Notes to accompany SQL course exercises…

With reference to: - Sams teach yourself SQL in 10 Minutes - Fourth Edition

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Loading Sample Files

Sample files are available from the Web page:

http://forta.com/books/0672336073/ (as referenced Forth Edition 2015 – Appendix A).

Once the SQL Management Studio has been installed, a new database must be created e.g. **SQL_Course**

For this course, the files are scripted into the created database (**SQL_Course)** i.e. CREATE TABLE (s) and INSERT INTO. (These are more full covered in Chapters 17 for CREATE TABLE and Chapter 15 INSERT INTO).

The cursor **must** select the newly created database (**SQL_Course)** in the Object Explorer before any file Importing to *ensure* the files will end up in the Exercise Database **SQL_Course)**, NOT the Master.

The *alternative* to scripting the files in is to Import (using Tasks/Import Data) the files from another database.

Point to the Microsoft .mdb file and follow the prompts.

If the data is imported from the .mdb database, *no* relationships will be inherited. If needed, then they will have to be added 'after the fact' with reference to Chapter 22 – Understanding Constraints.

NB

There is a sample backup database in the Backup directory of this CD for continued exercises regarding Cursors and Stored Procedures… refer to Chapter 'Exercise: Using Cursors and Stored Procedures '.

Chapter 15 – Inserting Data

Page 146 - INSERT INTO

Contains two statements

1. **INSERT INTO**
2. **VALUES**

N.B. There are no Column references in the Customers table (poor practice).

Page 147- INSERT_INTO by Column Reference

The INSERTED columns are **explicitly** stated after the table name – NO AMBIGUITY – Best Practice

Page 148 – Re-Ordering Column references

The Columns have been **explicitly** defined for the INSERT; VALUES must match the Column Order.

Page 149 – Partial Rows

Suggested that only the cust_id, cust_name be INSERTED; all other Columns allow NULL

Page 150 – Inserting Retrieved Data

This exercise requires that a NEW TABLE be CREATED and POPULATED (INSERT INTO) with data in preparation for the Insertion of retrieved data.

- **NB Lesson 17** must now be addressed to CREATE TABLE in preparation for INSERT INTO Retrieved Data

Page 163 – **CREATE TABLE**

```
CREATE TABLE CustNew
(
cust_id          CHAR(10)    NOT NULL    PRIMARY KEY,
cust_name        CHAR(50)    NOT NULL,
cust_address     CHAR(50),
cust _city       CHAR(50)
)
```

Continuing from **CREATE** CustNew table

INSERT INTO to populate the table as the final step for Inserting Retrieved Data

Two rows have been INSERTED into the CustNew table in preparation for the exercise on **Page 150**

Page 150 - INSERT_INTO_SELECT

INSERT the rows from another table into this table – this APPENDS rows to an existing table

This IMPORTS data into another table i.e. APPEND

Page 152 - SELECT_INTO_FROM (Make a Copy of the Table).

CREATES a new table on the fly and appends all (or nominated rows into the new table using WHERE)

This EXPORTS data into a newly created table i.e. MAKE TABLE

Chapter 16 – Updating & Deleting Data

Page 156 - 16_UPDATE

UPDATE modifies row(s) in an existing table

- **UPDATE** the nominated table
- **SET** the Column and Value to be Updated – an Assignment (=)
- **WHERE** the Column to be Updated is referenced (usually the PK)

Page 156 - 16_UPDATE_Multiple_Columns

Page 158 - 16_DELETE _All Rows

Deletes **ALL** rows from a table – NB **No** WHERE Clause

DELETE

FROM Table

Page 158 - 16_DELETE _WHERE

Deletes **specified** rows from a table conditional upon the WHERE Clause

DELETE

FROM Table

WHERE Row(s) are specified

Chapter 17 – Creating & Manipulating Tables

Page 164 - 17 **CREATE TABLE**

Create a new table by specifying the

1. Table Name
2. Data Type
3. Allow or Not allow NULLS

DATA TYPES:

Strings:

1.	CHAR	Fixed Length String 1 to 255 characters
2.	VARCHAR	National Character (Unicode) Fixed width
3.	NVARCHAR	National Character (Unicode) Variable width

Numeric Types:

1. BIT Single Bit value – Boolean for Flags
2. DECIMAL (**p**, [**s**]) Fixed or Floating Point, varying levels of precision

   p (precision) - The maximum total number of decimal digits that can be stored, both to the left and to the right of the decimal point. The precision must be a value from 1 through the maximum precision of 38. The default precision is 18.
   s (scale) - The maximum number of decimal digits that can be stored to the right of the decimal point. Scale must be a value from 0 through p. Scale can be specified only if precision is specified. The default scale is 0; therefore, 0 <= s <= p. Maximum storage sizes vary, based on the precision

   e.g. DECIMAL (10,4) is **10** places to the *right and left* of the decimal point - *Precision*
   the **4** is the number of decimals to the *right* of the decimal point - *Scale*
   10 - 4 = 6. **6** is the number of places which can be stored to the *left* of the decimal point

3. FLOAT Floating Point values
4. INTEGER Integer value (+ and –) 2 billion
5. REAL 4-byte Floating Point values
6. SMALLINT (+ and -) 32,000
7. TINYINT 0 – 255 (Positive Only)

Date and Time:

1. DATE	Date only value
2. TIME	Time Only
3. DATETIME	Date and Time values

Chapter 17 – Creating & Manipulating Tables (cont.)

Page 168 - 17 DEFAULT VALUES

Default values can be assigned at table creation time

E.g. **Quantity INTEGER NOT NULL Default 1,**

(By using a Default Value instead of a NULL, Columns that may be required to calculate will not fall over.)

UPDATING TABLES **– ALTER TABLE**

Should be avoided... Best to have an accurate schema before database construction.

Page 170 - 17 ALTER TABLE

ALTER TABLE Table name

ADD new Column

ALTER TABLE Table name

DROP COLUMN Column name

Page 172 - 17 DROP TABLE

Table name – (**NO** warning will be given, nor is there any UNDO!)

Chapter 18 – Using Views

Views are virtual tables...*they are queries that dynamically retrieve data when used* ...they contain NO data themselves. The data is returned dynamically from all table(s) in the View.

Views are used to *simplify* and allow the *reuse* of SQL statements

Page 179 - CREATE VIEW

Both **CREATE VIEW** and **DROP VIEW** have been used.

Two alternative **SELECT** Statements have been used demonstrating simple table (equi) joins, as well as **INNER** Joins.

Page 176 - Using the **VIEW**

The VIEW is used as a *virtual table* and the use of the **WHERE** Clause filters the customers that have purchased a particular product

VIEWS can be used for reformatting data prior to selection, filtering unwanted data before selection, or as a precursor to calculating fields.

Page 183 - CREATE VIEW

VIEWS with Calculated Fields e.g.

```
USE SQL_Course
CREATE VIEW v_AllCustomerDetails
AS
SELECT C.cust_id
, O.order_num
, C.cust_name
, C.cust_city
, OI.quantity
, OI.item_price
, OI.quantity * OI.item_price AS LineItem
, P.prod_id
, P.prod_name
, V.vend_name
, V.vend_address
FROM Customers AS C INNER JOIN Orders AS O
      ON C.cust_id = O.cust_id
      INNER JOIN OrderItems AS OI
      ON O.order_num = OI.order_num
      INNER JOIN Products as P
      ON OI.prod_id = P.prod_id
      INNER JOIN Vendors AS V
      ON P.vend_id = V.vend_id
```

Calculated fields can be processed within the VIEW to be utilised by other SELECT statements

Chapter 19 – Stored Procedures

The syntax for creating a STORED PROCEDURE is exactly that.

STORED PROCEDURE – AS

N.B. - CREATE PROCEDURE MUST be the FIRST/ONLY statement in this query batch

Page 194 - STORED PROCEDURE

Procedure has been modified to demonstrate

1. How a STORED PROCEDURE is CREATED.
2. How to DROP a STORED PROCEDURE.
3. How to DECLARE a variable.
4. How a STORED PROCEDURE uses the EXECUTE statement.

Code for a Stored Procedure to add a new Customer with an incremented cust_id

```
SELECT *
FROM CustNew

--DROP the NewCustomer Stored Procedure
--DROP PROCEDURE NewCustomer

--Create a new stored Procedure for inserting new customers with an incremented
cust_id

CREATE PROCEDURE NewCustomer @cust_name CHAR (20), @cust_address CHAR (50),
@cust_city CHAR (50)
AS
--Declare the variable for the new cust_id
DECLARE @Newcust_id INTEGER
--Get the current highest cust_id
SELECT @Newcust_id = MAX (cust_id )+ 1
FROM CustNew
--INSERT the New Customer
 INSERT INTO CustNew(cust_id,cust_name, cust_address,cust_city)
 VALUES (@Newcust_id,@cust_name, @cust_address, @cust_city)
--Return the NewCustomer
 RETURN @NewCust_id

--Execute the Stored Procedure
EXECUTE NewCustomer 'Fish Shop', '11 Bean Street', 'Glebe'
```

Chapter 19 – Stored Procedures (Cont.)

User Defined Stored Procedure – for mathematical calculations.

DECIMAL (10, 4) is 10 places to the right and left of the decimal point…
the 4 is the number of decimals returned to the right of the decimal point.
Calculate the number of integer places:
10 - 4 = 6 6 is the number of places which can be stored to the left of the decimal point.
6 integer positions to the left of the decimal and 4 decimals add to 10.

```
CREATE PROCEDURE CalcVars @VarOne DECIMAL(10, 6), @VarTwo DECIMAL(10, 6)
AS
DECLARE @VarResult DECIMAL(10, 6)
SELECT @Varresult = @varOne * @varTwo
PRINT @VarResult
RETURN @VarResult

EXEC dbo.CalcVars 122.85 ,81.4    -- returns four (4) decimal places – the maximum allowable

EXEC dbo.CalcVars 122.85 ,81.5    -- cannot return more than four (4) decimal places - ERROR
```

Chapter 20 – Managing Transactions

To ensure that batches of SQL statements are executed *in entirety with integrity*, a transaction management regime is employed.

BEGIN TRANSACTION	- the commencement of the transaction process
SAVE TRANSACTION	- establish point in the database 'record set' where the process can return to the *Savepoint*
COMMIT TRANSACTION	- all SQL statements between BEGIN and COMMIT will be executed if successful, OR NOT AT ALL if unsuccessful
ROLLBACK TRANSACTION	- return to the *Savepoint* in the case that all SQL statements have not been executed completely

Page 203 - Using *Savepoints*

SAVE TRANSACTION {Unique Identifier}

ROLLBACK TRANSACTION {Unique Identifier}

If you commit the transaction, you can't then make a rollback. Do one or the other!

- **NB Once you <u>BEGIN</u> a transaction, you MUST either <u>ROLLBACK</u> or <u>COMMIT</u>.**
- **The server will expect one of either of these two instructions, or will hang!**

Chapter 21 – Using Cursors

Cursors are the result dataset of a query. The dataset is 'loaded' into the Cursor for processing on a record by record basis. Once the Cursor is stored, applications (SQL code) can scroll or browse up and down through the data.

Page 207 - CREATE CURSOR

A Cursor is DECLARED.

```
DECLARED {CursorName} CURSOR
FOR
SELECT {Fields}
FROM {Table}
```

DECLARE statements -	Declare variables used in the code block
SET\SELECT statements -	Initialize the variables to a specific value
DECLARE CURSOR statement -	Populate the cursor with values that will be evaluated
OPEN statement -	Open the cursor to begin data processing
FETCH NEXT statements -	Assign the specific values from the cursor to the variables
NOTE -	This logic is used for the initial population before the WHILE statement and then again during each loop in the process as a portion of the WHILE statement
WHILE statement -	Condition to begin and continue data processing
BEGIN...END statement -	Start and end of the code block
NOTE -	Based on the data processing multiple BEGIN...END statements can be used could be just about any DML or administrative logic
CLOSE statement -	Releases the current data and associated locks, but permits the cursor to be re-opened
DEALLOCATE statement -	Destroys the cursor

Page 210 - USING CURSOR(s)

Once DECLARED, Cursors can be OPENED.
Variables are DECLARED to hold the contents of the Cursor.
Code executed against it.
Once the execution of the code has been completed, the Cursor must be CLOSED (each time).
Once a Cursor is CLOSED, it cannot be reused again.
It does not have to be 'RE-DECLARED' to be OPENED again, just OPEN it.

Once the Cursor is completely finished with, it is DEALLOCATED to return resources back to the application.
Once DEALOCATED, the Cursor must be DECLARED again before it can be OPENED.

Please note that cursors are the **SLOWEST** way to access data inside SQL Server. They should only be used when you truly need to access a row or object (e.g. a Database) one at a time.

N.B.
There are additional sample files for Cursors in the Section of this Document - Exercise: Using Cursors and Stored Procedures.

Chapter 21 – Using Cursors (cont.)

Example of a Cursor Statement

Copied from mssqltips.com

This will backup all databases for this instance of SQL Server…

```
DECLARE @name VARCHAR (50)            -- database name
DECLARE @path VARCHAR (256)           -- path for backup files
DECLARE @fileName VARCHAR (256)       -- filename for backup
DECLARE @fileDate VARCHAR (20)        -- used for file name

 -- specify database backup directory
SET @path = 'C:\Backup\'

 -- specify filename format
SELECT @fileDate = CONVERT(VARCHAR (20), GETDATE(),112)  -- returns in the
format 20160725

DECLARE db_cursor CURSOR FOR
SELECT name
FROM master.dbo.sysdatabases
WHERE name NOT IN ('master','model','msdb','tempdb')  -- exclude these
databases

OPEN db_cursor
FETCH NEXT FROM db_cursor INTO @name
 WHILE @@FETCH_STATUS = 0    -- continue until there are no more databases
to backup

 BEGIN
      SET @fileName = @path + @name + '_' + @fileDate + '.BAK'
      BACKUP DATABASE @name TO DISK = @fileName

    FETCH NEXT FROM db_cursor INTO @name
 END

CLOSE db_cursor
DEALLOCATE db_cursor
```

Chapter 22 - Constraints

PRIMARY KEY – A unique identifier for a table; allows the ability to form a relationship with a linked table via a Foreign Key. One Primary Key in the parent table and many of those keys in the linking table. Once associated, Referential Integrity can be enforced to ensure that a row is present in the Primary Key table before any subsequent records (rows) can be added as a Child Record in the linking table.

- ADD Primary Key
```
-- ADD a Primary Key to a table not keyed
ALTER TABLE CustNew
ADD PRIMARY KEY (cust_id)
```

For demonstration purposes, return the name of the Column containing the PK

- SELECT Primary Key
```
--Select the name of the Primary Key field
SELECT name
FROM sys.key_constraints
WHERE type = 'PK' AND OBJECT_NAME(parent_object_id) = N'CustNew';
GO
```

- ADD Foreign Key
```
--ALTER the table of the Foreign Key
ALTER TABLE Orders
ADD Constraint
--Describe the Relationship between the PK & FK
FOREIGN KEY (cust_id) REFERENCES Customers (cust_id)
```

- Check Constraints – CREATING TABLE
```
--Define the Column requiring the CHECK at Table creation
CREATE TABLE OrderItems
Quantity     INTEGER     NOT NULL    CHECK (quantity > 0)
```

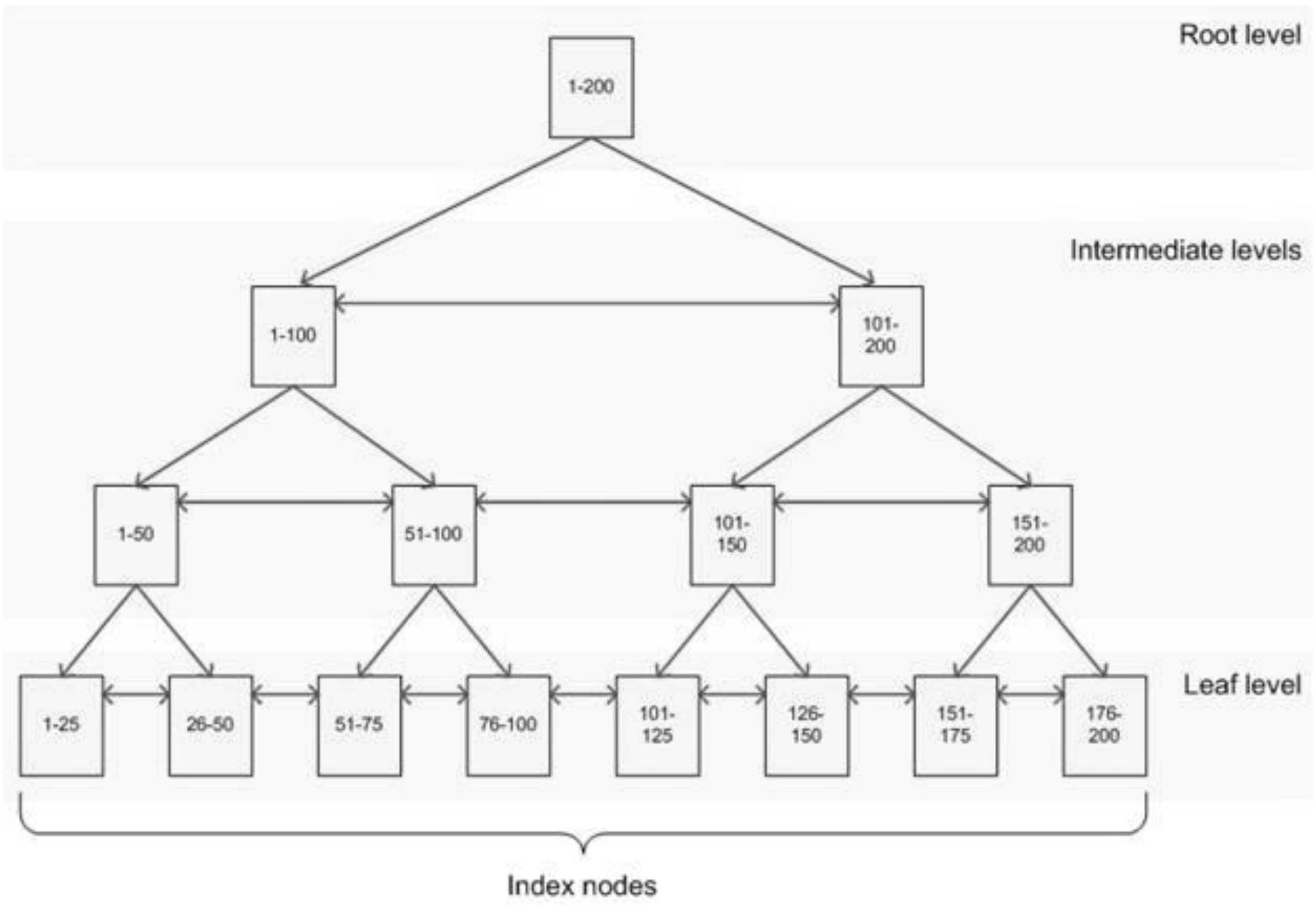
- Check Constraints – ALTERING TABLE
```
--ADD CONSTRAINT to the Column after Table built
ADD CONSTRAINT CHECK (quantity > 0)
```

Understanding Indexes

Indexes are used to sort data in a logical order.

A Primary Keyed Column is a **Clustered Index**.
There can be only one clustered index per table, because the data rows themselves can be sorted in **only one order**.

The returned Row is quickly found by the unique sorted Column (usually the PK).



Chapter 22 – Indexes (cont.)

The database also allows for **Non Clustered Indexes**.
Non Clustered Indexes are a separate Index file ordering the required Column alphabetically and associating the location of each Row with the position (Pointer) to the Table.

This is the Clustered Index column

id_PK	Item	Value	Location
1	Mon	54	South
2	Tue	21	West
3	Wed	83	South
4	Thu	24	North
5	Fri	97	West
6	Sat	72	West
7	Sun	41	North
8	Mon	14	South
9	Tue	96	East
10	Wed	50	South
11	Thu	81	West
12	Fri	88	South
13	Sat	88	North
14	Sun	62	West
15	Mon	24	West
16	Tue	70	North
17	Wed	77	South
18	Thu	85	East
19	Fri	35	South
20	Sat	34	West
21	Sun	57	South
22	Mon	73	North
23	Tue	95	West
24	Wed	13	West
25	Thu	85	North

This table is ordered by the I**tem Column** for faster access.

Index Table

id_PK	Pointer
5	Fri
12	Fri
19	Fri
1	Mon
8	Mon
15	Mon
22	Mon
6	Sat
13	Sat
20	Sat
7	Sun
14	Sun
21	Sun
4	Thu
11	Thu
18	Thu
25	Thu
2	Tue
9	Tue
16	Tue
23	Tue
3	Wed
10	Wed
17	Wed
24	Wed

Using Triggers

Triggers are created to be fired (triggered) after any **action query**:

- INSERT
- UPDATE
- DELETE

Examples of the uses for triggers would be generating audit tables to record data movements as a result of an action query i.e. writing logging tables.

The following example creates both a Employee_Test, and an Employee_Test_Audit tables for use in both the INSERT and UPDATE triggers. No DELETE trigger has been provided, but the trigger architecture is almost identical.

```
--CREATE TABLE Employee_Test
--(
--emp_ID INT Identity PRIMARY KEY,
--emp_Name Varchar(100),
--emp_Sal Decimal (10,2)
--)

--INSERT INTO Employee_Test VALUES ('Anees',1000);
--INSERT INTO Employee_Test VALUES ('Rick',1200);
--INSERT INTO Employee_Test VALUES ('John',1100);
--INSERT INTO Employee_Test VALUES ('Stephen',1300);
--INSERT INTO Employee_Test VALUES ('Maria',1400);

--SELECT *
--FROM Employee_Test

--CREATE TABLE Employee_Test_Audit
--(
--emp_AuditKey INT Identity PRIMARY KEY,
--emp_ID int,
--emp_name varchar(100),
--emp_Sal decimal (10,2),
--audit_Action varchar(100),
--audit_Timestamp datetime
--)

--SELECT *
--FROM Employee_Test_Audit
```

Chapter 22 – *Triggers (cont.)*

This is an After INSERT Trigger

==

```
--CREATE TRIGGER trgAfterInsert ON [dbo].[Employee_Test]
--FOR INSERT
--AS
--   DECLARE @empid INT;
--   DECLARE @empname VARCHAR(100);
--   DECLARE @empsal DECIMAL(10,2);
--   DECLARE @audit_action VARCHAR(100);

--   SELECT @empid=i.Emp_ID FROM inserted AS i;
--   SELECT @empname=i.Emp_Name FROM inserted AS i;
--   SELECT @empsal=i.Emp_Sal from inserted AS i;
--   SET @audit_action='Inserted Record -- After Insert Trigger.';

--   INSERT INTO Employee_Test_Audit
--           (emp_ID, emp_Name, emp_Sal, audit_Action, audit_Timestamp)
--   VALUES (@empid, @empname, @empsal, @audit_action, GetDate());

--   PRINT 'AFTER INSERT trigger fired.'
--GO

--INSERT INTO Employee_Test
--VALUES('Miles',2250);

--SELECT *
--FROM Employee_Test

--SELECT *
--FROM Employee_Test_Audit
```

==

Chapter 22 – Triggers (cont)

This is an After UPDATE Trigger

```
--CREATE TRIGGER trgAfterUpdate ON [dbo].[Employee_Test]
--FOR UPDATE
--AS
--   DECLARE @empid INT;
--   DECLARE @empname VARCHAR(100);
--   DECLARE @empsal DECIMAL(10,2);
--   DECLARE @audit_action VARCHAR(100);

--   SELECT @empid=i.Emp_ID FROM inserted AS i;
--   SELECT @empname=i.Emp_Name FROM inserted AS i;
--   SELECT @empsal=i.Emp_Sal FROM inserted AS i;

--   IF UPDATE(Emp_Name)
--        SET @audit_action='Updated Employee Name -- After Update
Trigger.';
--   IF UPDATE(Emp_Sal)
--        SET @audit_action='Updated Employee Salary -- After Update
Trigger.';

--   INSERT INTO Employee_Test_Audit(Emp_ID, Emp_Name, Emp_Sal,
Audit_Action, Audit_Timestamp)
--   VALUES(@empid, @empname, @empsal, @audit_action, GETDATE());

--   PRINT 'AFTER UPDATE Trigger fired.'
--GO

-- UPDATE Employee_Test
-- SET Emp_Sal=1550
-- WHERE Emp_ID=5
```

Exercise: Using Cursors and Stored Procedures

There is a sp_Exercise file in the Backup directory.

This is a complete database containing a number of Stored Procedures and examples of Cursors using those Stored Procedures.

The Backup file can be Restored to the SQL Server by following the steps below:

1. Ensure you have SQL Management studio open
2. Highlight the Databases folder
3. Right mouse click and select Restore Database
4. In the General page
    a. Source – Select Device
    b. Click on the ellipsis …
    c. Select Backup Device
    d. Add path to the sp_Exercise file in the Backup Directory
    e. Locate Backup File and Select All Files (*) from the File name
    f. Select sp_Exercise
    g. OK, then OK
    h. In the Destination, select the Database
    i. Add **a new database name** e.g. WorkingWithCursors
    j. Hit OK
5. A new database has been Restored to the SQL Server

Scripted exercise references are prefixed with Alpha characters e.g. AAA; BBB in the Project folder.