

# Database Designs

## Section 3: Advanced Retrieving Data Queries

### 3.1 Aggregate Operators

Aggregate operators allows us to return more interesting information from our data. Below is an example Sales\_Data table containing sales for two ASDA stores.

Sales_Data			
storeLocation	productName	salesDate	revenue
ASDA Coventry	Milk	November 02, 2020	1,233.32
ASDA Birmingham	Bread	November 02, 2020	5,434.74
ASDA Coventry	Coffee	November 02, 2020	3,855.96
ASDA Coventry	Coffee	November 02, 2020	2,280.90
ASDA Birmingham	Coffee	November 02, 2020	2,110.95
ASDA Coventry	Milk	November 01, 2020	4,558.24
ASDA Birmingham	Milk	November 01, 2020	6,849.99
ASDA Birmingham	Bread	November 01, 2020	2,543.57

The insights an analyst or business owner may be interested in retrieving from the above dataset are: Total Revenue, Best Performing Stores, Best Performing Products, Best Product-Store Combination that Sold Best.

We would like to find patterns in the data so that we can drive business decisions that would help the business to perform better. Below are some example Aggregate Operations which can help us retrieve more interesting data insights.

```
SELECT SUM(revenue) totalRevenue  
FROM Sales_Data;
```

The **SUM** aggregate operator wraps the column in brackets for the column data we wish to apply the sum function. Whatever result is returned from the aggregate operator is then returned in a column we have decided to name as totalRevenue. By omitting the **WHERE** clause from the select statement means that it will sum over all data within the Sales\_Data table.

The **SUM** is a function that operates over an entire column and not just a single cell and the result returned is a single value which can be named. The **SUM** can operate over an entire column or any subset of a column and does not necessarily have to be an entire column.

The reason SUM is called an aggregate function is because it acts on an aggregation of cells and not just a single cell.

```
SELECT AVG(revenue) averageRevenue
FROM Sales_Data;
```

The **AVG** aggregate operator is a function that operates over an entire column or a subset of a column and not just a single cell and returns a single value which can be named. This function averages all the values in the column. The syntax is the same as the **SUM** function above but it returns the average instead.

### 3.2 Group By Clause

The **GROUP BY** clause allows us to aggregate the returned data by grouping data in a certain logical unit. An example command using the **GROUP BY** clause would look like the below:

```
SELECT storeLocation, SUM(revenue) totalRevenue
FROM Sales_Data
GROUP BY storeLocation;
```

The result from the above query will return a table with two columns, storeLocation and totalRevenue, with a total sum of revenue for each store (i.e. a row per unique store).

The column we specify after the **GROUP BY** clause define what groups we would want to use and subtotal. Using the **SUM** aggregate operator with the **GROUP BY**, would define to what groups would we sum up i.e. what is the logical unit that we would run the **SUM** operation on. The **GROUP BY** can be used with other aggregate operators such as the **AVG** function.

We can visualise the **GROUP BY** as sorting the data before we perform the other operations i.e. before performing the **SUM** operation on the revenue column for every group. This will give a flatten result table demonstrated below:

Sales_Data			
storeLocation	productName	salesDate	revenue
ASDA Birmingham	Bread	November 02, 2020	5,434.74
ASDA Birmingham	Coffee	November 02, 2020	2,110.95
ASDA Birmingham	Milk	November 01, 2020	6,849.99
ASDA Birmingham	Bread	November 01, 2020	2,543.57
ASDA Coventry	Milk	November 02, 2020	1,233.32

Sales_Data			
ASDA Coventry	Coffee	November 02, 2020	3,855.96
ASDA Coventry	Coffee	November 02, 2020	2,280.90
ASDA Coventry	Milk	November 01, 2020	4,558.24

Sales_Data Query Results	
storeLocation	totalRevenue
ASDA Birmingham	16,939.25
ASDA Coventry	11,928.42

In the example query we can see that ASDA Birmingham is the best performing store based on total revenue.

The **SELECT** statement allows us to choose which columns we wish to display in our results after we have completed the thinning of the data using the **GROUP BY**. We can confidently remove the `productName` and `salesDate` columns from the results table without losing any information. However; we cannot **GROUP BY** any column that is not present in the select statement since the results would not make any sense. Therefore, any column specified in the **GROUP BY** statement must also be present in the **SELECT** statement i.e. it must be part of the final result.

**Remember:** The **WHERE** clause is generally used when we want to filter the number of rows that meet the **WHERE** clause condition. Therefore, if we want all rows we omit the **WHERE** clause. The **GROUP BY** clause on the other hand is used when we want to group our data in a logical unit. It is therefore possible to use both the **GROUP BY** and **WHERE** clauses at the same time for a more complex query.

The **GROUP BY** clause allows us to group by multiple columns so that we can answer more complex questions that uses a combination of columns. An example query would look like the below:

```
SELECT productName, storeLocation, AVG(revenue) averageRevenue
FROM Sales_Data
GROUP BY productName, storeLocation;
```

The **GROUP BY** clause above groups based on the unique combination of the two columns specified in the statement. In the above example, this provides a unique combinations of: ASDA Birmingham Bread, ASDA Birmingham Coffee, ASDA Birmingham Milk, ASDA Coventry Coffee and ASDA Coventry Milk.

The **AVG** operation will then be performed on each unique **GROUP BY** unit combination to provide the averages of each unit groups.

The above example can help us answer the question of what is the worst performing product in which store.