University of Technology, Sydney

Faculty of Engineering and Information Technology

School of Software

Subject   **Database Programming (31253)**

Assignment
## Autumn 2019

Due date -   30-MAY-2019 at midnight
Submit via email ….. Address will be provided

<u>INSTRUCTIONS</u>

1.   This assignment is worth 50% of your final grade and requires a commitment of about 35 hours from each student..

2. Your task is to produce a working solution to the problem given in this specification. The solution will be written in the PL*Sql language and will run in your schema in the LOZ database. Please be aware that you must produce code that compiles and runs.

3   You will be producing a report which will be a Terminal Usage report. I would like you to provide me with a design document for that report. You should include an ER diagram showing where the source of the report data is.

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

5. A hard copy of your code should not be included in the submission, only the design document for the report. The code will be marked in the database.

6. I will be looking at and running your code in the Database. 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.

7. 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.

8. 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.

9. 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. Assignments submitted later than two weeks will not be accepted

10. 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

11. I expect to return the marked Assignments 14 days after the submission date.
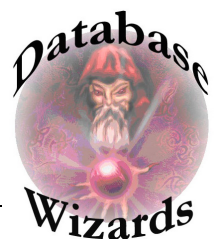
Modification History

<u>Please Note</u>
Modifications to the Assignment specification will freeze one week prior to the due date

Date	Comment
25-MAR-2019	Document Created

The Smartcard Financial Settlement System

Introduction

For the 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. *NOTE: that the Monthly Settlement is not part of the Assignment.
It is here only to help in understanding the system.*

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.
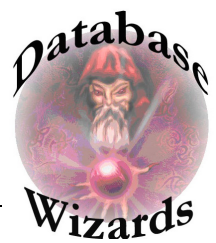
The components of the application are

- The Daily Settlement file and a corresponding report
- A report to show terminal usage
- System control using a RUN table
- An email to a nominated recipient with the Banking report file as an attachment

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.

This file is intended to be read by the banks systems.

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.

This file is intended to be read by humans.

A sample report is attached in the Appendix.

Terminal Usage Report
We need to keep track of the busiest terminals and the amount of traffic they generate. A report is required for the business units.

Each time the report is run it should produce Terminal Usage data for the current month, up to and including the current date.

The report specifications is provided.

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 and the status of each run.

You must use the run table to ensure that only one instance of the program is to run at any time. If the program is already running it cannot run again. If the program is restarted while another session is running then a log message is to be written into the logging table and the second program instance should terminate gracefully.

In order to minimize the banking costs we want to run only one settlement process per day. Use the run table to ensure that only one settlement is run per day.
If the settlement was already run on any day then the program should log a message to the log table and terminate gracefully.

If the program fails during the run it should log the failure reason to the logging table, update the run table with a status of FAIL. Also the fail reason should be written to the Run table so that production support know what needs to be repaired. The run end column should be populated. In such a situation, where the settlement failed, your program can be rerun on the same day. The assumption is that production support will have fixed the problem with the data so they may wish to run the settlement again. You MUST BE VERY CAREFULL however, that your program does not duplicate the merchants settlements. This could send us bankrupt.

The production support personnel will use the run table to assist them in monitoring and maintaining the system in the event of failures. One record should be created in this table for each run of the program.

Also, you are asked to maintain a log of your program runs 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 which will be made available to you. I will show you which table the COMMON.log procedure utilizes for logging, You are of course free and encouraged to develop your own logging process.
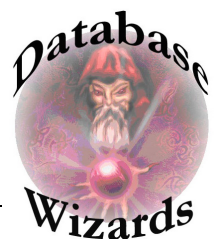
Email the Daily Settlement Report to a nominated person

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 I give you to add the file as an attachment to the email. The code and the full details will be provided on UTS Online.

Paramatising your code

So that your system is easily maintained once in production and to reduce the possibility of changes to the code I would like you to create a parameter table. The purpose of the parameter table is to store all the constants that you may hardcode in the code. Example of constraints that you will paramatise are date formats, email addresses etc.

Having the ability to paramatise your code will greatly reduce the maintenance and greatly increase the flexibility of your code.

Your table will be named DBP_PARAMETER

I will supply the code to create the table. You are free to create any additional attributes in the table but you must have the columns that I provide as a minimum.

System Constraints

- The FSS system should settle the transactions only once. It is possible that a user could restart the program 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. If the program fails on a day then a rerun is allowable but it is vital that
  - Settlements are not duplicated.
  - Each transaction is settled if the merchant total is greater than the minimum amount

- The Daily reports and the production of other reports should be re-runnable by the users at any time and for any given date.

- 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 E-R Diagram and specifications for the existing database tables can be found on UTSOnline under the Assignment tab.

- The daily transaction downloads, from the terminals, will be available in the database environment and the transaction table will be constantly uploaded with new transactions as they are downloaded from the terminals. This will be done by an existing automated process.

- 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*

- The bank will charge us a fee for all banking transactions. For this reason we will not be settling trivial amounts each time the program runs. Total settlement amounts for a merchant that are less than the designated minimum amount will not be settled in the daily transactions until the total settlement amount, during the month, reaches the minimum settlement amount. At the end of the month, any transactions that have not been processed during the month are 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
  [StudentNumber]_DS_DDMMYYYY.dat for the daily file and
  The report file name format is
  [StudentNumber]_DSREP_DDMMYYYY.rpt
  Note that DDMMYYYY denote the day, month, year of the settlement date when the deskbank file is created.

  When your system runs it will produce three files and an email.
  The files are
  The deskbank banking file
  The Banking report file
  The Terminal Usage report

  An email will be sent to a nominated recipient with the Settlement report as an attachment   (Optional)

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

Module	Name
Package	Pkg_FSS_Settlement
Daily Settlement	DailySettlement
Daily Banking Summary	DailyBankingSummary
Terminal Usage	TerminalUsage

Example
To run the daily settlement I will type
Pkg_FSS_Settlement.DailySettlement;

To run a report for today I will type
Pkg_FSS_Settlement.DailyBankingSummary

To run a report manually for a different date, say 18-MAR-2019 I will type
Pkg_FSS_Settlement.DailyBankingSummary('18-MAR-2019')

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

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
```

The Deskbank File Specifications

```
0                   01WBC       S/CARD BUS PAYMENTS    038759INVOICES          160519
1015-0102 70249893 5000000229 05CARDORAMA                          F 201905160000431032-797 001006SMARTCARD TRANS 00000000
1032-0990 00701123 5000000078 400STELLA PICTURE CO P/L             F 201905160000432032-797 001006SMARTCARD TRANS 00000000
1032-2770 00892386 5000013659 772TELSTRA PAYPHONE SERVICES         F 201905160000433032-797 001006SMARTCARD TRANS 00000000
1034-0020 00136556 1300139235 99S/CARD BUS PMTS                    N 800900000000000032-797 001006SMARTCARD TRANS 00000000
1062-1640 10171526 5000000250 60DUNCANS –CATERING – LOFTUS         F 201905160000435032-797 001006SMARTCARD TRANS 00000000
1083-0016 48518574 5000000023 00THE SMITH'S SNACKFOOD CO. LTD      F 201905160000436032-797 001006SMARTCARD TRANS 00000000
1096-0060 06623452 5000000081 640GERALDTON HEALTH SERVICES         F 201905160000437032-797 001006SMARTCARD TRANS 00000000
1105-1209 54269240 5000000031 02THE UNIVERSITY OF TECHNOLOGY       F 201905160000438032-797 001006SMARTCARD TRANS 00000000
1105-1345 06242640 5000000050 420FLORUM P/L T/A RUNDLE ARCADE NEW  F 201905160000439032-797 001006SMARTCARD TRANS 00000000
7999-999            0000000000 0013923599 0013923599                 000009
```

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

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

A note on the dates on the above report.
The report could be reprinted for any settlement date in the past. The dates that
are shown are for the date that the report is printed and the date that the
settlement was processed.

TERMINAL USAGE REPORT

```
                              SMARTCARD SETTLEMENT SYSTEM
                                TERMINAL USAGE REPORT
Report Date: 15-Jun-2019                                                        Page x

Usage Month: April 2019


TerminalID      Terminal  TerminalType                Merchant        Number of      TotalTransaction
                Type      Description                   Name         Transactions        Amount
----------      --------  --------------------   ----------------------------  --------------   ----------------
0022000010      VMS       Snack Vending Machine  The Smith's Snackfood Co. Ltd     525             $345.56
--
--


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

The Terminal Usage Report will be prepared automatically each time the
settlement system runs. The report when run should produce the Terminal usage
data for the current month up to and including the run date.
The report data should be ordered so that the most active terminal, in terms of
Total Transaction Amount, appears first then all the others in descending order.

The report is a compulsory component of the Assignment and must be produced.

Assignment Marking Scheme

Assignment Weight = 50%

Create a daily Deskbank file for delivery to the bank	40
Daily banking report for the business unit. Should be produced for any nominated date	20
Implement RUN Table correctly for program control	15
Terminal Usage Report	10
Email banking report to a nominated recipient	15
TOTAL	**100**

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

Create a daily Deskbank file for delivery to the bank	40
Daily banking report for the business unit	20
Implement RUN Table for production support	15
Terminal Usage Report	10

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
Settlement Date	The date that the transactions were settled for each merchant
Merchant	Storekeeper or any person or company that trades goods or services in return for payment