Project

This semester-long project is conducted during PL classes and outside class hours, in groups of 3-4 students. Each student must present and discuss the project individually, either orally or in writing. All group members must be present during the presentation; otherwise, absent members will receive a grade of zero. The project must be submitted by the specified deadline, with penalties or restrictions applied for late submissions as outlined in Moodle.

Objectives

The project's goal is to equip students in the "Advanced Topics in Databases" course with skills in utilizing different database paradigms and applying them in system design and implementation. The project involves developing an e-commerce platform for selling items (products and services) using various database management systems (DBMSs), both relational and non-relational, and implementing data management through the Python programming language.

The system should feature a user-friendly interface built with Tkinter, allowing customers to search for items, add or remove them from the shopping cart, and complete purchases. After receiving purchased items, customers should provide feedback on the system's usability and evaluate their satisfaction with the overall process. The platform should be designed with scalability and performance in mind.

By integrating Python, databases, and Tkinter, the project aims to deliver a comprehensive e-commerce solution that meets the needs of both customers and administrators, demonstrating the capabilities of these technologies in creating modern web applications.

Scenario Description

The company XPTOISEP, based in Porto, is undergoing a restructuring process. The company's director has decided to hire you to develop a new e-commerce platform for selling its items. After several meetings, the following requirements were identified:

- XPTOISEP has several warehouses in different regions. Each warehouse is identified by a (unique) code, a name, an address and a location in WGS84 geographical coordinates. Warehouses are divided into multiple physical zones, each with a specific capacity (total volume). Items can be stored in various physical zones, though some products may only be available in certain warehouses.

- An item is characterized by a unique reference, name, description, brand, type (product or service), and multiple suppliers, with one designated as the primary supplier. Each item has a purchase and sales price.

- If the item is a product, it includes information on the quantity in stock and the minimum required stock levels, which vary by warehouse. Sales prices change periodically, necessitating a history of prices and the date range during which they were valid.

- If the item is a service, it is defined by a maximum number of execution hours, the execution time, and the responsible employee.

- Products are categorized into subcategories, which in turn belong to general categories. Some products also have additional technical (e.g., EAN, model) and physical attributes (e.g., color, weight, height).

- XPTOISEP customers must authenticate to make online purchases. Upon authentication, the customer is identified by a code, name, address, postal code, VAT number, and email. Customers have an account ID, password, and status (new, active, blocked, or prohibited).

- At registration, customers must agree to the data processing terms required by the General Data Protection Regulation (GDPR), which must be available on the website. These terms may change over time, and the system must record the exact text of the conditions accepted by the customer on the date of acceptance.

- The platform is accessible for browsing the item catalog without registration. Registration is only required for purchasing.

- Placing orders involves a checkout process where authenticated customers can view, modify the shopping cart’s content, adjust quantities, and see the total purchase amount, including taxes, fees, and shipping costs.

- XPTOISEP offers a customer loyalty program, allowing customers to earn points (0.5% of the purchase value). For instance, a €100 purchase earns €0.50 in points. When the balance reaches €10, the amount can be redeemed at checkout. Purchases exceeding €100 qualify for free shipping.

- After the checkout process, the customer must make the payment which can be made by credit card or through MBWay. For credit card payments, the system submits the transaction for approval. If approved, the order status becomes "accepted"; otherwise, it becomes "suspended."

- XPTOISEP dispatches orders after payment confirmation. Each order requires a delivery address, which can differ from the customer's primary address. The system tracks the shipping status ("in transit" or "delivered"). Additionally, customers receive monthly vouchers based on their purchase amount (see table 1), valid for use within 15 days.

Table 1 - Voucher value to be awarded

Purchase Price (€)	Voucher Value (€)
>1000	20
[500 to 1000]	10
[300 to 500[	5

- The customer can use their voucher for purchases of any value. However, if the purchase amount is less than the voucher's value, the total purchase cost will be fully discounted.

- Once the order has been delivered, the customer is required to evaluate each purchased product by giving it a rating from 1 to 5 and writing a comment. Additional criteria may be defined to enable the generation of statistics.

- With the aim of continuously improving its website and, consequence, its sales, XPTOISEP intends to monitor customer interactions with the website– for example, it will track the pages visited by customers and their actions on each page.

- The system must meet several non-functional requirements:

    - Scalability: Capable of handling many customers simultaneously, especially during peak periods.

- Security: Customer data and payment information must be stored securely, with encryption for sensitive data.
- Availability: The system should be operational 24/7, ensuring high availability for purchases at any time.
- Performance: Product searches and checkout processes should be fast, even with a large number of items.

Project tasks

Part I

1-Define the system architecture and justify your choices.

2- Develop the database schema for different DBMSs, identifying and justifying the design patterns used.

3- Implement the schemas and populate the database.

Part II

A. Implement the following requirements, considering query optimization techniques where applicable.

Requirements Specification and Analysis

US1: **As an unregistered user**, I want to register in the system.

US2: ***As a system user****, I want to view all the information about a particular product.*

US3: **As Customer***,* I want to buy items

- **Acceptance Criteria:** The total amount in the shopping cart must not exceed €2000, which is the maximum billing limit for each cart
- **Acceptance criteria:** Product ratings/comments, should be available wherever possible.

US5: **As Customer,** I want to track the current status of a specific purchase.

US6: **As Warehouse Manager**, I want to know which are the suppliers of the best-selling items.

US7: **As Warehouse Manager**, I want to know which suppliers provide the best-selling items.

US8: **As Warehouse Manager**, I want to know the most-voted items and their suppliers.

US9: **As Warehouse Manager**, I want information about products that have reached their minimum stock level, and which suppliers supply these items.

US10: **As Warehouse Manager**, I want information about the warehouse aisles where that currently store products with the highest number of purchase orders that received a discount greater than 20%.

US11: **As Delivery Order Manager**, I want the system to provide the location of orders on a specific day and time.

US12: **As Delivery Order Manager**, I want to know the route taken by a particular order.

US13: **As Manager**, I want to know all the products purchased by the customer who used the highest number of vouchers purchased.

US14: **As Manager**, I want to know which purchases were made between June and August 17, with a preparation time of less than 10 hours and a delivery date more than 10 days after the purchase date.

US15: **As Manager**, I want information about the monthly purchases volume for products stored in warehouses where stock is at least 50% above the minimum, for the year 2018.

US16**: AS CIO**, I want the system to keep track of product stock in real-time to provide accurate product availability information to customers.

US17: **As CIO**, I want to know the monthly sales trends for the 5 best-selling products over the past 6 months.

US18: **As CIO**, I want to know the number of site visits per day and week during the current year.

US19: **As CIO**, I want to know, the geographic location of visitors and the most popular pages on the site.

US20: **As CIO**, I want to know which pages have the highest user abandonment rates and which pages have the most users clicking the help button.

B. Select two scenarios to demonstrate when and under what circumstances indexes can or cannot improve query performance. Justify your choices.

Observations

At the end of the project, each working group must prepare a succinct and clear technical report, that provides a detailed and clear presentation of the work carried out, including a full description of the **DBMSs** implemented, as well as the different development strategies adopted throughout the project.

Delivery and Presentation of Work

The final report, along with the material involved in its completion, must be submitted on **Moodle by 23:59 pm on December 09, 2024**, in a **ZIP file** format.

The zip file must have the following naming format: ClassQ_xxxxxxx_yyyyyyy_zzzzzzz.ZIP where:

- **ClassQ** - name of class and
- **xxxxxx_yyyyyyy_zzzzzzz** - student number.

The presentation will consist of a presentation of the work carried out, followed by a demonstration of the implemented databases, as well as the defined and created queries.

⇒ NOTE: Failure to meet the submission deadline will result in **a penalty of 10% for each day of delay.**

⇒ Is **mandatory** that **all group members** are present on the day/time of the presentation.