

# Scalar user defined functions

WRITING FUNCTIONS AND STORED PROCEDURES IN SQL SERVER



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# User defined functions (UDFs)

## What?

Routines that

- Can accept input parameters
- Perform an action
- Return result (single scalar value or table)

## Why?

- Can reduce execution time
- Can reduce network traffic
- Allow for Modular Programming

# What is modular programming?

- Software design technique
- Separates functionality into independent, interchangeable modules
- Allows code reuse
- Improves code readability

# Functions in recipes

## Chocolate Chip Cookies

<https://elanaspantry.com>

Servings: 24

### Ingredients:

2½ cups blanched almond flour (not almond meal)  
¼ teaspoon celtic sea salt  
¼ teaspoon baking soda  
10 tablespoons butter, melted  
1 tablespoon vanilla extract  
½ cup agave nectar or honey  
1 cup chocolate chips

### Instructions:

1. Combine dry ingredients in a large bowl
2. Stir together wet ingredients in a small bowl
3. Mix wet ingredients into dry
4. Form 1-inch balls and press onto a parchment paper lined baking sheet
5. Bake at 350°F for 7-10 minutes
6. Cool and serve

1. Press Bake button
2. Enter 350
3. Press Start button
4. Wait for preheat beep
5. Put cookies in oven
6. Enter 7 minutes on timer
7. After timer beeps check cookies If done then remove else cook for additional 3 minutes.

# Bake function input parameters

1. Press Bake button
2. Enter 350
3. Press Start button
4. Wait for preheat beep
5. Put cookies in oven
6. Enter 7 minutes on timer
7. After timer beeps check cookies If done then remove else cook for additional 3 minutes.



1. Press Bake button
2. Enter **@temp** parameter
3. Press Start button
4. Wait for preheat beep
5. Put cookies in oven
6. Enter **@minutes** on timer
7. After timer beeps check cookies If done then remove else cook for **@additional\_minutes**.

# Scalar UDF with no input parameter

```
-- Scalar function with no input parameters
CREATE FUNCTION GetTomorrow()
    RETURNS date AS BEGIN
RETURN (SELECT DATEADD(day, 1, GETDATE()))
END
```

# Scalar UDF with one parameter

```
-- Scalar function with one parameter
CREATE FUNCTION GetRideHrsOneDay (@DateParm date)
    RETURNS numeric AS BEGIN
RETURN (
    SELECT
        SUM(
            DATEDIFF(second, PickupDate, DropoffDate)
        ) / 3600
    FROM
        YellowTripData
    WHERE
        CONVERT (date, PickupDate) = @DateParm
) END;
```

# Scalar UDF with two input parameters

```
-- Scalar function with two input parameters
CREATE FUNCTION GetRideHrsDateRange (
    @StartDateParm datetime, @EndDateParm datetime
) RETURNS numeric AS BEGIN RETURN (
    SELECT
        SUM(
            DATEDIFF(second, PickupDate, DropOffDate)
        ) / 3600
    FROM YellowTripData
    WHERE
        PickupDate > @StartDateParm
        AND DropoffDate < @EndDateParm
    ) END;
```



# It's your turn to create UDFs!

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# Table valued UDFs

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# Inline table valued functions (ITVF)

```
CREATE FUNCTION SumLocationStats (  
    @StartDate AS datetime = '1/1/2017'  
) RETURNS TABLE AS RETURN  
SELECT  
    PULocationID AS PickupLocation,  
    COUNT(ID) AS RideCount,  
    SUM(TripDistance) AS TotalTripDistance  
FROM YellowTripData  
WHERE CAST(PickupDate AS Date) = @StartDate  
GROUP BY PULocationID;
```

```
CREATE FUNCTION CountTripAvgFareDay (  
    @Month char(2),  
    @Year char(4)  
) RETURNS @TripCountAvgFare TABLE(  
    DropOffDate date, TripCount int, AvgFare numeric  
) AS BEGIN INSERT INTO @TripCountAvgFare  
SELECT  
    CAST(DropOffDate as date),  
    COUNT(ID),  
    AVG(FareAmount) as AvgFareAmt  
FROM YellowTripData  
WHERE  
    DATEPART(month, DropOffDate) = @Month  
    AND DATEPART(year, DropOffDate) = @Year  
GROUP BY CAST(DropOffDate as date)  
RETURN END;
```

# Differences - ITVF vs. MSTVF

## Inline

- RETURN results of SELECT
- Table column names in SELECT
- No table variable
- No BEGIN END needed
- No INSERT
- Faster performance

## Multi statement

- DECLARE table variable to be returned
- BEGIN END block required
- INSERT data into table variable
- RETURN last statement within BEGIN/END block

# Your turn!

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# UDFs in action

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# Execute scalar with SELECT

```
-- Select with no parameters  
SELECT dbo.GetTomorrow()
```

```
+-----+  
| 2019-02-28 |  
+-----+
```



# Execute scalar with EXEC & store result

```
-- EXEC & store result in variable
DECLARE @TotalRideHrs AS numeric
EXEC @TotalRideHrs = dbo.GetRideHrsOneDay @DateParm = '1/15/2017'
SELECT
    'Total Ride Hours for 1/15/2017:',
    @TotalRideHrs
```

```
+-----+-----+
| Total Ride Hours for 1/15/2017: | 71626 |
+-----+-----+
```

# SELECT parameter value & scalar UDF

```
-- Declare parameter variable
-- Set to oldest date in YellowTripData
-- Pass to function with select
DECLARE @DateParm as date =
(SELECT TOP 1 CONVERT(date, PickupDate)
 FROM YellowTripData
 ORDER BY PickupDate DESC)
SELECT @DateParm, dbo.GetRideHrsOneDay (@DateParm)
```

```
+-----+-----+
| 2017-01-31 | 75519 |
+-----+-----+
```

```
SELECT TOP 10 *  
FROM dbo.SumLocationStats ('1/09/2017')  
ORDER BY RideCount DESC
```

PickupLocation	RideCount	TotalTripDistance
237	13254	22281.95
161	13206	28208.49
236	13200	24224.69
162	11859	26169.46
186	10587	22415.43
230	10257	26139.16
234	10234	19758.23
170	9963	20931.97
132	9230	144778.90
48	8361	18978.80

```
DECLARE @CountTripAvgFareDay TABLE(  
    DropOffDate    date,  
    TripCount      int,  
    AvgFare        numeric)  
INSERT INTO @CountTripAvgFareDay  
SELECT TOP 10 *  
FROM dbo.CountTripAvgFareDay (01, 2017)  
ORDER BY DropOffDate ASC  
  
SELECT * FROM @CountTripAvgFareDay
```

```

+-----+-----+-----+
| DropOffDate | TripCount | AvgFare |
+-----+-----+-----+
| 2017-01-01  | 279198    | 15.37   |
| 2017-01-02  | 225224    | 12.65   |
| 2017-01-03  | 277980    | 12.27   |
| 2017-01-04  | 289050    | 12.33   |
| 2017-01-05  | 323885    | 11.89   |
| 2017-01-06  | 339158    | 11.72   |
| 2017-01-07  | 306508    | 11.31   |
| 2017-01-08  | 292649    | 12.33   |
| 2017-01-09  | 302120    | 12.49   |
| 2017-01-10  | 305611    | 12.27   |
+-----+-----+-----+

```

# See your functions in action!

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# Maintaining user defined functions

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# ALTER Function

```
ALTER FUNCTION SumLocationStats (@EndDate as datetime = '1/01/2017')
RETURNS TABLE AS RETURN
SELECT
    PULocationID as PickupLocation,
    COUNT(ID) as RideCount,
    SUM(TripDistance) as TotalTripDistance
FROM YellowTripData
WHERE CAST(DropOffDate as Date) = @EndDate
GROUP BY PULocationID;
```



# CREATE OR ALTER

```
CREATE OR ALTER FUNCTION SumLocationStats (  
    @EndDate AS datetime = '1/01/2017')  
    RETURNS TABLE AS RETURN  
    SELECT  
        PULocationID as PickupLocation,  
        COUNT(ID) AS RideCount,  
        SUM(TripDistance) AS TotalTripDistance  
    FROM YellowTripData  
    WHERE CAST(DropOffDate AS Date) = @EndDate  
    GROUP BY PULocationID;
```

```
-- Delete function
```

```
DROP FUNCTION dbo.CountTripAvgFareDay
```

```
-- Create CountTripAvgFareDay as Inline TVF instead of MSTVF
```

```
CREATE FUNCTION dbo.CountTripAvgFareDay(  
    @Month char(2),  
    @Year char(4)  
) RETURNS TABLE AS RETURN (  
    SELECT  
        CAST(DropOffDate as date) as DropOffDate,  
        COUNT(ID) as TripCount,  
        AVG(FareAmount) as AvgFareAmt  
    FROM YellowTripData  
    WHERE  
        DATEPART(month, DropOffDate) = @Month  
        AND DATEPART(year, DropOffDate) = @Year  
    GROUP BY CAST(DropOffDate as date));
```

# Determinism improves performance

- A function is deterministic when it returns the same result given
  - the same input parameters
  - the same database state

```
SELECT
```

```
  OBJECTPROPERTY(  
    OBJECT_ID(' [dbo].[GetRideHrsOneDay]'),  
    'IsDeterministic'  
  )
```

```
+----+  
|  1  |  
+----+
```

```
SELECT
```

```
  OBJECTPROPERTY(  
    OBJECT_ID(' [dbo].[GetTomorrow]'),  
    'IsDeterministic'  
  )
```

```
+----+  
|  0  |  
+----+
```

# Schemabinding

- Specifies the schema is bound to the database objects that it references
- Prevents changes to the schema if schema bound objects are referencing it

```
CREATE OR ALTER FUNCTION dbo.GetRideHrsOneDay (@DateParm date)
RETURNS numeric WITH SCHEMABINDING
AS
BEGIN
RETURN
(SELECT SUM(DATEDIFF(second, PickupDate, DropoffDate))/3600
FROM dbo.YellowTripData
WHERE CONVERT (date, PickupDate) = @DateParm)
END;
```

# Let's practice!

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