Database Systems

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T-SQL programming

Declaring and Initializing a Variable:

Store values in the computer memory. Every variable has *type and value*

To use a variable, you must first declare it.

DECLARE @name type
example.:

DECLARE @myProdName nvarchar(40), @myProdID int

You assign a value to a variable after you declare it by using the SET statement or by using the SELECT statement.

Example:

SET @myProdName='Tea'
SET @myProdID=7

Query with parameters

We can use variables in the WHERE clause.

List those products which ProductID is the same as the @myProdID parameter value or the product name is equal with the @myProdName parameter:

```
DECLARE @myProdName nvarchar(40), @myProdID int
SET @myProdName='Pavlova'
SET @myProdID=7

SELECT ProductID, ProductName, UnitPrice
FROM Products
WHERE ProductID=@myProdID OR
    ProductName=@myProdName;
```

Results | Messages

	ProductID	ProductName	UnitPrice
1	7	Uncle Bob's Organic Dried Pears	30,00
2	16	Pavlova	17,45

Control Statements

IF ….ELSE
WHILE
GOTO
RETURN
Break/Continue
Try/Catch
WaitFor

Decision Statement - IF statement

IF condition
    [BEGIN]
    statement(s)
    [END]
ELSE
    [BEGIN]
    statement(s)
    [END]

IF structure

```
IF (SELECT COUNT(*) FROM Products WHERE UnitPrice<5)>0
BEGIN
    PRINT 'The unit price of the following products are less than 5$'
    SELECT ProductID, ProductName, UnitPrice
    FROM Products
    WHERE UnitPrice<5
END
ELSE
BEGIN
PRINT 'There is not any product wich unitprice less than 5$'
END
```

150 %

Results | Messages

	ProductID	ProductName	UnitPrice
1	24	Guaraná Fantástica	4,50
2	33	Geitost	2,50

CASE expression

You can use to apply conditional logic to determine the returned value.

The CASE expression has two forms—the *simple* form and the *searched* form.

The simple form compares an input expression to multiple possible scalar when expressions and returns the result expression associated with the first match. If there's no match and an ELSE clause is specified, the else expression is returned.

The simple form syntax:

```
CASE input expression
    WHEN expression
    THEN result expression
    ELSE result expression
END
```

Example of simple Case expression

```
SELECT CASE ProductLine
   WHEN 'R' THEN 'Road'
   WHEN 'M' THEN 'Mountain'
   WHEN 'T' THEN 'Touring'
   WHEN 'S' THEN 'Other'
   ELSE 'Parts'
END AS Category,
Name AS ProductName,
ProductNumber
FROM AdventureWorks2012.Production.Product
ORDER BY ProductName
```

Part of the result->

Results | Messages

	Category	ProductName	ProductNumber
1	Parts	Adjustable Race	AR-5381
2	Mountain	All-Purpose Bike Stand	ST-1401
3	Other	AWC Logo Cap	CA-1098
4	Parts	BB Ball Bearing	BE-2349
5	Parts	Bearing Ball	BA-8327
6	Other	Bike Wash - Dissolver	CL-9009
7	Parts	Blade	BL-2036
8	Other	Cable Lock	LO-C100
9	Parts	Chain	CH-0234
10	Parts	Chain Stays	CS-2812
11	Parts	Chainring	CR-7833

CASE Expression

The *searched* form of the CASE expression is more flexible. Instead of comparing an input expression to multiple possible expressions, it uses predicates in the WHEN clauses, and the first predicate that evaluates to true determines which *WHEN* expression is returned. If none is true, the CASE expression returns the *ELSE* expression.

```
SELECT ProductID, ProductName, UnitPrice,
CASE
WHEN UnitPrice < 20.00 THEN 'Low'
WHEN UnitPrice < 40.00 THEN 'Medium'
WHEN UnitPrice >= 40.00 THEN 'High'
ELSE 'Unknown'
END AS Pricerange
FROM Products;
```

Results | Messages

	ProductID	ProductName	UnitPrice	Pricerange
1	1	Chai	18,00	Low
2	2	Chang	19,00	Low
3	3	Aniseed Syrup	10,00	Low
4	4	Chef Anton's Cajun Seasoning	22,00	Medium
5	5	Chef Anton's Gumbo Mix	21,35	Medium
6	6	Grandma's Boysenberry Spread	25,00	Medium
7	7	Uncle Bob's Organic Dried Pears	30,00	Medium
8	8	Northwoods Cranberry Sauce	40,00	High
9	9	Mishi Kobe Niku	97,00	High
10	10	Ikura	31,00	Medium
11	11	Queso Cabrales	21,00	Medium
12	12	Queso Manchego La Pastora	38,00	Medium
13	13	Konbu	6,00	Low
14	14	Tofu	23,25	Medium
15	15	Genen Shouyu	15,50	Low
16	16	Pavlova	17,45	Low
17	17	Alice Mutton	39,00	Medium

Here another example of simple Case expression and variables

```
DECLARE @State nchar(2), @StateName nvarchar(15)
SET @State='MA'
SET @StateName=CASE @State
WHEN 'CA' THEN 'California'
WHEN 'MA' THEN 'Massachusetts'
WHEN 'NY' THEN 'New York'
END
SELECT @StateName as StateName;
```

Results | Messages

StateName
Massachusetts

Simple Case:
Check the last digit of OrderId in Orders table and show the value as a text, but only if it is in 1-5 range. Otherwise the result let be the text 'other.' List the first 15 rows from the table.

```
SELECT TOP 15 OrderID, OrderDate, OrderID%10 as LastDigit,
    CASE OrderID%10
        WHEN 1 THEN 'One'
        WHEN 2 THEN 'Two'
        WHEN 3 THEN 'Three'
        WHEN 4 THEN 'Four'
        WHEN 5 THEN 'Five'
        ELSE 'Other'
    END as LastDigitText
FROM Orders;
```

100 %

Results | Messages

	OrderID	OrderDate	LastDigit	LastDigitText
1	10249	1996-07-05 00:00:00.000	9	Other
2	10250	1996-07-08 00:00:00.000	0	Other
3	10251	1996-07-08 00:00:00.000	1	One
4	10252	1996-07-09 00:00:00.000	2	Two
5	10253	1996-07-10 00:00:00.000	3	Three
6	10254	1996-07-11 00:00:00.000	4	Four
7	10255	1996-07-12 00:00:00.000	5	Five
8	10256	1996-07-15 00:00:00.000	6	Other
9	10257	1996-07-16 00:00:00.000	7	Other
10	10258	1996-07-17 00:00:00.000	8	Other
11	10259	1996-07-18 00:00:00.000	9	Other
12	10260	1996-07-19 00:00:00.000	0	Other
13	10261	1996-07-19 00:00:00.000	1	One
14	10262	1996-07-22 00:00:00.000	2	Two
15	10263	1996-07-23 00:00:00.000	3	Three

LOOPS - WHILE

With the WHILE construct, you can create loops inside T-SQL in order to execute a statement block as long as a condition continues to evaluate to true.

Syntax:

WHILE condition
 [Begin]
  statements
[End]

Example:

```
DECLARE @Count int
SET @Count=5
WHILE @Count>0
BEGIN
 PRINT 'counter= '+CONVERT(nvarchar(3),@Count)
 SET @Count=@Count-1
 END;
```

Messages

```
counter= 5
counter= 4
counter= 3
counter= 2
counter= 1
```

CONVERT

If you want to print numeric values, you have to convert them to text type, as you can see in the earlier example. You can use the CONVERT() or the CAST() functions.

Example:

```
PRINT 'counter= '+CONVERT(nvarchar(3),@Count)
```

OR:

```
PRINT 'counter= '+CAST(@Count AS nvarchar)
```

CONTINUE and BREAK statements

Inside the WHILE loop, you can use a BREAK statement to end the loop immediately and a

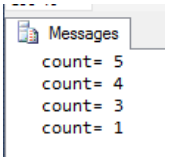
CONTINUE statement to cause execution to jump back to the beginning of the loop.

CONTINUE

IF @count =2, jump back to the beginning of the loop

```
DECLARE @count int
 SET @count=5
WHILE (@count>0)
BEGIN
     PRINT 'count= '+ CONVERT(nvarchar, @count)
     SET @count=@count-1
     IF(@count=2)
          BEGIN
           SET @count=@count-1
           CONTINUE
          END
END
```

The result:

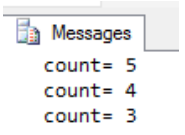


15

BREAK Statement

IF @Count=2 BREAK statement ends the loop immediately

```
DECLARE @count int
 SET @count=5
WHILE (@count>0)
BEGIN
     PRINT 'count= '+ CONVERT(nvarchar, @count)
     SET @count=@count-1
     IF(@count=2)
          BEGIN
            BREAK
          END
END
```



WAITFOR statement

The WAITFOR command can cause execution of statements to pause for a specified period of time. WAITFOR has three options: WAITFOR DELAY, WAITFOR TIME, and WAITFOR RECEIVE.
(WAITFOR RECEIVE is used only with Service Broker.)

WAITFOR DELAY causes the execution to delay for a requested duration.

For example, the following WAITFOR DELAY pauses code execution for 5 seconds.

```
WAITFOR DELAY '00:00:05' – pauses 5 seconds
```

WAITFOR TIME, on the other hand, pauses execution to wait for a specific time.

For example, the following code waits until '20:15:10'.

```
WAITFOR TIME '20:15:10'
```

RETURN statement

Whenever a RETURN is executed, execution of the stored procedure or function ends and control returns to the caller.

You can use more than one RETURN command in a procedure.

RETURN by itself causes SQL Server to send a status code back to the caller. The statuses are 0 for successful and a negative number if there is an error.

You can send your own return codes back to the caller by inserting an integer value after the RETURN statement.

Syntax:

RETURN [int-expression]

Using cursors

SQL Server is built to process sets of data. However, there are times when you need to process data one row at a time.

The result of a SELECT statement is returned to a server-side object called *cursor*, which allows you to access one row at a time within the result set and even allows scrolling forward as well as backward through the result set.

Cursors

Usage steps:

Declare variables to store fields from SELECT statement

Declare cursor and define the SELECT statement

Open the cursor

Fetch rows from the cursor

Close the cursor

Usage of Cursors

1. *Declare variables* to store the retrieved fields from the SELECT statement
2. *Declare cursor*: is used to define the SELECT statement that is the basis for the rows in the cursor.
3. *Open cursor*: Open causes the SELECT statement to be executed and loads the rows into a memory structure.
4. *FETCH* is used to retrieve one row at a time from the cursor.
5. *CLOSE* is used to close the processing on the cursor. *DEALLOCATE* is used to remove the cursor and release the memory structures containing the cursor result set.

An example: Using cursor list the Products table rows

```
-- Using Cursor
-- 1. declare variables
DECLARE @myProductID int, @myProductName nvarchar(40), @myUnitprice money
-- 2. declare cursor
DECLARE ProductCursor CURSOR FOR
SELECT ProductID, ProductName, UnitPrice
FROM Products
WHERE ProductID<=10
-- 3. Open the cursor
OPEN ProductCursor
```

Example (cont.)

```
-- 4. Fetch rows
FETCH NEXT FROM ProductCursor INTO @myProductID, @myProductName, @myUnitPrice
WHILE @@FETCH_STATUS=0
BEGIN
   PRINT 'myProductID= '+CAST(@myProductID AS nvarchar)
   PRINT 'myProductName= '+@myProductName
   PRINT 'myUnitPrice= '+CAST(@myUnitPrice AS nvarchar)
   FETCH NEXT FROM ProductCursor INTO @myProductID, @myProductName, @myUnitPrice
END
-- 5. Close the cursor
CLOSE ProductCursor
DEALLOCATE ProductCursor
```

0 – when the previous fetch was successful
-1 – when the row is beyond the result set
-2 – when the row fetched is missing

close the cursor and the DEALLOCATE it.

The Result

Messages

```
myProductID= 1
myProductName= Chai
myUnitPrice= 18.00
myProductID= 2
myProductName= Chang
myUnitPrice= 19.00
myProductID= 3
myProductName= Aniseed Syrup
myUnitPrice= 10.00
myProductID= 4
myProductName= Chef Anton's Cajun Seasoning
myUnitPrice= 22.00
myProductID= 5
myProductName= Chef Anton's Gumbo Mix
myUnitPrice= 21.35
myProductID= 6
myProductName= Grandma's Boysenberry Spread
myUnitPrice= 25.00
myProductID= 7
myProductName= Uncle Bob's Organic Dried Pears
myUnitPrice= 30.00
myProductID= 8
myProductName= Northwoods Cranberry Sauce
```

User Defined Functions

The purpose of a user-defined function (UDF) is to encapsulate reusable T-SQL code and return a scalar value or a table to the caller.

Types:

Scalar functions: retrieve only one value

Inline table-valued function: returns a table; contains single line of code

Table-valued function: returns a table; multiple lines of code is called a multistatement table-valued UDF.

User-defined Function

Create:

CREATE FUNCTION funcName(parameters)

Modify:

ALTER FUNCTION funcName

Delete:

DROP FUNCTION funcName

Calling:

schemaname.functionName

example: dbo.DiscountPrice()

User Defined Function

Example: Take an OriginalPrice and a discount value and return the result of multiplying them together.

```
CREATE FUNCTION DiscountPrice(@OriginalPrice money, @Discount float)
RETURNS money
AS
BEGIN
  RETURN @OriginalPrice * @Discount
END
```

Execute:

```
/* Futtatás */
SELECT dbo.DiscountPrice(120,0.2)
```

Results | Messages

	(No column name)
1	24,00

User defined Function

The input parameter can be a column value from a table:

```
SELECT dbo.DiscountPrice(UnitPrice,0.2), UnitPrice
FROM Products
WHERE ProductID=1;
```

Results | Messages

	(No column name)	UnitPrice
1	3,60	18,00

- The parameter can be a local variable

```
/* Execute */
DECLARE @Discount float
SET @Discount=0.2
SELECT dbo.DiscountPrice(UnitPrice, @Discount), UnitPrice
FROM Products
WHERE ProductID=1;
```

Inline table-valued function

A table-valued UDF returns a table rather than a single value to the caller. As a result, it can be called in a T-SQL query wherever a table is expected, which is in the FROM clause.

An **inline** table-valued function is the only type of UDF that can be written without a BEGIN/END block.

An inline table-valued UDF contains a single SELECT statement that returns a table.

Example: Create a function to retrieve the rows from Products table where the UnitsInStock value less or equel with the input parameter (@ReorderLevel)

```
CREATE FUNCTION ProductsToBeReordered(@ReorderLevel int)
RETURNS table
AS
RETURN
(
  SELECT *
  FROM Products
  WHERE UnitsInStock <= @ReorderLevel
)
```

To call the function, embed it in the FROM clause of a SELECT statement, but be sure to supply the required parameters.

```
SELECT *
FROM ProductsToBeReordered(6);
```

Results | Messages

	ProductID	ProductName	SupplierID	CategoryID	QuantityPerUnit	UnitPrice	UnitsInStock	UnitsOnOrder	ReorderLevel
1	5	Chef Anton's Gumbo Mix	2	2	36 boxes	21,35	0	0	0
2	8	Northwoods Cranberry Sauce	3	2	12 - 12 oz jars	40,00	6	0	0
3	17	Alice Mutton	7	6	20 - 1 kg tins	39,00	0	0	0
4	21	Sir Rodney's Scones	8	3	24 pkgs. x 4 pieces	10,00	3	40	5
5	29	Thüringer Rostbratwurst	12	6	50 bags x 30 sausgs.	123,79	0	0	0
6	31	Gorgonzola Telino	14	4	12 - 100 g pkgs	12,50	0	70	20
7	45	Rogede sild	21	8	1k pkg.	9,50	5	70	15
8	53	Perth Pasties	24	6	48 pieces	32,80	0	0	0
9	66	Louisiana Hot Spiced Okra	2	2	24 - 8 oz jars	17,00	4	100	20
10	68	Scottish Longbreads	8	3	10 boxes x 8 pieces	12,50	6	10	15
11	74	Longlife Tofu	4	7	5 kg pkg.	10,00	4	20	5

We can filter the result retrieved from the function

```
SELECT ProductID, ProductName, UnitsInStock
FROM ProductsToBeReordered(10)
WHERE ProductID <=50;
```

Results | Messages

	ProductID	ProductName	UnitsInStock
1	5	Chef Anton's Gumbo Mix	0
2	8	Northwoods Cranberry Sauce	6
3	17	Alice Mutton	0
4	21	Sir Rodney's Scones	3
5	29	Thüringer Rostbratwurst	0
6	30	Nord-Ost Matjeshering	10
7	31	Gorgonzola Telino	0
8	32	Mascarpone Fabioli	9
9	45	Rogede sild	5
10	49	Maxilaku	10

Multistatement Table-Valued UDF

Multistatement table-valued UDF can consist of multiple lines of T-SQL code.

A multistatement table-valued UDF has a RETURN statement at the end of the function body.

Solve the earlier problem with multistatement table-valued function! The returntable will contain the **ProductID**, **ProductName** and **UnitsInStock** fields and extends the fields with a new one the **Reorder** column which contains **yes/no** values according to the result of comparing UnitsInStock and @ReorderLevel values.

```
CREATE FUNCTION ProductsToBeReordered2(@ReorderLevel int)
RETURNS @MyProducts table
(
  ProductID int,
  ProductName nvarchar(40),
  UnitsInStock smallint,
  Reorder nvarchar(3)
)
AS
BEGIN

  INSERT INTO @MyProducts
    SELECT ProductID, ProductName, UnitsInStock, 'No'
    FROM Products;

  UPDATE @MyProducts
  SET Reorder = 'Yes'
  WHERE UnitsInStock <= @ReorderLevel

  RETURN

END
```

You must define the table to be returned as a table variable and insert data into the table variable. The RETURN statement just ends the function and is not used to send any data back to the caller.

The result of the execution (only the first 12 rows):

```
SELECT *
FROM ProductsToBeReordered2(20);
```

Results | Messages

	ProductID	ProductName	UnitsInStock	Reorder
1	1	Chai	39	No
2	2	Chang	17	Yes
3	3	Aniseed Syrup	13	Yes
4	4	Chef Anton's Cajun Seasoning	53	No
5	5	Chef Anton's Gumbo Mix	0	Yes
6	6	Grandma's Boysenberry Spread	120	No
7	7	Uncle Bob's Organic Dried Pears	15	Yes
8	8	Northwoods Cranberry Sauce	6	Yes
9	9	Mishi Kobe Niku	29	No
10	10	Ikura	31	No
11	11	Queso Cabrales	22	No
12	12	Queso Manchego La Pastora	86	No

Stored Procedure

- A **stored procedure** is a named collection of procedural and SQL statements. Stored procedures are stored in the database.
- There are two clear advantages to the use of stored procedures:
  - Stored procedures substantially reduce network traffic and increase performance. Because the procedure is stored at the server, there is no transmission of individual SQL statements over the network. The use of stored procedures improves system performance because all transactions are executed locally on the RDBMS, so each SQL statement does not have to travel over the network.
  - Stored procedures help reduce code duplication by means of code isolation and code sharing (creating unique SQL modules that are called by application programs), thereby minimizing the chance of errors and the cost of application development and maintenance.

Stored procedure

Stored procedures can call other stored procedures.

Whenever a RETURN is executed, execution of the stored procedure ends and control returns to the caller.

Syntax:

```
CREATE PROCEDURE procName
[parameters]
AS
Begin
    statements
End
```

To Modify: ALTER PROCEDURE procName

To Delete: DROP PROCEDURE procName

Stored procedures

Create in current database by using the CREATE PROCEDURE statement

```
CREATE PROCEDURE Production.LongLeadProducts
AS
  SELECT  Name, ProductNumber
  FROM    Production.Product
  WHERE   DaysToManufacture >= 1

GO
```

Use EXECUTE to run stored procedure

```
EXECUTE Production.LongLeadProducts
```

Syntax for Altering and Dropping Stored Procedures

- ALTER PROCEDURE

```
ALTER PROC Production.LongLeadProducts
AS
  SELECT  Name, ProductNumber, DaysToManufacture
  FROM    Production.Product
  WHERE   DaysToManufacture >= 1
  ORDER BY DaysToManufacture DESC, Name

GO
```

- DROP PROCEDURE

```
DROP PROC Production.LongLeadProducts
```

Stored Procedure

- *argument* specifies the parameters that are passed to the stored procedure. A stored procedure could have zero or more arguments or parameters.
- *IN/OUT* indicates whether the parameter is for input, output, or both.
- *data-type* is one of the procedural SQL data types used in the RDBMS. The data types normally match those used in the RDBMS table creation statement.
- Variables can be declared. You must specify the variable name, its data type, and (optionally) an initial value.

Input Parameters

- Provide appropriate default values
- Validate incoming parameter values, including null checks

```
ALTER PROC Production.LongLeadProducts
  @MinimumLength int = 1  -- default value
AS

IF (@MinimumLength < 0)    -- validate
  BEGIN
    RAISERROR('Invalid lead time.', 14, 1)
    RETURN
  END

SELECT  Name, ProductNumber, DaysToManufacture
FROM    Production.Product
WHERE   DaysToManufacture >= @MinimumLength
ORDER BY DaysToManufacture DESC, Name
```

```
EXEC Production.LongLeadProducts @MinimumLength=4
```

Output Parameters and Return Values

```
CREATE PROC HumanResources.AddDepartment
  @Name nvarchar(50), @GroupName nvarchar(50),
  @DeptID smallint OUTPUT
AS
IF ((@Name = '') OR (@GroupName = ''))
  RETURN -1

INSERT INTO HumanResources.Department (Name, GroupName)
VALUES   (@Name, @GroupName)

SET @DeptID = SCOPE_IDENTITY()
RETURN 0
```

```
DECLARE @dept int, @result int
EXEC @result = AddDepartment 'Refunds', '', @dept OUTPUT
IF (@result = 0)
   SELECT @dept
ELSE
   SELECT 'Error during insert'
```

Syntax for Structured Exception Handling

- TRY…CATCH blocks provide the structure
  - TRY block contains protected transactions
  - CATCH block handles errors

```
CREATE PROCEDURE dbo.AddData @a int, @b int
AS

BEGIN TRY
   INSERT INTO TableWithKey VALUES (@a, @b)
END TRY
BEGIN CATCH
   SELECT   ERROR_NUMBER() ErrorNumber,
            ERROR_MESSAGE() [Message]
END CATCH
```

Temporary tables

There are two types of temporary tables:

- local
- global

These temporary tables are created in **tempdb** and not within the database you are connected to. They have a finite lifetime.

Local temporary tables

A local temporary table is defined by prefixing the table name by a single hash mark: #.

```
CREATE TABLE #TempTableName (.....);
```

The scope of a local temporary table is the connection that created it only.

A local temporary table survives until the connection it was created within is dropped (when the Query Editor window is closed).

Local temporary table

```
CREATE TABLE #MyOrderTotalbyYear
(
rendelesev INT NOT NULL PRIMARY KEY,
menny INT NOT NULL
);
INSERT INTO #MyOrderTotalbyYear(rendelesev, menny)
  SELECT YEAR(O.orderdate) AS rendelesev, SUM(OO.OrderQty)
  FROM Sales.SalesOrderHeader as O
    JOIN Sales.SalesOrderDetail as OO
      ON OO.SalesOrderID=O.SalesOrderID
  GROUP BY YEAR(OrderDate);

  SELECT Cur.rendelesev, Cur.menny as curMenny, Prv.menny as PrvMenny
  FROM #MyOrderTotalbyYear as Cur
    LEFT OUTER JOIN #MyOrderTotalbyYear as Prv
      ON Cur.rendelesev=Prv.rendelesev+1;
```

%

Results | Messages

rendelesev	curMenny	PrvMenny
2005	11848	NULL
2006	60918	11848
2007	124699	60918
2008	77449	124699

Local temporary table

In a new query pan has been typed the same SELECT statement => error!(another session!!!)

SQLQuery2.sql - SZ...i-HP\Szendroi (55))* | SQLQuery1.sq

```
SELECT rendelesev, menny
FROM #MyOrderTotalbyYear
```

100 %

Messages

```
Msg 208, Level 16, State 0, Line 1
Invalid object name '#MyOrderTotalbyYear'.
```

Global temporary table

A global temporary table is defined by prefixing the table name by a double hash mark: ##.

The scope of a global temporary table differs significantly.

When a connection creates the table, it is then available to be used by any user and any connection, just like a permanent table.

A global temporary table will be "deleted" only when all connections to it have been closed.

TRIGGERS

The trigger is a special stored procedure, which answer an event in the database

Types:

- DDL (data definition)
- DML (data manipulation)

DDL triggers fire (execute) if a user modify the stucture of the database objects (CREATE, ALTER, DROP)

TRIGGERS

DML triggers execute when a user modify the data of a table.

The code run automatically when the event is happened.

We **cannot call the triggers explicitly**.

The triggers have not any input parameters or return values.

TRIGGERS

The DML triggers fires when an

- INSERT
- DELETE
- UPDATE operation is executing.

TRIGGERS

Triggers have to link to a table

The SQL server use to virtual tables when ececute SQL data manipulation statements

- INSERTED,
- DELETED

We can use these tables in our triggers.

Triggers

- A trigger is invoked before or after a data row is inserted, updated, or deleted.
- A trigger is associated with a database table.
- Each database table may have one or more triggers.
- A trigger is executed as part of the transaction that triggered it.

RDBMS vendors recommend triggers for:

- Auditing purposes (creating audit logs).
- Automatic generation of derived column values.
- Enforcement of business or security constraints.
- Creation of replica tables for backup purposes.

TRIGGERS

Syntax:

```
CREATE TRIGGER triggername
ON [shema.]tablename
{FOR|AFTER
[DELETE],[INSERT],[UPDATE] |INSTEAD OF}
AS
Sql statements
```

The triggering timing: FOR or AFTER. This timing indicates when the trigger's SQL code executes—in this case, before or after the triggering statement is completed.

Some Notes with TRIGGERS

- Oracle and MS SQL Server allow a trigger to include multiple triggering conditions; that is, any combination of INSERT, UPDATE, and/or DELETE.
- MySQL allows only one triggering condition per trigger. Therefore, if a certain set of actions should be taken in the case of multiple events, for example, during an UPDATE or an INSERT, then two separate triggers are required in MySQL. To reduce having duplicate code in both triggers, it is a common practice to create a stored procedure that performs the common actions, then have both triggers call the same stored procedure.

Trigger Example

Create a trigger which rejects the modification of the UnitsInStock value of a Product (Northwind DB), if its new value will be lower than the half of the original value was.

Triggers

```
CREATE TRIGGER ProductsControl
    ON Products
    FOR UPDATE
AS
    IF EXISTS
    (
        SELECT 'True'
        FROM Inserted i
        JOIN Deleted d
            ON i.ProductID=d.ProductID
        WHERE (d.UnitsInStock-i.UnitsInStock)>d.UnitsInStock/2
            AND d.UnitsInStock-i.UnitsInStock>0
    )
    BEGIN
        RAISERROR('Nem lehet a készletet több mint
        50%%-al csökkenteni',16,1)
        ROLLBACK TRAN
    END
```

```
--Teszteljük
UPDATE Products
SET UnitsInStock=2
Where ProductID=8
```

```
Messages
Msg 50000, Level 16, State 1, Procedure ProductsControl, Line 15
Nem lehet a készletet több mint
        50%-al csökkenteni
Msg 3609, Level 16, State 1, Line 1
The transaction ended in the trigger. The batch has been aborted.
```

Thank you for your attention!