Tess Ellis
Willem De Veirman
Project Step 6 (Portfolio Assignment) — *Group 72*

International Sports & Outdoors Sales (ISOS) Management System

URL to index.html: http://classwork.engr.oregonstate.edu:65346/

Executive Summary:

This project has undergone significant enhancements and refinements from its initial proposal to its final implementation. These changes, guided by both iterative feedback and design principles, have focused on improving database integrity, ensuring adherence to normalization standards, and enhancing user experience through functional and aesthetic improvements to the web application.

The database design saw multiple iterations to address inconsistencies and better align with real-world requirements. Key updates included renaming attributes like *order_ID* to *orderID* for consistency and correcting errors in the Entity-Relationship Diagram (ERD), particularly in the **OrderProducts** table, where relationships were misrepresented. Missing attributes such as *quantity* and *orderPrice* were added to this table to accurately reflect the relationship between **Orders** and **Products**. The naming conventions across the schema were unified, and nullable relationships were introduced to allow for greater flexibility in data representation, such as allowing *ProductInstances.orderID* to accept null values for unsold items.

The ERD and schema were further refined by introducing a **Brands** table to model brand partnerships and linking it with the **Products** table through a 1:M relationship. The *relationshipType* attribute in **Brands** and *categoryName* in **Products** replaced previously redundant tables, improving alignment with 3NF principles. Additionally, the **ProductInstances** table was introduced to track individual product units in a second M:M relationship between **Orders** and **Products**, ensuring precise inventory management.

From a user interface and functionality perspective, the web application saw significant enhancements. Dropdowns with dynamically populated values were implemented, such as *relationshipType* in **Brands** and *categoryName* in **Products**, simplifying data entry and reducing errors. JavaScript functions were updated to support these dropdowns, and the overall aesthetics of the web pages were improved for better usability. A landing page was added to streamline navigation, reducing clutter and improving the user experience.

SQL design was optimized by explicitly using Joins in the DML.SQL script to make foreign key relationships more intuitive. Unique constraints were added to primary keys and other necessary fields to ensure data integrity.

Major adjustments were made to align the database with real-world business requirements, such as ensuring that a product can only belong to one order while allowing a product category to accommodate multiple products. Feedback highlighted the importance of accurately modeling M:M relationships and resolving inconsistencies between the schema and ERD, which were addressed systematically.

Overall, these changes significantly improved the robustness, usability, and clarity of the project, resulting in a well-structured database and an intuitive, user-friendly application.

Project Outline:

International Sports & Outdoors is a company that sells a wide range of sports and outdoor equipment, generating approximately $200,000 in annual sales. The company collaborates with over 30 different brands, including well-known names in the industry like North Face, Patagonia, and Columbia, to provide high-quality gear to customers worldwide.

System Improvement Proposal:

The company's current system for managing inventory, orders, and customer interactions has become increasingly inefficient. Previously, much of the order management and customer data tracking was handled manually or with outdated software, leading to errors in inventory tracking, delays in processing orders, and difficulty managing supplier relationships. As the company expands its reach and partners with these major brands, managing the sales volumes and ensuring accurate tracking of brand-specific sales and deals has become even more challenging. With the business aiming to establish a stronger online presence, these inefficiencies have become more pronounced.

To address these issues, the company is implementing a new, robust database-driven website to streamline operations, improve customer satisfaction, and ensure that inventory and supplier management are handled more effectively as they transition to a more digital approach. This system will support more accurate order processing, track brand-specific deals and sales volumes, and provide better visibility into product availability, enhancing the overall efficiency of International Sports & Outdoors operations.

Database Outline (3NF):

1NF Compliance:

- All tables have atomic attributes (no repeating groups or arrays).
- Each table has a primary key defined, ensuring unique identification of records.

2NF Compliance:

- Every non-key attribute is fully functionally dependent on the entire primary key:
    - In **OrderProducts**, the fields *quantity* and *orderPrice* depend on the composite key (*orderID*, *productID*).
    - In **ProductInstances**, each instance is uniquely identified by *instanceID*, ensuring full dependency.

3NF Compliance:

- All tables are free from transitive dependencies:
    - Non-key attributes do not depend on other non-key attributes.
    - **Brands** details are stored in a separate **Brands** table, ensuring that attributes like *name* and *relationshipType* do not create transitive dependencies within other tables like **Products**.
    - Likewise, **Suppliers** information is isolated in the **Suppliers** table, and **Products** simply reference *supplierID* and *brandID*, removing indirect dependencies.
    - **ProductInstances** and **OrderProducts** tables capture product-specific order data.
    - **ProductCategories** and **RelationshipTypes** provide consistent references, reducing data-entry errors.

Entities and Attributes:

1. **Customers:** Records the details of customers.
    - *customerID*: INT (**Primary Key**, AUTO_INCREMENT, UNIQUE, NOT NULL)
    - *customerName*: VARCHAR(100) (NOT NULL)
    - *email*: VARCHAR(100) (NOT NULL, UNIQUE)
    - *address*: VARCHAR(255) (NOT NULL)
    - *phoneNumber*: VARCHAR(20), optional
    - *username*: VARCHAR(50) (NOT NULL, UNIQUE)
2. **Orders:** Tracks all customer orders and their statuses.
    - *orderID*: INT (**Primary Key**, AUTO_INCREMENT, UNIQUE, NOT NULL)
    - *orderDate*: DATE (NOT NULL)

- *shippingDate*: DATE
- *status*: ENUM('Pending', 'Shipped', 'Delivered', 'Canceled') (NOT NULL)
- *totalAmount*: DECIMAL(10, 2) (NOT NULL)
- *customerName*: INT (**Foreign Key** referencing *Customers.customerName*, NOT NULL)

3. **Products:** Records details of the sports and outdoor equipment available.
   - *productID*: INT (**Primary Key**, AUTO_INCREMENT, UNIQUE, NOT NULL)
   - *productName*: VARCHAR(100) (NOT NULL)
   - *description*: TEXT
   - *price*: DECIMAL(10, 2) (NOT NULL)
   - *categoryName*: VARCHAR(100) (NOT NULL)
   - *stockQuantity*: INT (NOT NULL)
   - *supplier:* VARCHAR(100) (NOT NULL) (referencing *Suppliers.supplierName)*
   - *brandName:* VARCHAR(100) (NOT NULL) (referencing *Brands.brandName)*

4. **Brands:** Represents the specific brands that provide products.
   - *brandID*: INT (**Primary Key**, AUTO_INCREMENT, UNIQUE, NOT NULL)
   - *brandName*: VARCHAR(100) (NOT NULL)
   - *contactInfo*: TEXT
   - *relationshipType*: VARCHAR(100) (NOT NULL)
   -
5. **Suppliers:** Represents the suppliers providing products to the store.
   - *supplierID*: INT (**Primary Key**, AUTO_INCREMENT, UNIQUE, NOT NULL)
   - *supplierName*: VARCHAR(100) (NOT NULL)
   - *contactInfo*: TEXT
   - *address*: VARCHAR(255) (NOT NULL)

Relationships:

1. **Customers (1:M) Orders:**
   - **Relationship Type:** One-to-Many (1:M)
   - **Explanation:** A single customer can place one or multiple orders, but each order is associated with only one customer.

- **Implementation:** The **Orders** table has a *customerID* foreign key that references the **Customers** table's primary key.

2. **Orders (M:M) Products:** There are two key relationships between **Orders** and **Products**, each represented by a different intermediate table to capture distinct aspects of the relationship:

   i) **Orders (M:M) Products via OrderProducts:**

   - **Relationship Type:** Many-to-Many (M:M)
   - **Explanation:** This relationship captures the general association between **Orders** and **Products** at the model or SKU level. It records the *quantity* and *orderPrice* of each product model included in an order.
   - **Implementation:** This is handled by the **OrderProducts** intermediate table, which includes:
     - *orderProductID*: INT (**Foreign Key** referencing *Orders.orderID*, NOT NULL)
     - *orderID*: INT (**Foreign Key** referencing *Products.productID*, NOT NULL)
     - productName
     - *quantity*: INT (NOT NULL) - represents quantity of the product model in the order
     - *unitPrice*: DECIMAL(10, 2) - records the price at the time of purchase
     - *totalPrice*
     - *orderDate*

   ii) **Orders (M:M) Products via ProductInstances:**

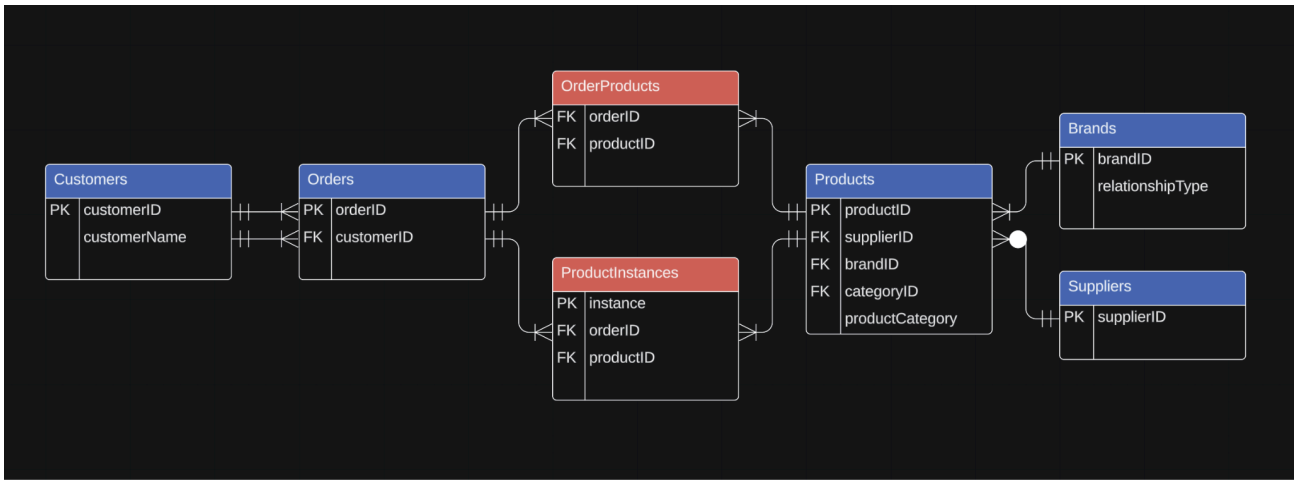
   - **Relationship Type:** Many-to-Many (M:M)
   - **Explanation:** This relationship captures the specific instances of products sold in an order, tracked by a unique identifier (*serialNumber*). This is useful for businesses that need to track individual product units.
   - **Implementation:** This is handled by the **ProductInstances** intermediate table, which includes:
     - *instanceID*: INT (**Primary Key**, AUTO_INCREMENT, UNIQUE, NOT NULL)
     - *orderID*: INT (**Foreign Key** referencing *Orders.orderID*)
     - *productID*: INT (**Foreign Key** referencing *Products.productID*, NOT NULL)

        - *serialNumber*: VARCHAR(50) (NOT NULL, UNIQUE) - unique identifier for each product unit
3. **Brands (1:M) Products:**
    - **Relationship Type:** One-to-Many (1:M)
    - **Explanation:** A brand can supply multiple products, and each product is associated with one brand.
    - **Implementation:** The *brandID* and *brandName* in the **Products** table references the **Brands** table's primary key and attribute.
4. **Products (M:1) Suppliers:**
    - **Relationship Type: Many-to-One (M:1)**
    - **Explanation:** Multiple products can be supplied by a single supplier, but each product is supplied by one and only one supplier. This relationship is important for tracking which supplier provides a given product.
    - **Implementation:** The **Products** table contains a *supplierID* and *supplierName* foreign key that references the **Suppliers** table's primary key and attribute.
5. **Suppliers (1:M) Products:**
    - **Relationship Type:** One-to-Many (1:M)
    - **Explanation:** A single supplier can supply multiple products, but each product is supplied by only one supplier. This relationship works in the opposite direction of the previous one and is part of the same relationship pair.
    - **Implementation:** The *supplierID* in the **Products** table acts as the foreign key referencing the **Suppliers** table, indicating that multiple products can be linked back to a single supplier.

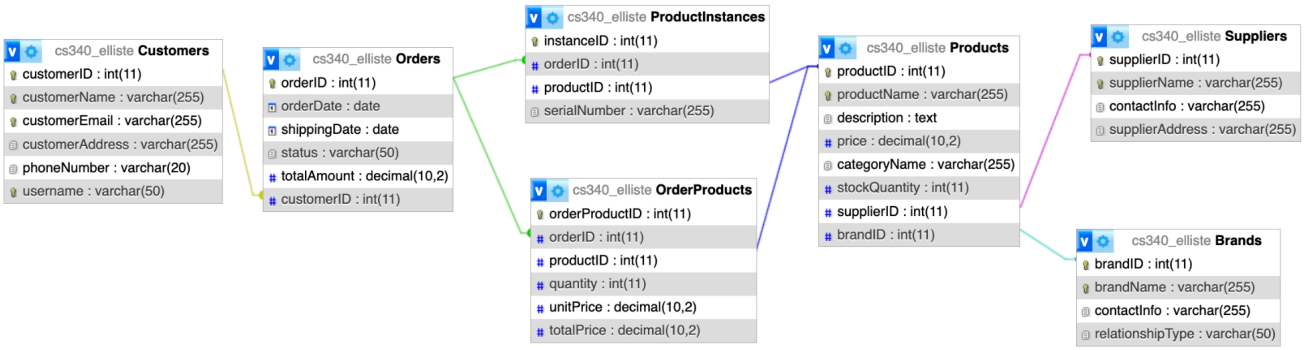
Justification of 3NF Compliance:

- **Removal of Partial Dependencies:** Each attribute in a table is fully dependent on the primary key.
    - For example, in **OrderProducts**, *quantity* and *orderPrice* depend on both *orderID* and *productID*, as they describe details of the relationship between these two entities.
- **Removal of Transitive Dependencies:** Non-key attributes do not depend on other non-key attributes.
    - For instance, **Brands** has its own table rather than storing *brandID* details in **Products**.

Entity-Relationship Diagram (ERD):



Schema:



Sample Data:

Customers

Add		Customer ID	Customer Name	Email	Address	Phone Number	Username
Edit	Delete	1	John Doe	johndoe@example.com	123 Maple St	123-456-7890	johndoe
Edit	Delete	2	Jane Smith	janesmith@example.com	456 Oak St	234-567-8901	janesmith
Edit	Delete	3	Bob Brown	bobbrown@example.com	789 Pine St	345-678-9012	bobbrown

Orders

Add		Order ID	Order Date	Shipping Date	Status	Total Amount	Customer Name
Edit	Delete	1	2024-10-01	2024-10-05	Shipped	159.98	John Doe
Edit	Delete	2	2024-10-03	2024-10-07	Delivered	99.99	Jane Smith
Edit	Delete	3	2024-10-04	2024-10-09	Pending	79.99	Bob Brown

Products

Add		Product ID	Product Name	Description	Price	Category Name	Stock Quantity	Supplier	Brand
Edit	Delete	1	Hiking Backpack	Durable hiking backpack	99.99	Outdoor Gear	50	Outdoor Gear Suppliers Inc.	North Face
Edit	Delete	2	Sleeping Bag	Warm and lightweight	59.99	Womens Gear	30	Adventure Equipment Co.	Patagonia
Edit	Delete	3	Climbing Rope	Strong climbing rope	79.99	Mens Gear	20	Mountain Sports Supply	Columbia

Brands

Add		Brand ID	Brand Name	Contact Info	Relationship Type
Edit	Delete	1	North Face	contact@northface.com	exclusive
Edit	Delete	2	Patagonia	contact@patagonia.com	preferred
Edit	Delete	3	Columbia	contact@columbia.com	exclusive

Suppliers

Add		Supplier ID	Supplier Name	Contact Info	Address
Edit	Delete	1	Outdoor Gear Suppliers Inc.	info@ogs.com	111 Cedar Ave
Edit	Delete	2	Adventure Equipment Co.	contact@mss.coms	333 Aspen Rd
Edit	Delete	3	Mountain Sports Supply	contact@mss.com	333 Aspen Rd

OrderProducts

Add		Order Product ID	Order ID	Product Name	Quantity	Unit Price	Total Price	Order Date
Edit	Delete	1	1	Hiking Backpack	1	99.99	99.99	2024-10-01
Edit	Delete	2	2	Sleeping Bag	1	59.99	59.99	2024-10-03
Edit	Delete	3	3	Climbing Rope	1	79.99	79.99	2024-10-04

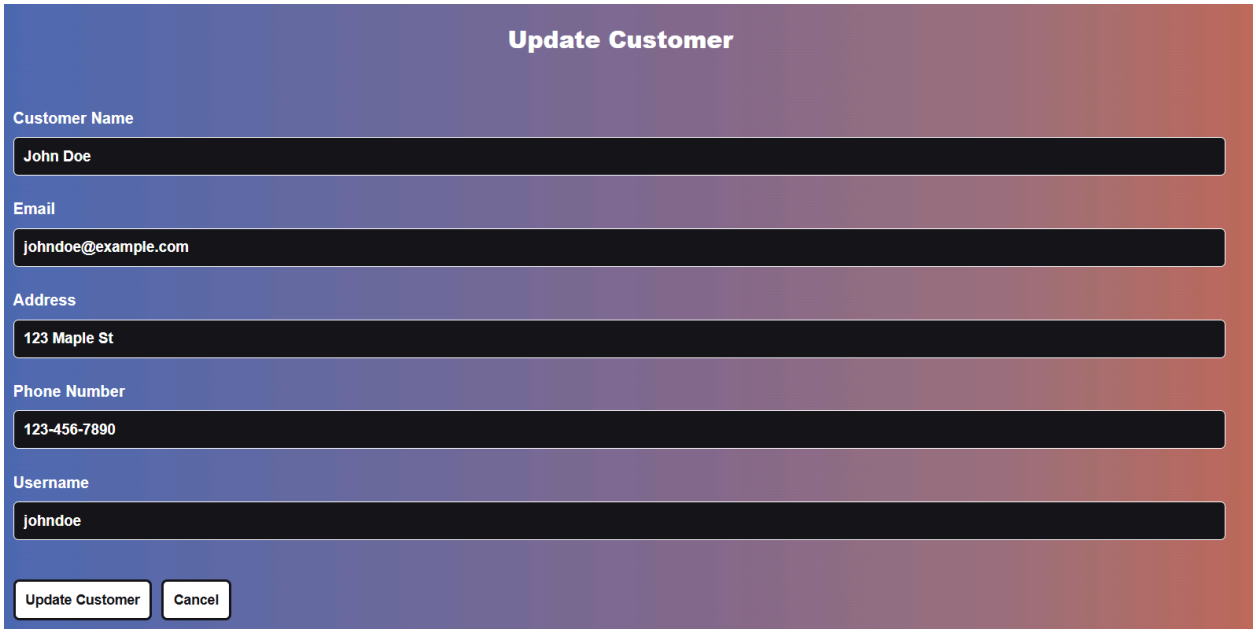
Product Instances

Add		Instance ID	Order ID	Product ID	Serial Number
Edit	Delete	1	1	1	SN123456
Edit	Delete	2	2	2	SN789012
Edit	Delete	3	3	3	SN345678

UI Screenshots:

Add Customer (Create): fill in the fields

Update Customer (Update): fields prepopulated and editable as desired



Delete Customer (Delete): Warning appears to confirm request