. For ease of marking, I would like you to document your approach to the solution of the program. Please keep your description relevant and to the point. It is strongly recommended that you utilize diagrams to convey your ideas and design. The reader should be able to understand how your system works by reading the documentation, not by reading your code. Please indicate any features that you are particularly proud of or that you want to be noted during the marking process.

2. You are expected to submit a professional presentation, prepared using a suitable Word Processor. A hand written submission is not acceptable and will not be marked.
   Your hardcopy submission should include your ORACLE userid *DO NOT INCLUDE YOUR PASSWORD*

3. I will be looking at your code in the database on the ORALAB machine. Once the assignment is handed in you must NOT recompile or modify any component of your system. I will be checking the object modification dates and if any object has been modified after the due date the assignment will not be marked.

4. There may be errors and ambiguities in the assignment specification. If so, corrections/clarifications will be posted to the subject web sites. You are expected to check and incorporate these changes into your submission. The specification will be frozen one week before the assignment is due.

5. I will be utilizing UTSOnline extensively to answer questions on specification and to provide details of the existing data. I will assume that you will be checking the site regularly to make yourself aware of the latest developments.

6. Please take note of the due date, and work to that date, as extensions will be granted only under extenuating circumstances. Late submissions are to be negotiated with the lecturer. Students should be aware that a penalty of up to 50% may be applied for late submissions.

7. Students are advised to make themselves familiar with the Academic Misconduct statement detailed in the Subject Outline and conduct themselves according to the expectations of the University

8. I expect to return the marked Assignments 14 days after the submission date.

Modification History

Please Note
Modifications to the Assignment specification will freeze one week prior to the due date.

The Smartcard Financial Settlement System

Introduction

For the second Assignment for Database Programming and Administration you are required to write a Financial Settlement System (FSS) for a Smartcard Transaction Centre. The Deliverables for the Assignment are structured in a way to enable you to achieve a mark that is related to the amount of work that you will contribute and the level of knowledge that you have attained. The detailed marking structure can be found at the rear of the document.

Overview

For some time now there has been a trial deployment of a Smartcard System in various locations throughout the country. A number of different types of Smartcard terminals have been deployed at selected sites. The types of terminals include Parking Meters, Payphones, various Vending machines and ticketing machines at selected railway stations. A number of Smartcard enabled terminals have also been placed in selected retail outlets like Newsagents and University canteens enabling the holders of the Smart cards to pay for their purchases using these cards.

The term electronic cash is often used when talking about Smartcard transactions; however the electronic cash needs to be converted to real cash so that the merchants, accepting the cards as payment, can be reimbursed. During the trial phase, the merchants were reimbursed manually, once a week. The settlement amount calculations have been done by the staff in our IT department and the merchants were sent a cheque for the amount of the settlement. During the initial trial phase the merchants were not charged a fee on the Smartcard transactions.

The Smartcard System is moving into the next phase of deployment. The number of merchants will be increased and there is a requirement to automate the Settlement process. The payment to the Merchants will be done via a direct credit into their nominated bank accounts and is to be done daily.

Each month the merchants will be charged a fee for the use of the Smartcard. The fee to be charged will be a percentage of the total transactions for the month. The actual amount is yet to be negotiated and it will be uniform for every transaction. The fee collection will be done via a direct debit from the merchant bank account. The merchant will also be sent a statement showing the money banked and the fees charged for the month.

Your task is to write the application for the Smartcard Financial Settlement System. You are required to only create the daily settlement system and associated report. The application is to run in the Oracle Database and is to be written using the PL*SQL language.

The components of the application are

- The Daily Settlement
- A report to identify any potential fraud
- System control using a RUN table

The details of the application follow.

Daily Settlement *Deskbank File*

The FSS system will be required to run daily and at the conclusion of the run, will produce a banking file that will be known as a Deskbank file. The Deskbank file will be sent to the designated banking organization electronically, most likely using a secure FTP channel. The Deskbank file, when run in the banking system will contain information necessary to credit the merchants bank account with the amount collected by the Smartcard transactions. The total of the deposits into the merchants accounts is to be offset by a debit from our working bank account. The total of the deposits and the debits is to reconcile to zero.

A sample Deskbank file and the file specification can be found in the Appendix
*****See the Note on Minimum Settlement under System Constraints*

Daily Settlement Report

In addition to the Deskbank file, your system is to produce a daily reconciliation report. The report will be used by the business unit and will show the banking details generated by the Daily Settlement. The report will be created automatically when the deskbank file is produced, however your system should be flexible enough to allow the manual creation for a given settlement date.
A sample report is attached in the Appendix.

Fraud Report

The security department's role is to maintain the integrity and the validity of the Smartcard system. They have asked for a Fraud report. The report is to list all those cards and the associated transactions where there is suspicion of fraud. No sample of the report exists so you are free to design a *sensible* report format of your own.

RUN Table

The FSS system will run each day and should settle all those transactions that have not yet been settled. You are asked to create and maintain a RUN table, which should keep track of the run, dates, the processing date ranges and the status of each run. The production support personnel will use this table to assist them in monitoring and maintaining the system in the event of failures. Also, you are asked to maintain a log table which will enable the production support team to monitor the progress of your run. The log table will contain a timestamp and a periodic entry to mark the progress of your system.

Note: The logging is to be done by using the COMMON.log procedure

Email the Daily Settlement Report to a nominated person

This component is optional and only those students that wish to take on the challenge can attempt this.

The Daily Settlement Report once created can be emailed to a nominated recipient. I will provide you with the bulk of the code you need to generate the email. You will need to modify the code to add the file to the email as an attachment. The code and the full details will be provided on UTS Online. I may have a short session after a lecture to explain the requirements and the architecture that is to be used

System Constraints

- The FSS system should settle the transactions only once. It is possible that a user could restart the system multiple times on a given day. You should ensure that the settlements are not duplicated. In the cases where the user tries to run the application more than once on a given day, the system should not allow. This is to be controlled by the run table

- The Daily reports and the production of other reports should be re-runable at any time and for any given day.

- The existing FSS system is located on ORALAB in the DBP_ADMIN schema. Select privilege has been granted on all objects in the schema to enable you to view the existing data. Your FSS system, when completed will make up the Smartcard system. It will be standalone, but will also be integrated into the existing tables. You should not make any modifications to the existing structure because your changes might 'break' other components of the system.

- The ER Diagram and specifications for the existing database tables can be found on UTSOnline under the Assignment 2 tab.

- The daily transaction downloads, from the terminals, will be available in the database environment and the transaction table will be constantly updated with new transactions as they are downloaded from the terminals. Note that there will only ever be one download per day.

- It is anticipated that the transaction tables will grow very quickly. We will adopt an archiving strategy to move the data from the production environment into an, as yet, undefined environment. You can not assume that the transaction data is always available for your use. *Note: Archiving of the transaction data is not in the scope of this assignment*

- Total settlement amounts that are less than the designated minimum amount will not be settled in the daily transactions until the total settlement amount reaches the minimum settlement amount. At the end of the month, any transaction that has not been processed during the month is to be finalized, irrespective of the amount.

- The minimum settlement amount is configurable and is stored in the FSS_REFERENCE table under the identifier of **Daily Minimum Settlement**

- The reload of the Smartcard and the subsequent collection and banking of the reload money is not a component of this system

- The Deskbank file name will take the following format DS_DDMMYYYY_[Your Initials].dat for the daily file and
  Note that DDMMYYYY denote the day, month, year of the settlement date when the deskbank file is created.

- So that life is made easier for Laurie while automatically testing the system, please follow the naming convention below

Module	Name
Package	Pkg_FSS_Settlement
Daily Settlement	DailySettlement
Daily Banking Summary	DailyBankingSummary (DD-Mon-YYYY)
FraudReport	FraudReport

Elements of the Smartcard System

Below is a picture gallery that illustrates some of the elements that go to make up the Smartcard System.

The Smartcard

Vending machines with Smartcard readers

Smartcard enabled Parking meters

Some of the Smartcard terminals to be located in the merchant premises

Payphone Installed with a Smartcard reader

Contact less Smartcard readers at a railway station

The Deskbank File Specifications

```
0                 01WBC       S/CARD BUS PAYMENTS       038759INVOICES    150514
1015-010270249893 500000022905CARDORAMA                          F 201405150000431032-797   001006SMARTCARD TRANS 00000000
1032-099000701123 500000078400STELLA PICTURE CO P/L              F 201405150000432032-797   001006SMARTCARD TRANS 00000000
1032-277000892386 500013659772TELSTRA PAYPHONE SERVICES          F 201405150000433032-797   001006SMARTCARD TRANS 00000000
1034-002000136556 130013923599S/CARD BUS PMTS                    N 800500000000000032-797   001006SMARTCARD TRANS 00000000
1062-164010171526 500000025060DUNCANS -CATERING - LOFTUS         F 201405150000435032-797   001006SMARTCARD TRANS 00000000
1083-001648518574 500000002300THE SMITH'S SNACKFOOD CO. LTD      F 201405150000436032-797   001006SMARTCARD TRANS 00000000
1096-006006623452 500000081640GERALDTON HEALTH SERVICES          F 201405150000437032-797   001006SMARTCARD TRANS 00000000
1105-120954269240 500000003102THE UNIVERSITY OF TECHNOLOGY       F 201405150000438032-797   001006SMARTCARD TRANS 00000000
1105-134506242640 500000050420FLORUM P/L T/A RUNDLE ARCADE NEW F 201405150000439032-797   001006SMARTCARD TRANS 00000000
7999-999            000000000000139235990013923599                      000009
```

Header Record

```
Create the Header record as follows :
FIRST RECORD - TYPE 0  1 record
Type Zero Descriptive Record

Posn. Size  Field       Comments
 1     1    Record Type       Zero (0)
 2    17    Not Used          Blanks
19     2    Reel Sequence    Start at 01
21     3    F.I. Code       "WBC"  (Bank mnemonic code)
24     7    Not Used         Blanks
31    26    User            "S/CARD BUS PAYMENTS"
57     6    User B.S.B.      038759
63    12    Description      "INVOICES"
75     6    Processing Date "DDMMYY" format"
81    40    Not Used          Blanks
```

Data Record

```
TRANSACTION RECORD - TYPE 1  many records
Type One Detail Record

Posn.    Size     Field           Comments
  1        1      Record Type          1
  2        7      B.S.B.        BSB in 999-999 format
  9        9      Account No.   Bank Account
 18        1      Not Used      Blank
 19        2      Tran. Code    13 --  debit, 50 -- credit
 21       10      Value         Zero filled, in cents.
 31       32      Title         Merchants's Account title
 63        3      BankingFlag   ' F ' Ledger code
 66       15      Lodgement Ref. TRANSACTION_SEQ_NUMBER
 81       16      Trace           "032-797   001006"
 97       16      Remitter        eg. "SMARTCARD TRANS"
116        8      GST Tax         Zeroes
```

Footer Record

```
Create the Footer record as follows :
LAST RECORD TYPE 7 - 1 record
    Type Seven File Total Record

Posn. Size  Field          Comments
 1     1    Type              7
 2     7    Filler         "999-999"
 9    12    Not Used        Blanks
21    10    File total      Zero filled, in cents.
31    10    Credit total    Zeroes filled in cents.
41    10    Debit total     Zero filled, in cents.
51    24    Not Used        Blanks
75     6    Record Count    Number of Data records
81    40    Not Used        Blanks
```

Daily Banking Summary Report

SAMPLE DAILY BANKING REPORT

Settlement Date

SMARTCARD SETTLEMENT SYSTEM
DAILY DESKBANK SUMMARY

Date DD-Mon-YYYY Page x

Merchant ID	Merchant Name	Account Number	Debit	Credit
700000100	CARDORAMA	015-010270249893		229.05
700000200	STELLA PICTURE CO P/L	032-099000701123		784.00
700000300	TELSTRA PAYPHONE SERVICES	032-277000892386		136597.72
700000400	DUNCANS -CATERING - LOFTUS	062-164010171526		250.60
700000500	THE SMITH'S SNACKFOOD CO. LTD	083-001648518574		23.00
700000600	GERALDTON HEALTH SERVICES	096-006006623452		816.40
700000700	THE UNIVERSITY OF TECHNOLOGY	105-120954269240		31.02
700000800	FLORUM P/L T/A RUNDLE ARCADE NEW	105-134506242640		504.20
	S/CARD BUS PMTS	034-002000136556	139235.99	
BALANCE TOTAL			139235.99	139235.99

Deskbank file Name : <file name>
Dispatch Date : DD Mon YYYY

Settlement Date

****** End of Report ******

Marking Scheme

Create a daily Deskbank file for delivery to the bank	12
Daily banking report for the business unit	6
Implement RUN Table for production support	4.5
Fraud Report for the security department	3
Email banking report to a nominated recipient	4.5
TOTAL	**30**

Note
The first three items of the list are mandatory and must be produced by each student as a minimum. The items are

Create a daily Deskbank file for delivery to the bank	12
Daily banking report for the business unit	6
Implement RUN Table for production support	4.5

Glossary of Terms

Deskbank File	A fixed width file that is used to communicate with the banking system. The file contains the details of the direct debits and credits that are to be carried out by the bank on our behalf. The file is designed to be read by the banks computer system. It is crucial that the specification of the file is adhered to. If not, the banking system will fail and we will incur a financial penalty
Transaction Date	This is a date that a transaction is made and is recorder by the terminal. The date is unreliable because we do not have control over the terminal
Download Date	This is the Date that a transaction was downloaded into the system. The date is recorder by the Smartcard server.
Transaction Code	The values are either 13 or 50. 13 is the code for a deposit into the nominated account 50 is the code for a withdrawal from the nominated account
Banking Flag	This value is historic and is used by some systems. Our system will not use this value; however the banking system requires that this value is present. You should hardcode a suitable value.
Lodgment Ref	This is a unique sequence number created by concatenating the date with a unique number for the day. This attribute should be used to link all the transactions for a merchant throughout the daily settlement
Trace	This is a hard coded value and is required by the deskbank system
File Total	A sum of the debits and the credits
Credit Total	A SUM of all the credit statements
Debit Total	A SUM of all the debit totals
Record Count	A number of records in the deskbank file, not including the header and the footer
Processing Date	The date and time that the transactions were processed and the deskbank file was produced
Merchant	Storekeeper or any person or company that trades goods or services in return for payment