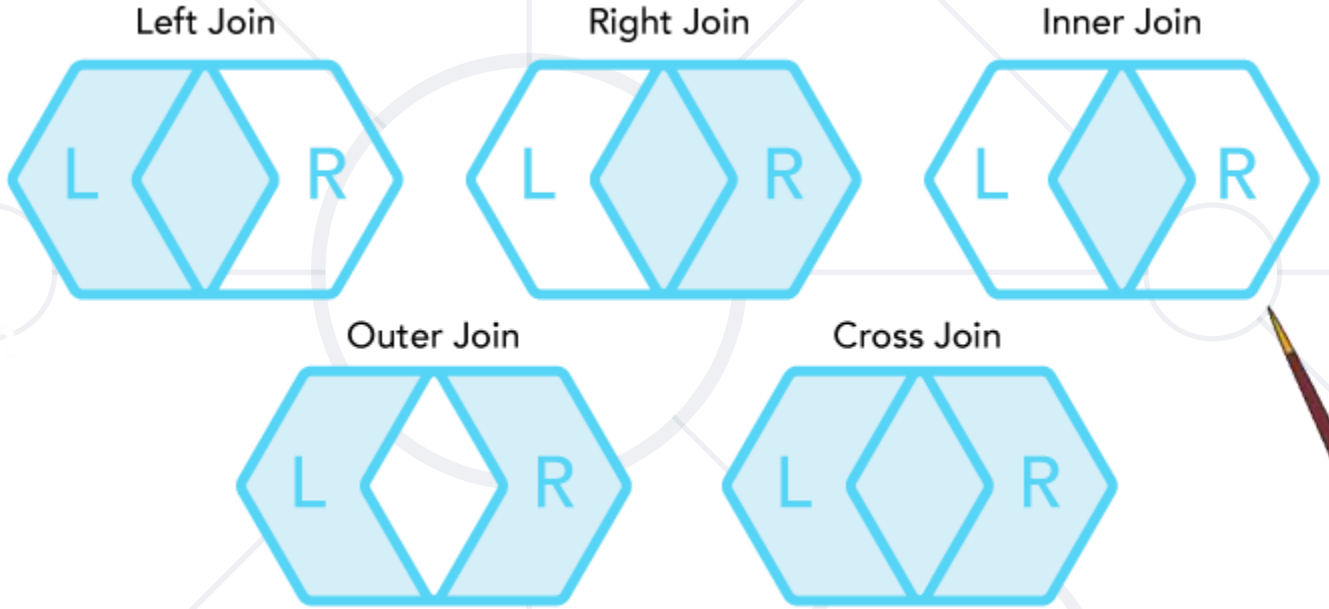
Joins, Subqueries, CTEs



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#csharp-db

JOINS

Gathering Data from Multiple Tables

Data from Multiple Tables

- Sometimes you need data from **several tables**

Employees

EmployeeName	DepartmentID
Edward	3
John	NULL

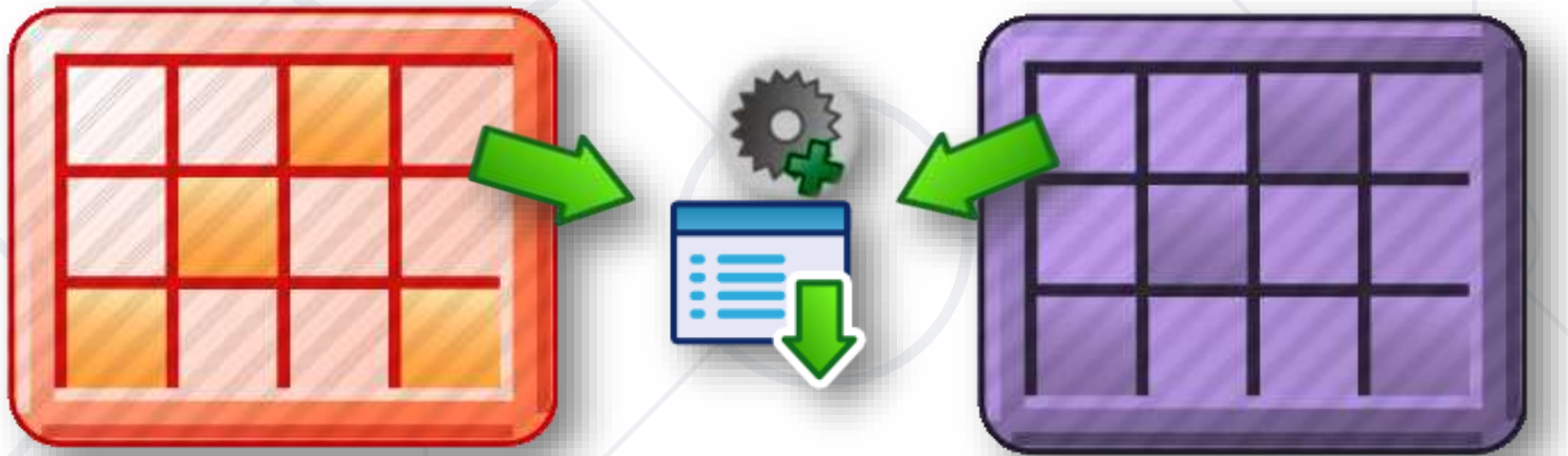
Departments

DepartmentID	DepartmentName
3	Sales
4	Marketing
5	Purchasing

EmployeeName	DepartmentID	DepartmentName
Edward	3	Sales

Types of Joins

- **Inner** joins
- **Left**, **right** and **full outer** joins
- **Cross** joins



INNER vs. OUTER Joins

- **Inner** join
  - Join of two tables returning **only rows matching** the join **condition**
- **Left** (or **right**) **outer** join
  - Returns the results of the inner join as well as unmatched rows from the left (or right) table
- **Full outer** join
  - Returns the results of an **inner join** along with all **unmatched rows**

Inner Join

Employees

EmployeeID	DepartmentID
263	3
270	NULL

Departments

DepartmentID	DepartmentName
3	Sales
4	Marketing
5	Purchasing

Result

EmployeeID	DepartmentID	DepartmentID	DepartmentName
263	3	3	Sales

Inner Join Syntax

```
SELECT * FROM Employees AS e
  INNER JOIN Departments AS d
  ON e.DepartmentID = d.DepartmentID
```

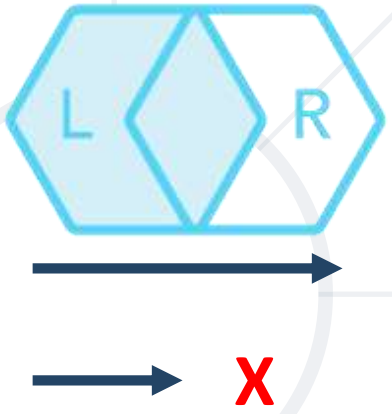
Depatments Table

Join Condition

Left Outer Join

Employees

EmployeeID	DepartmentID
263	3
270	NULL



Departments

DepartmentID	DepartmentName
3	Sales
4	Marketing
5	Purchasing

Result

EmployeeID	DepartmentID	DepartmentID	DepartmentName
263	3	3	Sales
270	NULL	NULL	NULL

Left Outer Join Syntax

```
SELECT * FROM Employees AS e
  LEFT OUTER JOIN Departments AS d
  ON e.DepartmentID = d.DepartmentID
```

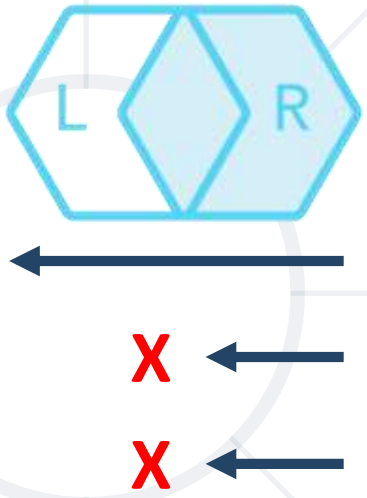
Table Depatments

Join Condition

Right Outer Join

Employees

EmployeeID	DepartmentID
263	3
270	NULL



Departments

DepartmentID	DepartmentName
3	Sales
4	Marketing
5	Purchasing

Result

EmployeeID	DepartmentID	DepartmentID	DepartmentName
263	3	3	Sales
NULL	NULL	4	Marketing
NULL	NULL	5	Purchasing

Right Outer Join Syntax

```
SELECT * FROM Employees AS e
 RIGHT OUTER JOIN Departments AS d
 ON e.DepartmentID = d.DepartmentID
```

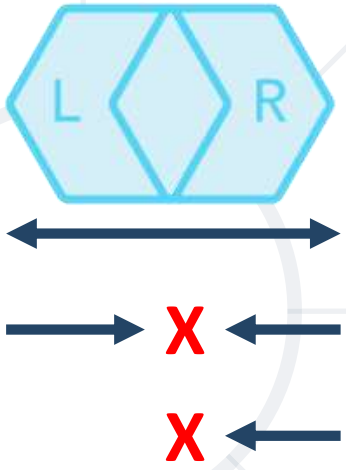
Depatments Table

Join Condition

Full Join

Employees

EmployeeID	DepartmentID
263	3
270	NULL



Departments

DepartmentID	DepartmentName
3	Sales
4	Marketing
5	Purchasing

Result

EmployeeID	DepartmentID	DepartmentID	DepartmentName
263	3	3	Sales
270	NULL	NULL	NULL
NULL	NULL	4	Marketing
NULL	NULL	5	Purchasing

Full Join Syntax

```
SELECT * FROM Employees AS e
  FULL JOIN Departments AS d
  ON e.DepartmentID = d.DepartmentID
```

Depatments Table

Join Condition

Cartesian Product (1)

- This will produce a Cartesian product:

```
SELECT LastName, Name AS
DepartmentName
FROM Employees, Departments
```

- The result:

LastName	DepartmentName
Gilbert	Engineering
Brown	Engineering
…	…
Gilbert	Sales
Brown	Sales

Cross Join

Employees

EmployeeID	DepartmentID
263	3
270	NULL

Departments

DepartmentID	DepartmentName
3	Sales
4	Marketing
5	Purchasing

Result

EmployeeID	DepartmentID	DepartmentID	DepartmentName
263	3	3	Sales
263	3	4	Marketing
263	3	5	Purchasing
270	NULL	3	Sales
270	NULL	4	Marketing
270	NULL	5	Purchasing

Cross Join Syntax

```
SELECT * FROM Employees AS e
 CROSS JOIN Departments AS d
```

Depatments Table

No Join Conditions

Join Overview

Sally	13
John	10
Michael	22
Bob	11
Robin	7
Jessica	15

18	Accounting
10	Marketing
12	HR
22	Engineering
8	Sales
7	Executive

Relation

Join Overview (2)

Software University

- Inner Join

Sally	13
John	10
Michael	22
Bob	11
Robin	7
Jessica	15

18	Accounting
10	Marketing
12	HR
22	Engineering
8	Sales
7	Executive

Join Overview (3)

Software University

- Left Outer Join

		⟷	18	Accounting
Sally	13	⟷	NULL	NULL
John	10	⟷	10	Marketing
			12	HR
Michael	22	⟷	22	Engineering
			8	Sales
Bob	11	⟷	NULL	NULL
Robin	7	⟷	7	Executive
Jessica	15	⟷	NULL	NULL

Join Overview (4)

Software University

- Right Outer Join

NULL	NULL	⟷	18	Accounting
Sally	13			
John	10	⟷	10	Marketing
NULL	NULL	⟷	12	HR
Michael	22	⟷	22	Engineering
NULL	NULL	⟷	8	Sales
Bob	11			
Robin	7	⟷	7	Executive
Jessica	15			

Join Overview (5)

Software University

- Full Outer Join

NULL	NULL	⟷	18	Accounting
Sally	13	⟷	NULL	NULL
John	10	⟷	10	Marketing
NULL	NULL	⟷	12	HR
Michael	22	⟷	22	Engineering
NULL	NULL	⟷	8	Sales
Bob	11	⟷	NULL	NULL
Robin	7	⟷	7	Executive
Jessica	15	⟷	NULL	NULL

Problem: Addresses with Towns

- Display **address information** of all employees in "**SoftUni**" **database**. Select **first 50 employees**.
  - The exact format of data is shown below
  - Order them by FirstName, then by LastName (ascending)
    - Hint: **Use three-way join**

	FirstName	LastName	Town	AddressText
1	A. Scott	Wright	Newport Hills	1400 Gate Drive
2	Alan	Brewer	Kenmore	8192 Seagull Court
3	Alejandro	McGuel	Seattle	7842 Ygnacio Valley Road
4	Alex	Nayberg	Newport Hills	4350 Minute Dr.

Check your solution here: https://judge.softuni.org/Contests/Compete/Index/393#0

Solution: Addresses with Towns

```
SELECT TOP 50 e.FirstName, e.LastName,
  t.Name as Town, a.AddressText
FROM Employees e
  JOIN Addresses a ON e.AddressID = a.AddressID
  JOIN Towns t ON a.TownID = t.TownID
ORDER BY e.FirstName, e.LastName
```

Check your solution here: https://judge.softuni.org/Contests/Compete/Index/393#0

Problem: Sales Employees

- Find **all employees** that are in the "**Sales**" **department**. Use "**SoftUni**" **database**.
  - Follow the specified format:

	EmployeeID	FirstName	LastName	DepartmentName
1	268	Stephen	Jiang	Sales
2	273	Brian	Welcker	Sales
3	275	Michael	Blythe	Sales
4	276	Linda	Mitchell	Sales
5	277	Jillian	Carson	Sales

  - Order them by **EmployeeID**

Check your solution here: https://judge.softuni.org/Contests/Practice/Index/393#2

Solution: Sales Employees

```
SELECT e.EmployeeID, e.FirstName, e.LastName,
   d.Name AS DepartmentName
FROM Employees e
   INNER JOIN Departments d
      ON e.DepartmentID = d.DepartmentID
WHERE d.Name = 'Sales'
ORDER BY e.EmployeeID
```

Departments Table

Check your solution here: https://judge.softuni.org/Contests/Practice/Index/393#2

Problem: Employees Hired After

- Show **all employees** that:
  - Are **hired after** `1/1/1999`
  - Are either **in** "`Sales`" or "`Finance`" department

	FirstName	LastName	HireDate	DeptName
1	Deborah	Poe	2001-01-19 00:00:00	Finance
2	Wendy	Kahn	2001-01-26 00:00:00	Finance
3	Candy	Spoon	2001-02-07 00:00:00	Finance
4	David	Barber	2001-02-13 00:00:00	Finance

  - Sorted by `HireDate` (**ascending**)

Check your solution here: https://judge.softuni.org/Contests/Practice/Index/393#5

Solution: Employees Hired After

```
SELECT e.FirstName, e.LastName, e.HireDate,
  d.Name as DeptName
FROM Employees e
  INNER JOIN Departments d
  ON (e.DepartmentId = d.DepartmentId
  AND e.HireDate > '1/1/1999'
  AND d.Name IN ('Sales', 'Finance'))
ORDER BY e.HireDate ASC
```

Check your solution here: https://judge.softuni.org/Contests/Practice/Index/393#5

Problem: Employee Summary

- Display information about **employee's manager** and **employee's department**
  - Show only **the first 50** employees
  - The exact format is shown below:

	EmployeeID	EmployeeName	ManagerName	DepartmentName
1	1	Guy Gilbert	Jo Brown	Production
2	2	Kevin Brown	David Bradley	Marketing
3	3	Roberto Tamburello	Terri Duffy	Engineering
4	4	Rob Walters	Roberto Tamburello	Tool Design
5	5	Thierry D'Hers	Ovidiu Cracium	Tool Design

  - Sort by **`EmployeeID`** (**ascending**)

Check your solution here: https://judge.softuni.org/Contests/Practice/Index/393#9

Solution: Employee Summary

```
SELECT TOP 50
  e.EmployeeID,
  e.FirstName + ' ' + e.LastName AS EmployeeName,
  m.FirstName + ' ' + m. LastName AS ManagerName,
  d.Name AS DepartmentName
FROM Employees AS e
  LEFT JOIN Employees AS m ON m.EmployeeID =
e.ManagerID
  LEFT JOIN Departments AS d ON d.DepartmentID =
    e.DepartmentID
  ORDER BY e.EmployeeID ASC
```

Cross Table Selection

Self-join

Table Departments

Check your solution here: https://judge.softuni.org/Contests/Practice/Index/393#9

Subqueries

Query Manipulation On Multiple Levels

Subqueries

- Use a query's result as data for another query

Employees

EmployeeID	Salary
59	19,000
71	43,300
…	…

Query

```
WHERE DepartmentID IN
```

Subquery

DepartmentID	Name
10	Finance

Subquery Syntax

```
SELECT FROM Employees AS e
 WHERE e.DepartmentID IN
  (
   SELECT d.DepartmentID
     FROM Deparments AS d
    WHERE d.Name = 'Finance'
  )
```

Table Depatments

Subquery

Problem: Min Average Salary

- Display **lowest average salary** of **all departments**.
  - Calculate average salary for each department.
  - Then show the value of smallest one.

	MinAverageSalary
1	10866.6666

Check your solution here: https://judge.softuni.org/Contests/Practice/Index/393#10

Solution: Min Average Salary

```
SELECT
  MIN(a.AverageSalary) AS MinAverageSalary
  FROM
  (
    SELECT e.DepartmentID,
           AVG(e.Salary) AS AverageSalary
      FROM Employees AS e
   GROUP BY e.DepartmentID
  ) AS a
```

Subquery

Table Employees

Check your solution here: https://judge.softuni.org/Contests/Practice/Index/393#10

Common Table Expressions

Reusable Subqueries

Common Table Expressions

- **Common Table Expressions** (**CTE**) can be considered as "**named subqueries**"
- They could be used to improve code **readability** and code **reuse**
- Usually, they are positioned in the beginning of the query

```
WITH CTE_Name (ColumnA, ColumnB…)
AS
(
-- Insert subquery here.
)
```

Common Table Expressions Syntax

```
WITH Employees_CTE
   (FirstName, LastName, DepartmentName)
AS
(
   SELECT e.FirstName, e.LastName, d.Name
   FROM Employees AS e
   LEFT JOIN Departments AS d ON
     d.DepartmentID = e.DepartmentID
)

SELECT FirstName, LastName, DepartmentName
   FROM Employees_CTE
```

Temporary Tables

Temporary Tables

- **Temporary tables** are stored in **tempdb**
- Automatically deleted when they are **no longer used**

```
CREATE TABLE #TempTable
(
    -- Add columns here.
)

SELECT * FROM #TempTable
```

Temporary Table Syntax

```
CREATE TABLE #Employees
(
      Id INT PRIMARY KEY,
      FirstName VARCHAR(50) NOT NULL,
      LastName VARCHAR(50),
      Address VARCHAR(50)
)

SELECT * FROM #Employees
```

Types of Temporary Tables

- **Table variables** (`DECLARE @t TABLE`)
  - Visible only to the connection that creates it
- **Local temporary tables** (`CREATE TABLE #t`)
  - Visible only to the connection that creates it
- **Global temporary tables** (`CREATE TABLE ##t`)
  - Visible to everyone
  - Deleted when all connections that have referenced them, have closed
- **Tempdb permanent tables** (`USE tempdb CREATE TABLE t`)
  - Visible to everyone. Deleted when the server is restarted

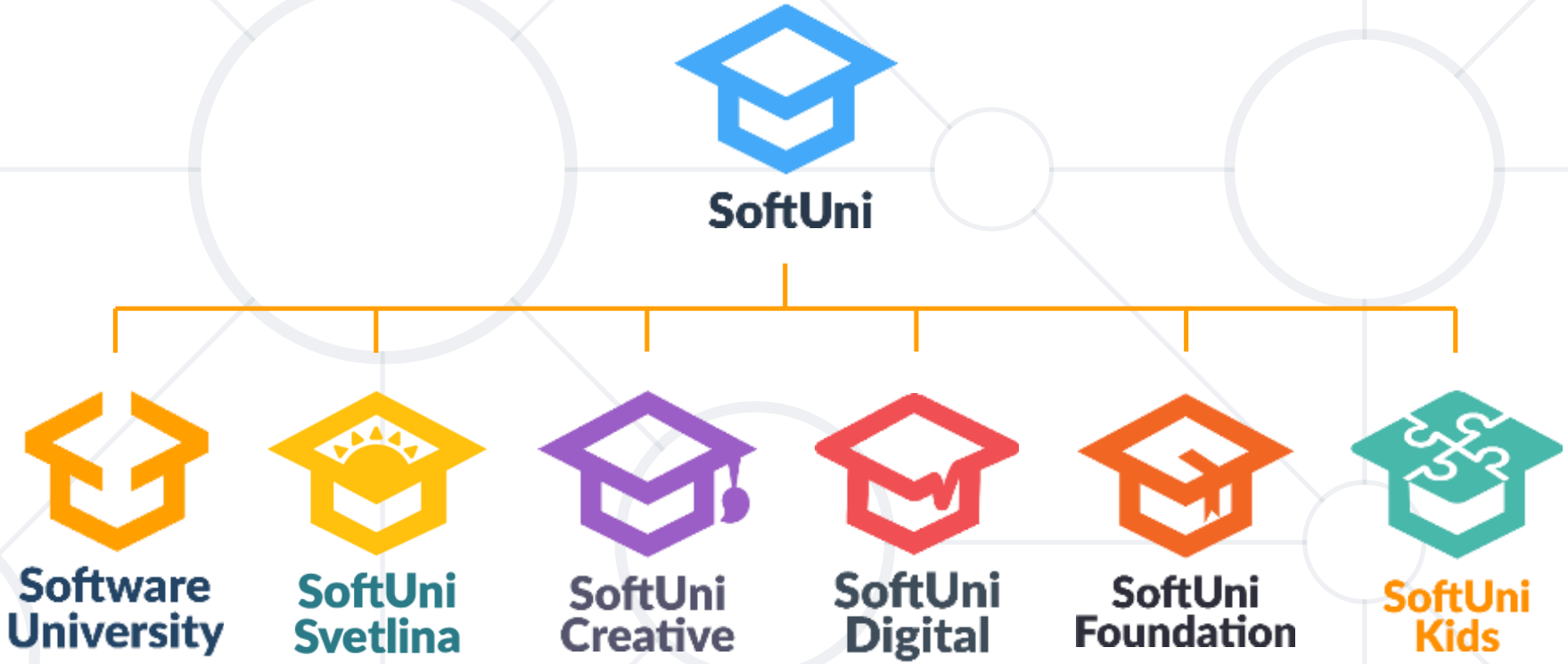
Summary

- **Joins**

```
SELECT * FROM Employees AS e
  JOIN Departments AS d ON
d.DepartmentId = e.DepartmentID
```

- **Subqueries** are used to nest queries
- **CTE's** improve code reuse and readability
- **Indices** improve SQL search performance if used properly

Questions?



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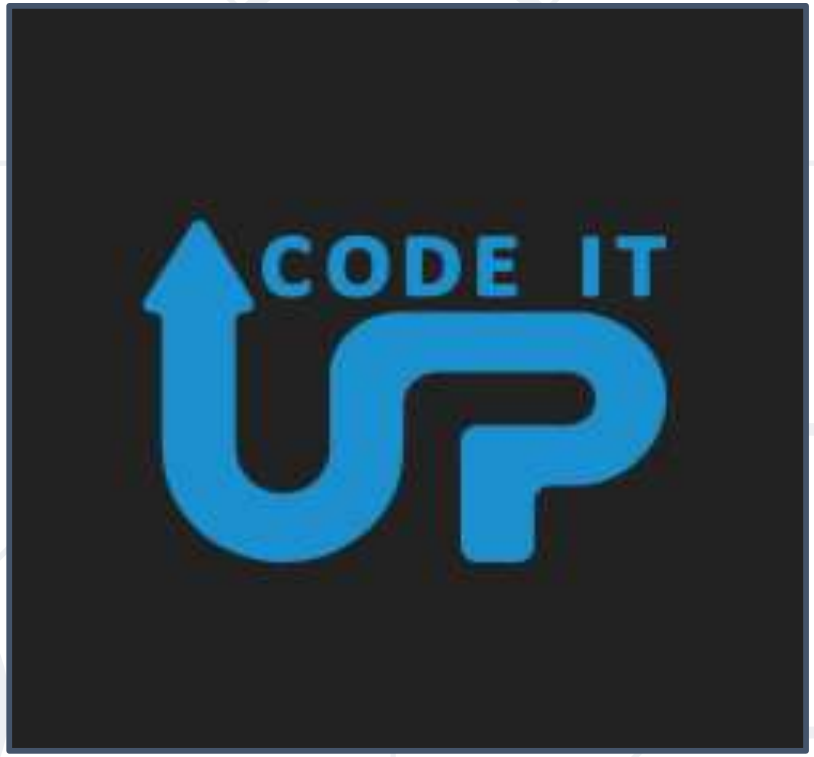

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