

# Query Optimization

**TRAINSIGNAL**  
THE GLOBAL LEADER IN PROFESSIONAL COMPUTER TRAINING



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## Indexes

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### Index Concepts

Guarantees order in which data is sorted

Think of a phonebook

- Data sorted by last name

Designing indexes takes time and planning

- More indexes generally leads to faster querying
- More indexes generally leads to slower modifications
  - Data in an index must be kept up to date

Indexes must be maintained

- Administrator must defragment indexes

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## Index Types

### Clustered index

- Order in which the data in the table is stored
- Page number in a book

### Nonclustered index

- Copy of data sorted for queries
- Index in the back of a book
  - Contains a pointer back to the original content

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## Index Example

Customers		
CustomerID	Name	JoinDate
42	Christopher	11/8/2011
43	Karin	12/1/2011
44	Dave	12/5/2011
45	Susan	12/7/2011

IX_Customers_Name	
Name	CustomerID
Christopher	42
Dave	45
Karin	43
Susan	44

```
SELECT Name
      , JoinDate
FROM   Customers
WHERE  Name LIKE 'Chris%';
```

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## Statistics

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## Query Optimizer

Determines how to execute a query

- Generates an execution plan

### Goals

- Best way to execute a query
- Determine the execution plan as quickly as possible



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## Statistics

Stores information about data in indexes and tables

- "Cliff's Notes"

Used to determine how to execute a query

SQL Server automatically maintains indexes

- Administrators can control this manually

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## Query Plans

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## Query Plans

See what's going on behind the scenes  
Determine the execution plan used by SQL Server

Uses:

- Optimizing queries
- Determine which indexes were used

Two options to view:

- Actual execution plan
  - Requires the query be executed
- Estimated execution plan
  - May not be correct

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## Data Access Methods

Scan

- Examines every row in the table or index
- Imagine searching for all people named Christopher in the phonebook

Seek

- Able to follow path directly to the desired data
- Imagine searching for all people with a last name of Harrison in the phonebook

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## Join Algorithms

Merge Join

- Data is presorted
- Most efficient join

Loop Join (Nested Loops)

- One table is much smaller than the other
- Smaller table is searched for values that match larger table

Hash Join

- Large tables and unsorted data
- Slowest type of join

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# Query Hints

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## Query Hint Concepts

Control how SQL Server will execute a query

- Which index to use
- How to lock data

*Typically* avoided

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## Locking Hints

### ROWLOCK

- Force locks at the row level

### PAGELOCK

- Force locks at the page level

### TABLOCK

- Force locks at the table level

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## Index and Parameter Hints

### FORCESCAN

- Scans index or table

### FORCESEEK

- Seeks at the index or table

### OPTIMIZE FOR UNKNOWN

- Tells SQL Server to create a query plan where the value for the parameter will change frequently

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## Dynamic Management Objects

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## Dynamic Management Objects

Used to see what's going on behind the scenes

- Find out how SQL Server is using resources
- Identify problem queries

Views are treated like tables

Functions accept parameters

- Parameters are often other database objects

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## Index Dynamic Management Objects

`sys.dm_db_index_usage_stats`

- Determine which indexes are (or aren't) being used

`sys.dm_db_missing_index_details`

- Determine what indexes SQL Server thinks should be added

`sys.dm_db_index_physical_stats`

- Determine how an index is using disk space

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## Transaction Dynamic Management Objects

`sys.dm_tran_database_transactions`

- Something

`sys.dm_tran_session_transactions`

- Something

`sys.dm_tran_locks`

- Something else

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Dynamic SQL

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## Dynamic SQL

Allows for the creation of SQL on the fly

- Can enable a more flexible application

### Concerns

- Performance
  - Something
- Security
  - SQL Injection Attacks
    - Allows an attacker to inject their own SQL statements
    - Use parameters

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## Executing Dynamic SQL Statements

```
EXECUTE sp_executesql <SQL>  
    , <Parameter Definitions>  
    , <Parameter Values>
```

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