National University of Computer & Emerging Sciences, Karachi
Fall-2024 School of Computing (BSCS, BSSE, BSCY, BSAI)
Assignment # 2

Subject: Database Systems -CS2005	**Post Date: 10/10/2024**
Total Marks: 40	**Due Date:** 20/10/2024
Course Instructors: Dr. Zulfiqar, Dr. Anam Qureshi, Omer Qureshi, Basit Jasani, Abeer Gauher, Atiya Jokiyo, Fizza Aqeel, Javeria Farooq, Zain Noreen, Alina Arshad	

Instructions to be strictly followed.

- It should be obvious that submitting your work after the due date will result in zero points being awarded.
- Plagiarism (copying/cheating) and late submissions result in a zero mark.

Question #1 Medical Treatment History for a PATIENT

We want to design an attribute for a **PATIENT** entity type that tracks their history of multiple medical treatments.
Each treatment will contain:

- The **hospital name** where the treatment was given.
- The **start and end dates** of the treatment.

Each patient will show:

- A list of **procedures** performed during the treatment (if any).
- A list of **medications** prescribed during the treatment (if any).

Each **procedure entry** will contain:

- **Procedure name**
- **Date** the procedure was performed.

Each **medication entry** will contain:

- **Medication name**
- **Dosage**
- **Duration** (number of days).

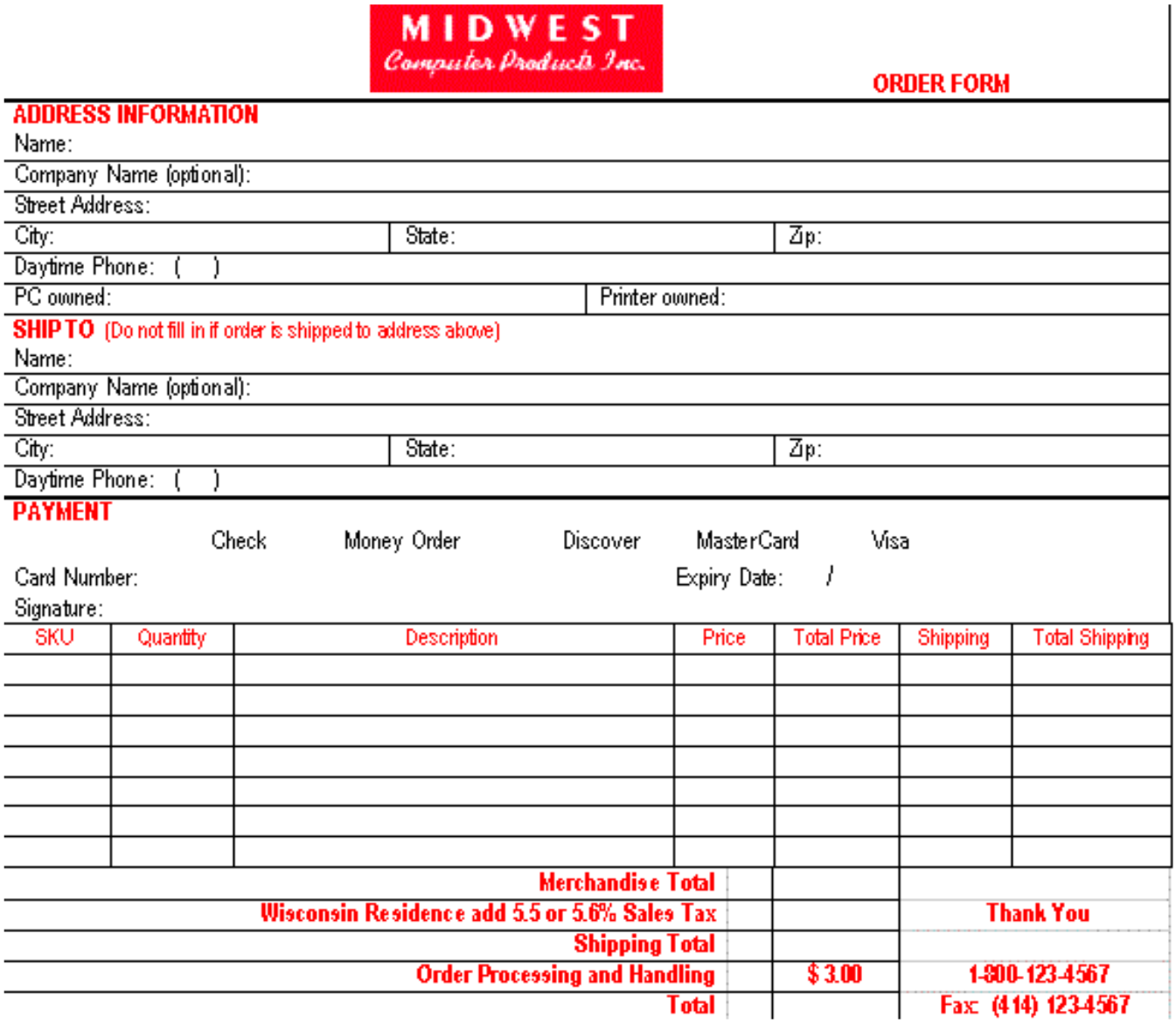
a) Design attributes to hold this information.
b) Show an alternative design for the attributes discussed above that uses only entity types (including weak entity types, if needed) and relationship types.

Question#2

A sales representative, like Alex, can supervise a group of other sales representatives, while each individual representative is supervised by only one person. Furthermore, Alex may handle several clients, though each client is assigned to only one representative. Clients can place multiple orders, and each order is associated with just one client. Every order includes a variety of stock items, and any stock item can be part of multiple orders. Stock items are composed of several components, and these components are often used to assemble different items. The assembly process involves multiple workers collaborating to build the stock items from these components. The components are provided by several vendors, with each vendor supplying a range of parts, and any part can be sourced from multiple vendors.
a) Design an ERD for the given scenario.

Question#3

Based on the provided order form, identify the entities, attributes, and relationships between them. Create an ER diagram to visually represent these entities and their relationships, including the cardinality of each relationship.



MIDWEST Computer Products Inc.

ORDER FORM

ADDRESS INFORMATION

Name:

Company Name (optional):

Street Address:

City: | State: | Zip:

Daytime Phone: ( )

PC owned: | Printer owned:

SHIP TO (Do not fill in if order is shipped to address above)

Name:

Company Name (optional):

Street Address:

City: | State: | Zip:

Daytime Phone: ( )

PAYMENT

Check Money Order Discover MasterCard Visa

Card Number: Expiry Date: /

Signature:

SKU	Quantity	Description	Price	Total Price	Shipping	Total Shipping

Merchandise Total			
Wisconsin Residence add 5.5 or 5.6% Sales Tax			Thank You
Shipping Total			
Order Processing and Handling		$ 3.00	1-800-123-4567
Total			Fax (414) 123-4567

Question#4

A car rental company tracks detailed information about the cars available for rent, their categories, and the suppliers providing these cars. Each car has a unique CarID, specific model, price per day, category, and supplier. The system also records the supplier's contact details. Currently, all car details, supplier information, and category details are stored in a single table:

Table: Cars Available for Rent

CarID	Model	PricePerDay	CategoryID	CategoryName	SupplierID	SupplierName	Email	Phone
C101	Toyota Camry	5000	CT1	Sedan	S1	Hertz	hertz@cars.com	123-456-789
C102	Honda Civic	4500	CT1	Sedan	S2	Enterprise	enterprise@cars.com	987-654-321
C103	Ford Explorer	7000	CT2	SUV	S1	Hertz	hertz@cars.com	123-456-789

C104	**Chevrolet Tahoe**	**8000**	**CT2**	**SUV**	**S3**	**Avis**	**avis@cars.com**	**654-321-987**
C105	**Toyota Corolla**	**4800**	**CT1**	**Sedan**	**S1**	**Hertz**	**hertz@cars.com**	**123-456-789**
C106	**Tesla Model X**	**9500**	**CT3**	**Electric**	**S4**	**Sixt**	**sixt@cars.com**	**741-852-963**
C107	**Jeep Cherokee**	**7500**	**CT2**	**SUV**	**S2**	**Enterprise**	**enterprise@cars.com**	**987-654-321**
C108	**Nissan Leaf**	**9000**	**CT3**	**Electric**	**S4**	**Sixt**	**sixt@cars.com**	**741-852-963**

QNO: 04 Part A

a) A new supplier, "Budget Rentals," wants to register with the car rental company, but the company has not yet added any cars for this supplier.

Input:

Supplier: **Budget Rentals**
Supplier Email: **budget@rentals.com**
Supplier Phone: **555-000-555**

How can we insert the supplier's information (e.g., "Budget Rentals") into the system without assigning any cars? In the current design, is it possible to insert supplier details without car data? What could be the issue with this?

b) The supplier "Hertz" changes its contact number from **123-456-789** to **999-888-777**.

Input:
Supplier: **Hertz**
New Phone: **999-888-77**

How would the current table structure handle this update? What happens if you update the phone number for "Hertz" in only some rows but not all? How does this lead to an update anomaly, and what are the implications for **data consistency**

c) The company decides to remove all cars rented from the supplier "Avis" (i.e., C104 is the only car rented from "Avis").

Input:
CarID to delete: **C104**

If the last car rented from "Avis" is deleted from the system, what happens to the supplier information for "Avis"? How does this lead to a delete anomaly, and what are the potential issues with losing supplier data?

QNO: 04 Part B

The table **Cars Available for Rent** is prone to anomalies and data inconsistencies. You need to redesign this system using **normalization**.Normalize the Cars Available for Rent table step-by-step:

- Convert the table into **1NF** by addressing any unorganized data (if applicable).
- Identify the **primary key** for the relation and remove **partial dependencies** to achieve **2NF**.
- Identify **transitive dependencies** (if any) and convert the table to **3NF**.

1. **Final Schema Design:**
    - After converting the table into **3NF**, present the **final schema**.
    - Define the **primary keys** and **foreign keys** in the final design.
2. **Justify Your Design:**
    - Explain how normalization solves the insert, update, and delete anomalies in the original table.
    - Discuss the **advantages** of the new design in terms of data consistency and integrity.

Question#5

Examine the Patient Medication Form for the Agha Khan Hospital

1. Identify the functional dependencies represented by the attributes
2. Describe and illustrate the process of normalizing the attributes to produce a set of well-designed 3NF relations.
3. Identify the primary, alternate, and foreign keys in your 3NF relations

AGHA KHAN HOSPITAL
Patient Medical Form

Patient Number: F10054

Full Name Muhammad Ali
Ward Number : Ward 12
Bed Number : 14
Ward Name : Cardiology

Drug Number	Name	Description	Dasage	Method of Admin	Units per day	Start Date	Finish Date
10045	Paracetamol	Pain Killer	15mg	Oral	40	10/5/2023	12/01/2024
10055	Atenolol	Antibiotic	40mg	IV	15	10/5/2023	16/9/2023
10058	Paracetamol	Pain Killer	15 mg	Oral	17	13/01/2024	28/08/2024

Question#6

Consider the following relation

R (Reservation_ID, Customer_ID, Room_Number, Stay_Date, Room_Type, Service_Code, Service_Charge).

In the above relation, a tuple describes a **hotel reservation** made by a customer, with details about the room they stayed in, the type of room, the services they availed, and the service charges.

Assume that a **room type** (like Suite, Deluxe) is determined by the room number and that **room types** are fixed across all customers.

Assume that each **service code** (like room service, laundry, etc.) has a fixed **service charge** (regardless of customer or room).

1. Is this relation in 2NF? Justify your answer and decompose if necessary.
2. Then argue whether further normalization to 3NF is necessary, and if so, perform it.

Good Luck!