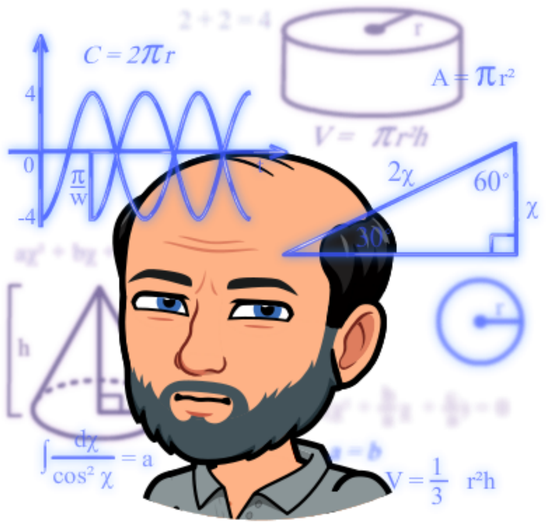
Window functions in SQL Server
 - brush up your skills



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Data Saturday Denmark
Kongens Lyngby 2026-01-31

Window functions in SQL Server

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- Developer for ERP apps, SQL scripts and BI stuff
- Worked at consultancies, ISVs, end user companies
- 1995: SQL Server, 2014: R, 2020: Power*, 2024: Arduino
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Agenda

- Introduction: window functions
- Aggregate functions
- Window frames
- Ranking functions
- Statistical/analytical functions
- Offset functions
- Specials
- Round-up, resources, learning

Introduction: window functions

- „In SQL, a window function or analytic function is a function which uses values from one or multiple rows to return a value for each row.
  (This contrasts with an aggregate function, which returns a single value for multiple rows.)
  Window functions have an OVER clause; any function without an OVER clause is not a window function, but rather an aggregate or single-row (scalar) function.“ *1)
- „A window function in SQL is a type of function that allows us to perform calculations across a specific set of rows related to the current row. These calculations happen within a defined window of data, and they are particularly useful for aggregates, rankings, and cumulative totals without altering the dataset.“ *2)
- A window function applies additional filtering to a query, which can be defined by partitioning, ordering, and framing clauses.
  Contrary to a WHERE clause, this works on each row individually.

*1: https://en.wikipedia.org/wiki/Window_function_(SQL), *2: https://www.geeksforgeeks.org/window-functions-in-sql

Introduction: window functions

- **General form:**

  SELECT <column_1>, <column_2>,
  <window_function> **OVER** (**PARTITION BY** <…> | **ORDER BY** <...> | <**window_frame**>) <column_alias>
  FROM <table_name> …

- **<window_frame>:**

  Rows | Range [| Groups] BETWEEN <lower_bound> AND <upper_bound> [<window frame exclusion>]
  Unbounded preceding | N preceding | Current row | N following | Unbounded following

- **Named window definition (SQL Server 2022):**

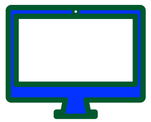
  SELECT <column_1>, <column_2>,
  <window_function_1>() OVER **<window_name>** <column_alias_1>
  <window_function_2>() OVER **<window_name>** <column_alias_2>
  FROM <table_name> …
  WINDOW <window_name> AS (PARTITION BY <...> | ORDER BY <...> | <window_frame>)

Aggregate functions

The usual suspects:

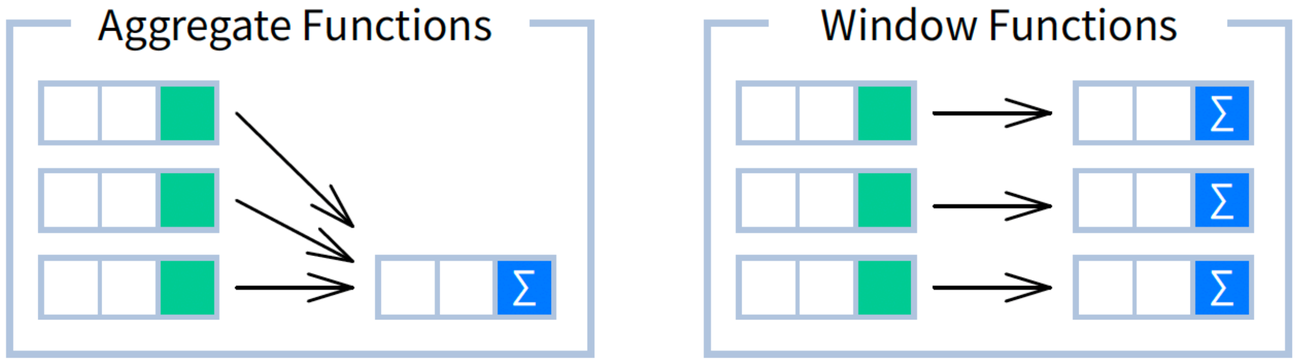
- AVG() Average value
- COUNT(), COUNT_BIG() Count of values
- MIN(), MAX() Minimum / Maximum of value
- SUM(), PRODUCT() Sum / product of values
- and also VAR(), VARP(), STDEV(), STDEVP(), CHECKSUM_AGG(int)

work as ‘normal’ aggregates, but also in conjunction with Window functions.



Aggregate functions

Grouped aggregates vs Window aggregates



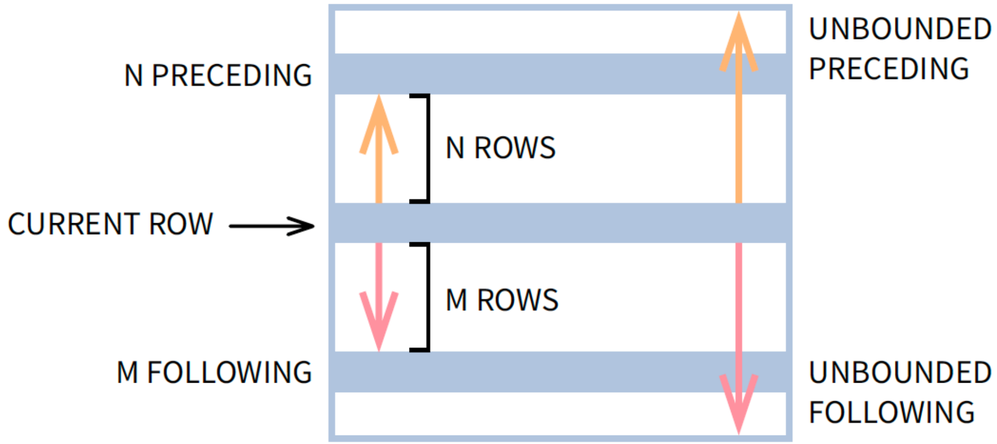
Aggregating on a grouped level vs
aggregating on criteria relative to each individual row.

Visualization by: https://learnsql.com/blog/sql-window-functions-cheat-sheet/

Window frames

- Introduce an additional level of filtering, relative to the current row, applicable to aggregate functions and First_value, Last_value, [Nth_value]

```
<ROWS | RANGE | GROUPS> BETWEEN lower_bound AND upper_bound
```



The bounds can be any of the five options:

- `UNBOUNDED PRECEDING`
- `n PRECEDING`
- `CURRENT ROW`
- `n FOLLOWING`
- `UNBOUNDED FOLLOWING`

The `lower_bound` must be BEFORE the `upper_bound`.

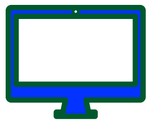
! The default behaviour with an optional ORDER BY is:
RANGE BETWEEN UNBOUNDED PRECEDING AND CURRENT ROW

Visualization by: https://learnsql.com/blog/sql-window-functions-cheat-sheet/

Ranking functions

- ROW_NUMBER()
  returns the sequential number of each row within a partition
- RANK()
  similar to ROW_NUMBER(), but returns the same value for ties, allows gaps
- DENSE_RANK()
  returns the same rank value for ties, without gaps
- NTILE(n)
  evenly distributes the rows into the specified number of groups,
  returns the group number for each row; i.e. NTILE(4) -> quartiles

all of them require OVER(ORDER BY …)



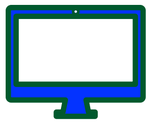
Statistical/analytical functions

Rank distribution:

- PERCENT_RANK()
  calculates the relative rank of a row within a partition
- CUME_DIST()
  returns the cumulative distribution of a row within a partition

Inverse distribution:

- PERCENTILE_CONT
  calculates a percentile based on continuous distribution
- PERCENTILE_DISC
  returns the percentile based on discrete distribution

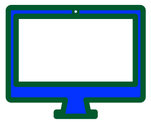


Offset functions

- LAG(expr, offset, default) value from row before current row
- LEAD(expr, offset, default) value from row after current row

- FIRST_VALUE() by order within the partition (not the smallest value)
- LAST_VALUE() by order within the partition (not the highest value)

- [NTH_VALUE()] not implemented in SQL Server



Specials

- Ordered set functions

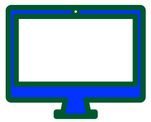
  - STRING_AGG() - in SQL-standard called LISTAGG

  - [Hypothetical set functions] grouped

  - [Inverse distribution functions] grouped

- [Row-pattern recognition] Totally not implemented in SQL Server ☹️

- First and last record in a partition



Specials: Gaps and islands

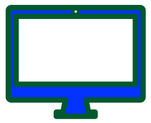
GapStart	GapEnd
2025-09-24	2025-09-24
2025-09-27	2025-09-28
2025-10-03	2025-10-05

Gaps

2025-09-22
2025-09-23
2025-09-25
2025-09-26
2025-09-29
2025-09-30
2025-10-01
2025-10-02
2025-10-06
2025-10-07
2025-10-08

Islands

IslandStart	IslandEnd
2025-09-22	2025-09-23
2025-09-25	2025-09-26
2025-09-29	2025-10-02
2025-10-06	2025-10-08



Resources:

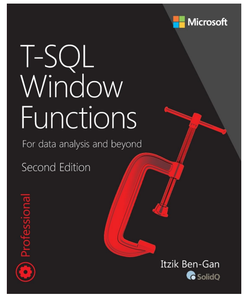
- MS Learn: https://learn.microsoft.com/en-us/training/modules/write-queries-that-use-window-functions/

  https://learn.microsoft.com/en-us/sql/t-sql/queries/select-over-clause-transact-sql/

  https://learn.microsoft.com/en-us/sql/t-sql/queries/select-window-transact-sql/
- LearnSQL (incl. cheat sheet): https://learnsql.com/blog/sql-window-functions-guide/

- AW2025 download: https://learn.microsoft.com/en-us/sql/samples/adventureworks-install-configure
- AdventureWorks diagram: https://www.dbdiagrams.com/online-diagrams/adventureworks/

- Itzik Ben-Gan: „T-SQL Window Functions - For data analysis and beyond“, ISBN 978-0135861448



Window functions in SQL Server

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