

Database

A database is an organized collection of data stored, Small databases can be stored on a file system, while large databases are hosted on computer clusters or cloud storage. Some examples of databases are -

1 Attendance Register

2 Cricket scorecard

3 Product Inventory

4 Telephone directory

Attendance Register					
Student	10-07-2022	09-07-2022	08-07-2022	07-07-2022	06-07-2022
S1	A	P	P	P	A
S2	P	P	A	P	A
S3	P	P	A	P	P
S4	P	P	P	P	P
S5	P	P	P	P	P
S6	P	P	P	P	P
S7	P	A	P	P	P
S8	P	P	P	P	P
S9	P	P	P	A	P
S10	P	P		A	P

SCORECARD			
Player	Runs	Wickets	Catches
P1	51	0	0
P2	286	0	0
P3	233	0	5
P4	137	0	2
P5	257	5	0
P6	32	2	0
P7	200	0	0
P8	87	3	2
P9	99	7	0
P10	331	2	3

Product Inventory					
Product	Quantity	Price	To be packed	To be Shipped	To be delivered
P1	51	521	4	4	16
P2	286	98	15	10	18
P3	233	676	10	20	16
P4	137	733	5	5	22
P5	257	686	22	21	14
P6	32	278	16	19	15
P7	200	227	13	18	3
P8	87	86	19	3	2
P9	99	332	17	9	13
P10	331	565	6	17	4

Telephone directory			
Person	Country code	State Code	Number
P1	91	22	9999 -XXXX - 8900
P2	1	33	9999 -XXXX - 8900
P3	108	657	9999 -XXXX - 8900
P4	118	982	9999 -XXXX - 8900
P5	64	234	9999 -XXXX - 8900
P6	110	12	9999 -XXXX - 8900
P7	127	133	9999 -XXXX - 8900
P8	68	42	9999 -XXXX - 8900
P9	71	42	9999 -XXXX - 8900
P10	92	34	9999 -XXXX - 8900

Why Store Data on Computer

1. Trillions of Data to be stored

2. Security Issues (payment details)

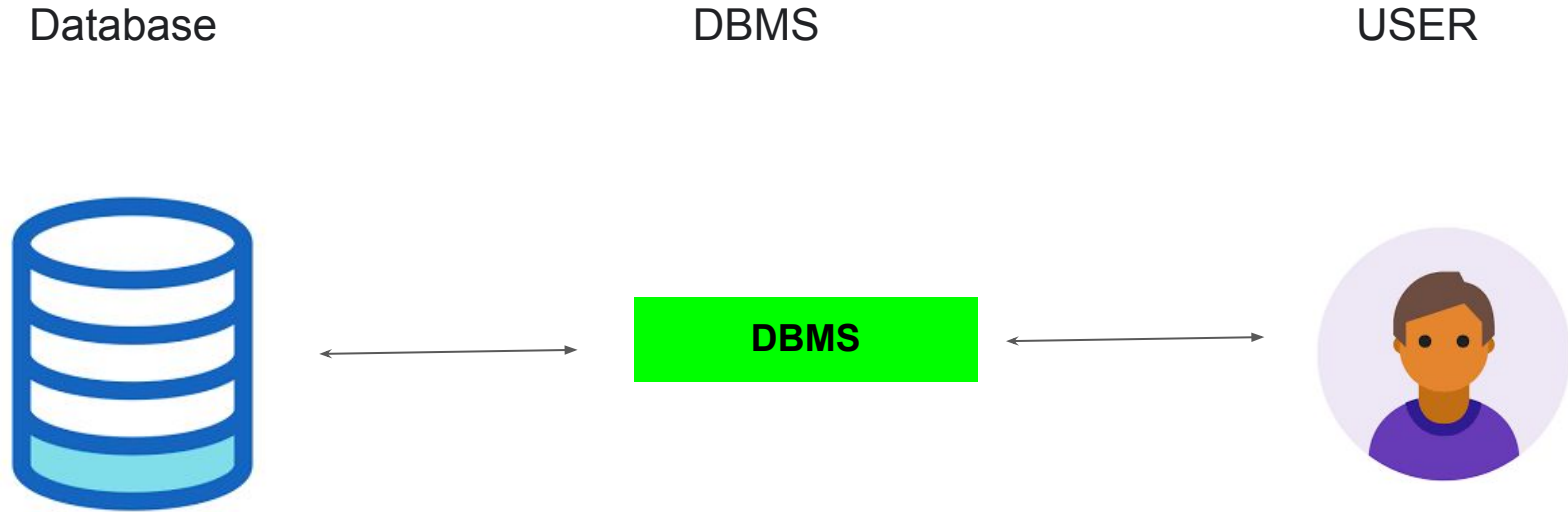


3. Better Decision making

4. Each info readily available

DBMS

The software which is used to manage the database is called Database Management System(DBMS). It provides us with an interface or a tool, to perform various operations.



What can DBMS do ?

- creating the database
- manipulating the database
- storing and retrieving the data from the database
- deleting data from the database, etc

DBMS runs on certain rules , and can limit what data the end-user sees and provides multiple views of the same database depending upon the user accessibility. For example, you can provide access to write on the database to some particular users only and for other users, you can provide the read access. All this can be done by a DBMS software , Some popular DBMS software is MySQL, Oracle, SQLite, PostgreSQL, MariaDB etc.

CRUD

C- **C**reate

R- **R**ead

U- **U**pdate

D- **D**eleate

Types of Databases

Relational (SQL)

1. Data stored in one or more tables
2. Each table has rows and columns
3. Each row is identified by a unique key

Non Relational (Not Just SQL / NOT SQL)

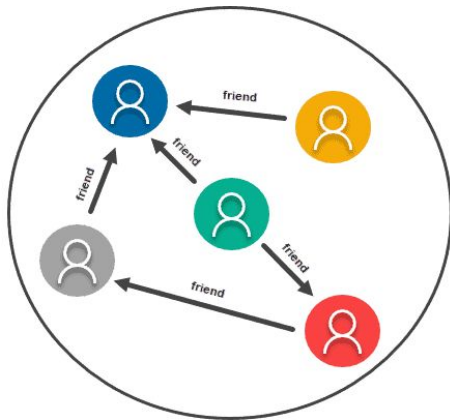
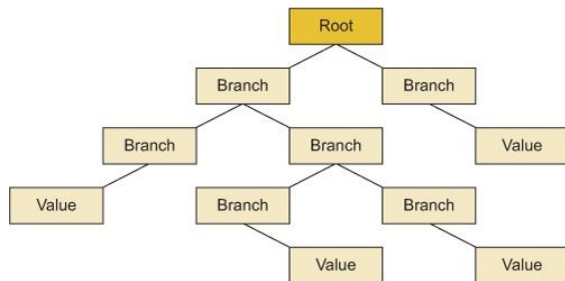
1. Data stored in traditional table
2. Key Value stores (JSON) , documents , graphs

Eg. of Relational

Player	Runs	Wickets	Catches
P1	51	0	0
P2	286	0	0
P3	233	0	5
P4	137	0	2
P5	257	5	0
P6	32	2	0
P7	200	0	0
P8	87	3	2
P9	99	7	0
P10	331	2	3

Player	Name
P1	N1
P2	N2
P3	N3
P4	N4
P5	N5
P6	N6
P7	N7
P8	N8
P9	N9
P10	N10

Eg. of Non Relational



Customer Document

```

"customer" =
{
  "id": "Customer:1",
  "firstName": "John",
  "lastName": "Wick",
  "age": 25,
  "address": {
    "country": "US",
    "city": "New York",
    "state": "NY",
    "street": "21 2nd Street",
  },
  "hobbies": [ Football, Hiking ],
  "phoneNumbers": [
    {
      "type": "Home",
      "number": "212 555-1234"
    },
    {
      "type": "Office",
      "number": "616 565-6789"
    }
  ]
}
}

```

Relational Database (SQL) [RDBMS]

RDBMS helps users to create a relational database

Eg. - Mysql , Oracle, Postgresql etc

SQL -Language to interact to the database using a query.

Sql query which runs on one rdbms need not necessarily will run on the other too , it requires modification.

Used to apply CRUD operations.

WHY SQL ?

- Faster Processing Speed
- Minimal Requirement of Coding
- Easier Data Manipulation
- Restricted Access

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DATATYPE

String Datatype

Data type	Description	Max size	Storage
char(n)	Fixed width character string	8,000 characters	Defined width
varchar(n)	Variable width character string	8,000 characters	2 bytes + number of chars
varchar(max)	Variable width character string	1,073,741,824 characters	2 bytes + number of chars
text	Variable width character string	2GB of text data	4 bytes + number of chars
nchar	Fixed width Unicode string	4,000 characters	Defined width x 2
nvarchar	Variable width Unicode string	4,000 characters	
nvarchar(max)	Variable width Unicode string	536,870,912 characters	
ntext	Variable width Unicode string	2GB of text data	
binary(n)	Fixed width binary string	8,000 bytes	
varbinary	Variable width binary string	8,000 bytes	
varbinary(max)	Variable width binary string	2GB	
image	Variable width binary string	2GB	

Numeric Datatype

Data type	Description	Storage
bit	Integer that can be 0, 1, or NULL	
tinyint	Allows whole numbers from 0 to 255	1 byte
smallint	Allows whole numbers between -32,768 and 32,767	2 bytes
int	Allows whole numbers between -2,147,483,648 and 2,147,483,647	4 bytes
bigint	Allows whole numbers between -9,223,372,036,854,775,808 and 9,223,372,036,854,775,807	8 bytes
decimal(p,s)	Fixed precision and scale numbers.	5-17 bytes
	Allows numbers from $-10^{38} + 1$ to $10^{38} - 1$.	
	The p parameter indicates the maximum total number of digits that can be stored (both to the left and to the right of the decimal point). p must be a value from 1 to 38. Default is 18.	
	The s parameter indicates the maximum number of digits stored to the right of the decimal point. s must be a value from 0 to p. Default value is 0	
numeric(p,s)	Fixed precision and scale numbers.	5-17 bytes
	Allows numbers from $-10^{38} + 1$ to $10^{38} - 1$.	
	The p parameter indicates the maximum total number of digits that can be stored (both to the left and to the right of the decimal point). p must be a value from 1 to 38. Default is 18.	
	The s parameter indicates the maximum number of digits stored to the right of the decimal point. s must be a value from 0 to p. Default value is 0	
smallmoney	Monetary data from -214,748.3648 to 214,748.3647	4 bytes
money	Monetary data from -922,337,203,685,477.5808 to 922,337,203,685,477.5807	8 bytes
float(n)	Floating precision number data from $-1.79E + 308$ to $1.79E + 308$.	4 or 8 bytes
	The n parameter indicates whether the field should hold 4 or 8 bytes. float(24) holds a 4-byte field and float(53) holds an 8-byte field. Default value of n is 53.	
real	Floating precision number data from $-3.40E + 38$ to $3.40E + 38$	4 bytes

Time & Date Datatype

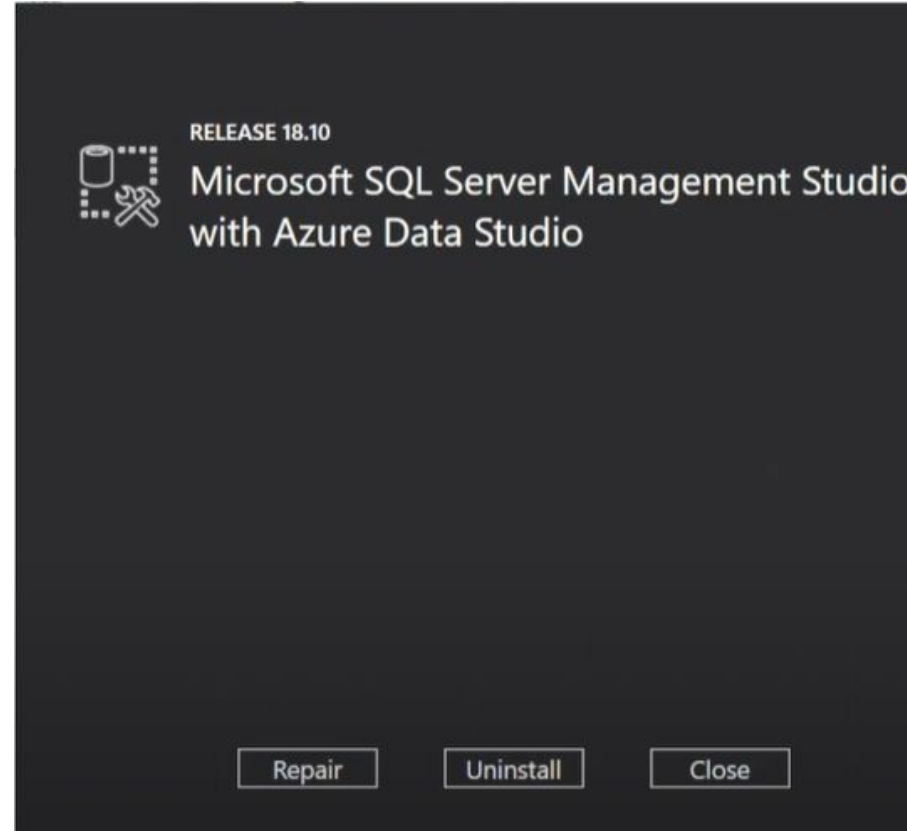
Data type	Description	Storage
datetime	From January 1, 1753 to December 31, 9999 with an accuracy of 3.33 milliseconds	8 bytes
datetime2	From January 1, 0001 to December 31, 9999 with an accuracy of 100 nanoseconds	6-8 bytes
smalldatetime	From January 1, 1900 to June 6, 2079 with an accuracy of 1 minute	4 bytes
date	Store a date only. From January 1, 0001 to December 31, 9999	3 bytes
time	Store a time only to an accuracy of 100 nanoseconds	3-5 bytes
datetimeoffset	The same as datetime2 with the addition of a time zone offset	8-10 bytes
timestamp	The timestamp value is based upon an internal clock and does not correspond to real time.	

SSMS Installation

Links -

<https://learn.microsoft.com/en-us/sql/ssms/download-sql-server-management-studio-ssms?view=sql-server-ver15>

<https://www.microsoft.com/en-us/sql-server/sql-server-downloads>



CRUD Operations

DDL	DML	DCL	TCL
Data Definition Language	Data Manipulation Language	Data Control Language	Transaction Control Language
Create - Creating new database or table. Alter - Alter the structure of the database (adding a column) Drop - Delete Objects from database permanently Truncate - Removes all record from table , not the table	Insert - insert data into table Update - Update existing data in table Delete - Delete specific record in table	Grant - give access privilege to the database Revoke - withdraws privileges	Commit - saves the work done Rollback - restores to the last commit Savepoint - identify a point in the transaction to which you can roll back later

Primary Key

Primary Key		
Roll no	Name	Stream
1	James	Maths
2	Robert	Biology
3	Jessica	Commerce
4	Michael	Arts
5	David	Biology
6	William	Commerce
7	Robert	Arts
8	Paul	Arts
9	Kevin	Maths
10	Brian	Maths

Primary Key		
Aadhar No.	Name	state
1	n1	a1
2	n2	a2
3	n3	a3
4	n4	a4
5	n5	a5
6	n2	a2
7	n7	a7
8	n8	a8
9	n1	a9
10	n10	a10

Surrogate Key (any random id for primary key)

Primary Key		
Roll no	Name	Stream
1	James	Maths
2	Robert	Biology
3	Jessica	Commerce
4	Michael	Arts
5	David	Biology
6	William	Commerce
7	Robert	Arts
8	Paul	Arts
9	Kevin	Maths
10	Brian	Maths

Natural Key (choosing a key which has real purpose)

Primary Key		
Aadhar No.	Name	state
1	n1	a1
2	n2	a2
3	n3	a3
4	n4	a4
5	n5	a5
6	n2	a2
7	n7	a7
8	n8	a8
9	n1	a9
10	n10	a10

Foreign key

Table 1		
Roll no	Name	Stream id
1	James	1
2	Robert	2
3	Jessica	3
4	Michael	4
5	David	2
6	William	3
7	Robert	4
8	Paul	4
9	Kevin	1
10	Brian	1
Table 2		
id	Name	
1	Maths	
2	Biology	
3	Commerce	
4	Arts	

Composite key

Table 1			
Class	Name	Contact no	Stream id
5	James	87008673390	1
6	Robert	87017691689	2
7	Jessica	87025314473	3
5	Michael	87069370501	4
6	David	87008673390	2
6	William	87090649708	3
5	Robert	87094110006	4
7	Paul	87130978764	4
6	Michael	87025314473	1
5	Brian	87181964548	1

SQL Operators

- “=” (equal to)
- “>” (greater than)
- “>=” (greater than equal to)
- “<” (less than)
- “<=” (less than equal to)
- “!=” (not equal to)
- Where (filter the records)
- AND
- OR
- NOT

- Between
- Is null
- In
- Distinct
- Avg
- Count
- Max
- Min
- Sum

Wildcard

Sorting

Limit / TOP

Functions in SQL

String Functions

Char_length ,

length ,

charindex ,

concat,

left & right ,

replace ,

reverse, substr , substring , trim , upper , lower , concat_ws() , difference , ltrim ,
rtrim

Date Time Functions

CAST , year , month , day , time , dateadd, datediff , date part

Mathematical Functions

Ceil , floor, power, round

Aggregate Function

Group by and having clause

Aggregate function

AVG, COUNT, LISTAGG , MAX, MIN,SUM

Joins in sql

Left

Right

Inner

Cross

Full outer join