**CSCI 4125/5125 Course Project**

**Data Models and Database Systems**

**Fall 2023**

**Course Project**

**Phase 10: Normalization**

**Due: Tuesday, 11/28 @ 11:59pm**

**Reading:** Silberschatz Chapter 7

**Submission Guidelines:**

1. This assignment is worth 50 points for all students.

2. It is your responsibility to make sure all files are readable and submitted on time.

**Submission:**

- Tasks 1, 2 & 3. Submit a single file for all answers. You may draw out solutions by hand, but they must be legible and clearly organized into a single file.

**Task1. Product Relation (20 points total).** Since you originally designed the web store database, fields have been added to the original PRODUCT relation. You start to notice some data inconsistencies (due to update anomalies caused by data redundancy). Your job is to evaluate and fix these problems.

*Original Product Relation*

PRODUCT(ProductID, ProductName, Price)

*New Product Relation*

NEWRELATION(ProductID, ProductName, Price, SupplierID, SupplierName, Factory, City, State, RepresentativePhone, ManagerPhone

F = {

ProductID 🡪 ProductName

SupplierID 🡪 SupplierName, RepresentativePhone, Factory

ProductID, SupplierID 🡪 Price

Factory 🡪 City, State, ManagerPhone

}

**1. [5 points]** What is the primary key of this relation? *Hint:* It’s not ProductID.

**2. [10 points]** Remove any partial key dependencies to create a set of linked relational schemas in Second Normal Form. Primary keys require a solid underline. Foreign keys require a dotted underline and an arrow to the attribute(s) they reference.

**3. [5 points]** Remove any transitive dependencies to create a set of linked relational schemas in Third Normal Form. Primary keys require a solid underline. Foreign keys require a dotted underline and an arrow to the attribute(s) they reference.

*Note:* You only need to consider the decomposition for the PRODUCT relation for now. Task 3 will ask you to draw the entire schema.

**Task2. Customer Relation (20 points total).** Someone in your organization created the new CUSTOMER relation below to store (multiple) payment methods for customers.

*Original Customer Relation*

CUSTOMER(CustomerID, Name, DateOfBirth, ReferrerID)

*New Customer Relation*

CUSTOMER(CustomerID, Name, DateOfBirth, ReferrerID, PaymentMethods)

**4. [5 points]** To allow multiple payment methods for each customer, how would you alter the relation so that it is in proper 1NF? Show the proper 1NF schema. *Hint:* think back to the pizza toppings example.

**5.** **[5 points]** Did your new relation in 1NF introduce any redundancies? If so, what functional dependencies do you need to decompose on? ***Hint:* it may help to create some example values.**

**6.** **[10 points]** Using the functional dependencies you identified, show the new relation(s) in proper 3NF. Primary keys require a solid underline. Foreign keys require a dotted underline and an arrow to the attribute(s) they reference.

*Note:* You only need to consider the decomposition for the CUSTOMER relation for now. Task 3 will ask you to draw the entire schema.

**Task3. Updated Project Schema (10 points).**

**7.** Using your answers from Task1 and Task2, draw the updated schema for the entire web store in proper 3NF.