

Capstone Project on SQL

Course Description:

This 8-hour capstone project is designed to evaluate and reinforce the basic understanding of participants in querying and managing data using Microsoft SQL Server. Through a series of real-world scenarios, participants will demonstrate their ability to apply SQL concepts to solve complex data challenges. This project serves as a comprehensive test of their skills, including data retrieval, filtering, aggregation, joins, subqueries, basic data manipulation and data backup/recovery.

Scenario Overview

AdventureWorks, a global leader in manufacturing, is undergoing a comprehensive digital transformation to improve operational efficiency and enhance customer experiences. The company is seeking to extract actionable insights from its extensive data to address challenges in key departments such as Human Resources, Sales, Inventory, Procurement, and Finance.

As the SQL expert, your mission is to analyse critical business areas, solve department-specific challenges, and create scalable SQL solutions that will empower strategic decision-making. You will work through multiple phases, each containing practical tasks, theoretical challenges, and advanced exercises.

Phase 1: Employee and HR Insights (60 minutes)

Challenge

AdventureWorks needs enhanced visibility into its workforce and recruitment efforts to optimize employee engagement and resource allocation.

Tasks:

- Employee Directory:** Fetch employee names, job titles, and department names (HumanResources.Employee and HumanResources.Department tables).
- New Hire Trends:** Identify employees hired in the last year (HireDate column).
- Candidate Resumes:** Extract job candidate names and resumes from the HumanResources.JobCandidate table.
- Role Distribution:** Calculate the number of employees grouped by job title.
- Department Headcount:** Fetch department names and calculate total employees per department.

Advanced Challenge:

- Create a SQL view consolidating job titles, departments, and hiring dates for HR dashboards.
-

Phase 2: Sales and Customer Insights (90 minutes)

Challenge

The sales team requires data-driven insights into customer behavior, sales trends, and representative performance to maximize revenue.

Tasks:

1. **Top Customers:** Identify the top 10 customers based on total sales revenue (SalesOrderHeader and SalesOrderDetail tables).
2. **Loyalty Analysis:** Find customers with repeat orders in the past 6 months (SalesOrderHeader table).
3. **Regional Trends:** Retrieve revenue contribution by region (SalesTerritory table).
4. **Monthly Sales Analysis:** Analyze sales by month for the past 3 years to identify peak sales periods.
5. **Sales Representative Performance:** Calculate total sales revenue for each sales representative (SalesPerson table).

Advanced Challenge:

- Develop a stored procedure to retrieve top-performing regions dynamically for any selected year.
-

Phase 3: Inventory and Product Management (90 minutes)

Challenge

AdventureWorks aims to improve inventory turnover and maximize product profitability while maintaining stock levels to meet customer demand.

Tasks:

1. **Low Stock Alert:** Identify products with stock levels below 100 units (ProductInventory table).
2. **Product Categorization:** Fetch product categories, subcategories, and product names (ProductCategory and ProductSubcategory tables).
3. **Profit Margins:** Calculate profitability for each product by subtracting standard costs from sales prices (Product table).

4. **Inventory Turnover:** Analyze inventory turnover rates using sales and stock data.
5. **Slow-Moving Items:** Identify products with minimal sales in the last fiscal year.

Advanced Challenge:

- Create a trigger to auto-flag low-stock items for reorder when stock drops below a threshold.
-

Phase 4: Procurement and Vendor Analysis (60 minutes)

Challenge

The procurement team needs to assess vendor performance, cost efficiency, and delivery reliability.

Tasks:

1. **Vendor Directory:** Retrieve vendor names, contact details, and associated purchase orders (Vendor table).
2. **Delivery Timeliness:** Identify vendors with the highest on-time delivery rates (PurchaseOrderHeader table).
3. **Spending by Vendor:** Calculate total procurement spending for each vendor in the last fiscal year.
4. **Frequent Suppliers:** List vendors providing the most products.
5. **Procurement Trends:** Analyze monthly spending trends over the last 2 years.

Advanced Challenge:

- Write a SQL query to calculate average delivery times and identify vendors exceeding deadlines.
-

Phase 5: Financial Analysis and Strategic Planning (90 minutes)

Challenge

Management seeks actionable financial insights and accurate forecasts to drive strategic decisions.

Tasks:

1. **Annual Revenue:** Calculate total revenue for each fiscal year (SalesOrderHeader table).
2. **Category Contribution:** Determine revenue contributions for each product category (ProductCategory and SalesOrderDetail tables).

3. **Profitability by Region:** Analyze profit margins across regions (SalesTerritory and SalesOrderHeader tables).
4. **Quarterly Sales Trends:** Extract quarterly sales data for the last 3 years to identify growth patterns.
5. **Revenue Forecasting:** Predict revenue growth for the next fiscal year based on historical trends.

Advanced Challenge:

- Write a stored procedure to auto-generate quarterly financial summaries.
-

Phase 6: Marketing and Campaign Analysis (60 minutes)

Challenge

AdventureWorks needs insights into customer segments to design targeted marketing campaigns.

Tasks:

1. **Customer Segments:** Group customers by purchasing frequency and average order value (SalesOrderHeader table).
2. **Product Recommendations:** Identify frequently purchased products and bundle opportunities (SalesOrderDetail table).
3. **Campaign Effectiveness:** Analyze sales growth before and after marketing campaigns.
4. **Seasonal Trends:** Determine products with peak sales during specific months (Product and SalesOrderDetail tables).
5. **High-Value Customers:** Retrieve customers with the highest lifetime value.

Advanced Challenge:

- Create a query that simulates reward tier assignments based on customer spending.
-

Phase 7: Advanced SQL Concepts (90 minutes)

Challenge

Participants will explore advanced SQL features and solve complex database challenges.

Tasks:

1. **Optimized Queries:** Rewrite queries to improve performance for large datasets.
2. **Dynamic Views:** Create views that consolidate data for specific business needs.
3. **Error Handling:** Write SQL scripts with exception handling for null or invalid values.

4. **Backup Simulation:** Simulate a database backup and restoration process.
5. **Custom Functions:** Develop a user-defined function to calculate annual profit margins dynamically.