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| CS 222 – Database Concepts | | |
| Dr. M. Irfan Uddin | | |
| **Program: BSCS(5th)** | **Assignments** | **Semester: Fall 2024** |
| **Marks: 20** | **Date: October 21, 2024** |  |

**Lab Schedule for DB Assignments**

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| --- | --- | --- | --- | --- | --- |
| **Day** | **8:30-10:00** | **10:05-11:35** | **11:40-01:10** | **01:30-03:00** | **03:05-04:35** |
| **Monday** | CS222: Database Concepts BSCS 5th B Lab # 1 |  |  |  |  |
| **Tuesday** | CS222: Database Concepts BSCS 5th B Lab # 1 |  |  |  |  |
| **Wednesday** |  |  |  | CS222: Database Concepts BSCS 5th A Lab # 1 | CS222: Database Concepts BSCS 5th A Lab # 1 |
| **Thursday** |  |  |  | CS222: Database Concepts BSSE 5th  Lab # 1 | CS222: Database Concepts BSSE 5th  Lab # 1 |
| **Friday** |  |  |  |  |  |

**Case Study: Online Bookstore Management System**

An online bookstore wants to maintain a database to track its operations. The bookstore sells a variety of books to customers across different regions. Each book has an ISBN, title, author, genre, publication year, and price. The bookstore also records customer information, including name, email, phone number, and address. Customers place orders, and each order contains multiple books. For each order, details like the order date, order status, total amount, and payment method are recorded. The bookstore also tracks inventory levels, suppliers, and employee information.

The bookstore database should help answer business questions, such as:

* Which books are most popular?
* What is the average order size?
* How much inventory is left for each book?
* Who are the top customers based on purchase history?

Note: All assignments should be submitted on the link given below.  
Submission link: <https://forms.gle/3oosWKq4QRnZgfEz5>

**Assignment 1: Case Study Analysis and Requirements Gathering**

**Objective:** Conduct a detailed requirements analysis based on the online bookstore case study.

**Instructions:**

1. Analyze the case study and identify the essential entities (e.g., Book, Customer, Order, Supplier, Employee).
2. List key attributes for each entity and note any relationships between them (e.g., customers place orders, books belong to orders).
3. Determine the main functional requirements of the bookstore, such as tracking orders, inventory, and customer details.
4. Outline expected interactions, like querying popular books and tracking inventory levels.

**Deliverables:** A document that outlines:

* Key entities and attributes.
* Functional requirements of the bookstore system.
* Brief explanation of each entity’s role in the system.

**Submission Due on November 15, 2024 23:95.**

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**Assignment 2: ER Diagram Design**

**Objective:** Design an Entity-Relationship (ER) Diagram based on the requirements analysis from Assignment 1.

**Instructions:**

1. Create an ER diagram to represent the database design for the online bookstore.
2. Identify relationships between entities, specifying the cardinalities (e.g., a customer can place multiple orders, but an order belongs to a single customer).
3. Define primary keys for each entity and mark foreign keys that represent relationships.
4. Add cardinality and participation constraints where applicable.

**Deliverables:** A completed ER diagram with entities, relationships, primary keys, foreign keys, and constraints.

**Submission Due on December 10, 2024 23:95.**

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**Assignment 3: Database Normalization**

**Objective:** Normalize the ER diagram from Assignment 2 up to the Third Normal Form (3NF).

**Instructions:**

1. Convert your ER diagram entities into tables.
2. Perform normalization to remove redundancy and anomalies. Explain the steps as follows:
   * Convert tables to 1NF by ensuring atomic attributes.
   * Apply 2NF by removing partial dependencies.
   * Apply 3NF by eliminating transitive dependencies.
3. Document each normalization step, including any changes made to the tables, attributes, or relationships.

**Deliverables:** A report detailing each normalization step and the resulting tables in 3NF.

**Submission Due on December 20, 2024 23:95.**

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**Assignment 4: SQL Database Implementation**

**Objective:** Implement the normalized database in SQL.

**Instructions:**

1. Based on the normalized tables, write SQL scripts to create the database schema in a relational database system (e.g., MySQL).
2. Include the following:
   * SQL commands to create tables with primary keys, foreign keys, and constraints.
   * Sample data (at least 5–10 records per table) for tables like Book, Customer, Order, and OrderItem.
   * Sample queries to demonstrate basic operations (e.g., adding a customer, placing an order, updating an inventory record, deleting an order).
3. Include a diagram or table to show the database schema.

**Deliverables:** SQL scripts for table creation, sample data insertion, and basic queries. Screenshots of sample query results.

**Submission Due on January 10, 2025 23:95.**

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**Assignment 5: Advanced SQL Queries and Stored Procedures**

**Objective:** Perform complex queries and create stored procedures.

**Instructions:**

1. Write SQL queries that provide insights based on business needs, such as:
   * Finding the top 5 most popular books based on order frequency.
   * Calculating the total sales amount for each customer.
   * Listing all orders placed within a specific date range.
   * Checking inventory to identify books with low stock levels.
2. Create two stored procedures:
   * One that generates a monthly sales report.
   * One that calculates total revenue from each customer in a given period.
3. Write triggers to handle specific actions, such as:
   * Automatically updating inventory when a book is ordered.
   * Logging each new order with the order date and customer ID.

**Deliverables:** SQL scripts for advanced queries, stored procedures, and triggers, with explanations and screenshots of their execution.

**Submission Due on January 31, 2025 23:95.**

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**Assignment 6: Introduction to Big Data Concepts with NoSQL**

**Objective:** Understand Big Data concepts and explore NoSQL databases using the online bookstore example.

**Instructions:**

1. Install MongoDB or another NoSQL database and perform the following:
   * Create a document-based schema using the bookstore data (e.g., create a books collection and a customerscollection).
   * Insert documents into these collections and perform basic CRUD operations.
   * Write aggregation queries to calculate total orders for each customer or find the most popular book.

**Deliverables:** Screenshots of NoSQL schema creation, CRUD operations, and aggregation queries with explanations of each step.

**Submission Due on February 7, 2025 23:95.**

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