Basic aggregate functions

TIME SERIES ANALYSIS IN SQL SERVER

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Key aggregation functions

Counts

`COUNT()`

`COUNT_BIG()`

`COUNT(DISTINCT)`

Other Aggregates

`SUM()`

`MIN()`

`MAX()`

What counts with COUNT()

Number of Rows

```
COUNT(*)
```

```
COUNT(1)
```

```
COUNT(1/0)
```

Non-NULL Values

```
COUNT(d.YR)
```

```
COUNT(NULLIF(d.YR, 1990))
```

Distinct counts

```
SELECT
    COUNT(DISTINCT c.CalendarYear) AS Years,
    COUNT(DISTINCT NULLIF(c.CalendarYear, 2010)) AS Y2
FROM dbo.Calendar c;
```

Years	Y2
50	49

Filtering aggregates with CASE

```
SELECT
    MAX(CASE WHEN ir.IncidentTypeID = 1
             THEN ir.IncidentDate
             ELSE NULL
        END) AS I1,
    MAX(CASE WHEN ir.IncidentTypeID = 2
             THEN ir.IncidentDate
             ELSE NULL
        END) AS I2,
FROM dbo.IncidentRollup ir;
```

I1	I2
2020-06-30	2020-06-29

Let's practice!

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Statistical aggregate functions

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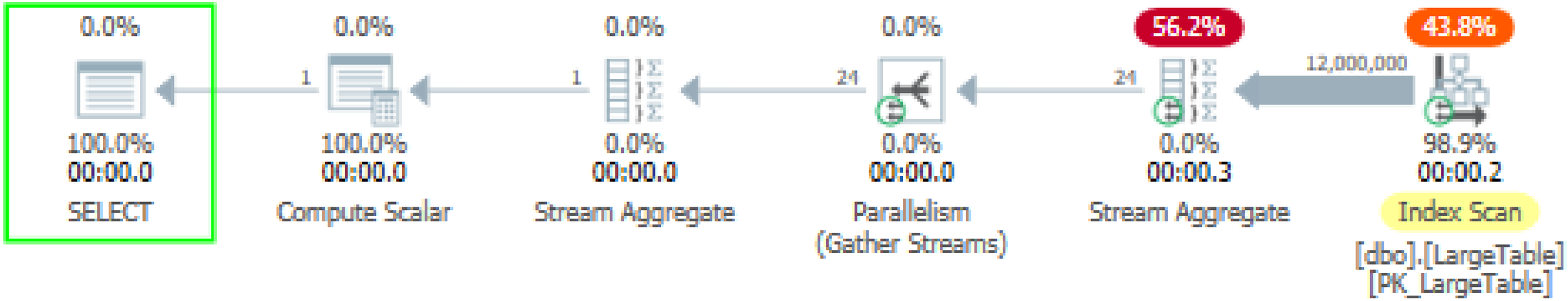
Statistical aggregate functions

`AVG()`	Mean
`STDEV()`	Standard Deviation
`STDEVP()`	Population Standard Deviation
`VAR()`	Variance
`VARP()`	Population Variance

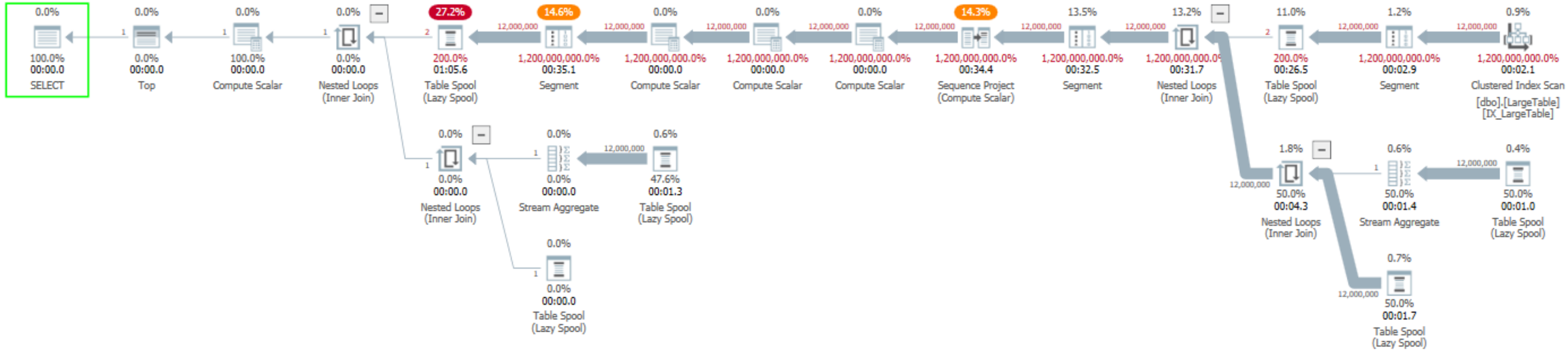
What about median?

```
SELECT TOP(1)
    PERCENTILE_CONT(0.5)
        WITHIN GROUP (ORDER BY l.SomeVal DESC)
        OVER () AS MedianIncidents
FROM dbo.LargeTable l;
```

But how bad is it?



This bad


0.0%
100.0%
00:00.0
SELECT
0.0%
0.0%
00:00.0
Top
0.0%
100.0%
00:00.0
Compute Scalar
0.0%
0.0%
00:00.0
Nested Loops
(Inner Join)
27.2%
200.0%
01:05.6
Table Spool
(Lazy Spool)
14.6%
12,000,000
1,200,000,000.0%
00:35.1
Segment
0.0%
12,000,000
1,200,000,000.0%
00:00.0
Compute Scalar
0.0%
12,000,000
1,200,000,000.0%
00:00.0
Compute Scalar
0.0%
12,000,000
1,200,000,000.0%
00:00.0
Compute Scalar
14.3%
12,000,000
1,200,000,000.0%
00:34.4
Sequence Project
(Compute Scalar)
13.5%
12,000,000
1,200,000,000.0%
00:32.5
Segment
13.2%
12,000,000
1,200,000,000.0%
00:31.7
Nested Loops
(Inner Join)
11.0%
200.0%
00:26.5
Table Spool
(Lazy Spool)
1.2%
12,000,000
1,200,000,000.0%
00:02.9
Segment
0.9%
12,000,000
1,200,000,000.0%
00:02.1
Clustered Index Scan
[dbo].[LargeTable]
[IX_LargeTable]
0.0%
0.0%
00:00.0
Nested Loops
(Inner Join)
0.0%
0.0%
00:00.0
Stream Aggregate
0.6%
12,000,000
47.6%
00:01.3
Table Spool
(Lazy Spool)
0.0%
0.0%
00:00.0
Table Spool
(Lazy Spool)
1.8%
12,000,000
50.0%
00:04.3
Nested Loops
(Inner Join)
0.6%
50.0%
00:01.4
Stream Aggregate
0.4%
12,000,000
50.0%
00:01.0
Table Spool
(Lazy Spool)
0.7%
12,000,000
50.0%
00:01.7
Table Spool
(Lazy Spool)

The cost of median

	Median	Mean
Est. Cost	95.7%	4.3%
Duration	68.5s	0.37s
CPU	68.5s	8.1s
Reads	72,560,946	39,468
Writes	87,982	0

Let's practice!

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Downsampling and upsampling data

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Data in nature

```
SELECT
    SomeDate
FROM dbo.SomeTable
```

SomeDate
2019-08-11 06:14:29.990
2019-08-11 11:07:37.633
2019-08-11 14:08:00.337

Downsampling data

```
SELECT
    CAST(SomeDate AS DATE) AS SomeDate
FROM dbo.SomeTable
```

SomeDate
2019-08-11
2019-08-11
2019-08-11

Further downsampling

```
SELECT
    DATEADD(HOUR, DATEDIFF(HOUR, 0, SomeDate), 0) AS SomeDate
FROM dbo.SomeTable
```

`DATEDIFF(HOUR, 0, '2019-08-11 06:21:16')` = 1,048,470

`DATEADD(HOUR, 1048470, 0)` = 2019-08-11 06:00:00

SomeDate
2019-08-11 06:00:00.000
2019-08-11 11:00:00.000
2019-08-11 14:00:00.000

What about upsampling?

Downsampling

- Aggregate data
- Can usually sum or count results
- Provides a higher-level picture of the data
- Acceptable for most purposes

Upsampling

- Disaggregate data
- Need an allocation rule
- Provides artificial granularity
- Acceptable for data generation, calculated averages

Let's practice!

TIME SERIES ANALYSIS IN SQL SERVER

Grouping by ROLLUP, CUBE, and GROUPING SETS

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Hierarchical rollups with ROLLUP

```
SELECT
    t.Month,
    t.Day,
    SUM(t.Events) AS Events
FROM Table
GROUP BY
    t.Month,
    t.Day
WITH ROLLUP
ORDER BY
    t.Month,
    t.Day;
```

Month	Day	Events
NULL	NULL	100
1	NULL	60
1	1	3
1	2	4
...	...	...
2	NULL	40
2	1	8

Cartesian aggregation with CUBE

```
SELECT
    t.IncidentType,
    t.Office,
    SUM(t.Events) AS Events
FROM Table
GROUP BY
    t.IncidentType,
    t.Office
WITH CUBE
ORDER BY
    t.IncidentType,
    t.Office;
```

IncidentType	Office	Events
NULL	NULL	250
NULL	NY	70
NULL	CT	180
T1	NULL	55
T1	NY	30
T1	CT	25

Define grouping sets with GROUPING SETS

```
SELECT
    t.IncidentType,
    t.Office,
    SUM(t.Events) AS Events
FROM Table
GROUP BY GROUPING SETS
(
  (t.IncidentType, t.Office),
  ()
)
ORDER BY
    t.IncidentType,
    t.Office;
```

IncidentType	Office	Events
NULL	NULL	250
T1	NY	30
T1	CT	25
T2	NY	10
T2	CT	110
T3	NY	30
T3	CT	45

Let's practice!

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