

## Report: SQL Analysis and Optimization

### Requirement 1: Total Sales and Customer Insights

- **Objective:** Calculate the total spending of each customer and rank the top 10 customers by total sales.
- **Approach:**
  - Used a `WITH` clause to create a Common Table Expression (CTE) named `invoiceCountItems` to count items per invoice.
  - Created a second CTE named `profit_per_customer` to calculate the number of invoices, total spending, and items for each customer.
  - Ordered results by total spending in descending order and limited the output to the top 10 customers.
- **Top 10 Customers:**

Customer ID	Full Name	Number of Invoices	Total Per Customer	Number of Items
6	Helena Holý	7	49.62	38
26	Richard Cunningham	7	47.62	38
57	Luis Rojas	7	46.62	38

### Requirement 2: Ranking Products by Sales

- **Objective:** Rank products by total sales and identify the top-selling products.
- **Approach:**
  - Used a CTE `invoiceline_trackname` to join `InvoiceLine` and `Track` tables, calculating total sales (`unitprice * quantity`) and the total quantity sold.
  - Applied the `RANK()` window function to rank products by quantity sold in descending order.
  - Limited the result to the top 10 products.
- **Top-Selling Products:**

Track ID	Product Name	Total Sales	Quantity Sold	Rank
2	Balls to the Wall	1.98	2	1
8	Inject The Venom	1.98	2	1
9	Snowballed	1.98	2	1

### Requirement 3: Indexing and Performance Optimization

- **Objective:** Optimize the query to calculate total sales per customer using indexing.
- **Steps:**
  1. **Before Index:**
    - Observed a **full table scan** during the aggregation process.
  2. **Index Creation:**
    - Created an index on `Invoice.CustomerId` using:  
  

```
sql
Copy code
CREATE INDEX IF NOT EXISTS idx_invoice_customerid ON
Invoice (CustomerId);
```
  3. **After Index:**
    - Execution plan shows optimization with aggregation (`AggStep`, `AggFinal`) using the index.
- **Key Metrics:**
  - **Before Index:** Full table scan (`OpenRead`, `Rewind` operations observed).
  - **After Index:** Use of aggregation steps (`AggStep`, `AggFinal`), indicating optimized query execution.