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ASIA PACIFIC UNIVERSITY
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Title : **Database Management Group Assignment Part 1**

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Module Lecturer : **Mr. Muhammad Huzaifah bin Ismail**

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Group Members :

No	Name	TP Number
1	Lim Chee Xuan	TP 075916
2	Paureen Tan Nie Nie	TP 075914
3	Phang Shea Wen	TP 075813

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1.0 Database and Database Management System (DBMS)

Database is a collection of logically related information typically stored in the computer system (Oracle, n.d.). The information is related to the end user data which are raw facts and Metadata which are data about data (APU, n.d.). Database Management System (DBMS) is a collection of programs that manage the database (APU, n.d.). It provides several functions like create database, store and retrieve data from the database, manipulate the database, delete data from the database and so on (Oracle, n.d.).

1.1 Disadvantages of File-based System

1.1.1 Time-Consuming

Time consuming is one of the disadvantages of file-based systems as when the number of files expands, it causes the system administration to become difficult (APU, n.d.). For example, when a user wanted information that is not possible to be provided by using only a single file and requires multiple different files which are in different departments (Dwaipaya, 2023). So that, it is time consuming for the organization's employees to check each of the files in every department manually and carefully, then find out the relationships between the files to decipher the information that the user requested (Dwaipaya, 2023).

1.1.2 Difficulty in File Structure Modifications

Other than that, the disadvantage of the file-based system is the difficulty to make changes in existing file structure as it requires modification towards all the programs that using the similar data in that file (APU, n.d.). That means that whenever a modification has been conducted, it is more likely to produce errors (APU, n.d.). Thus, it requires extra time and manpower to debug the whole program.

1.1.3 Data Duplication

Data duplication is also the major problem when using the system, so it becomes a disadvantage of the file-based system. The data duplication will occur due to manual data storage, so that the same data used will exist in multiple locations and using the space in each of the hard disk (Dwaipaya, 2023). Resources, money, and time had been wasted to maintain all the machines

that store the duplication data (Dwaipaya, 2023). Case study for this disadvantage is that when an organization that having multiple regional office around the world and each of the office having its own file-based system which its function is to store employee records, financial data, and operational documents. However, due to the decentralized nature of file-based systems, data duplication has become a common problem.

1.2 Advantages of Database and Database Management System (DBMS)

1.2.1 Data Backup and Recovery

The advantage of Database and Database Management System (DBMS) is data recovery as Database and DBMS provide features for data backup and recovery so the data can be recovered if any accident has occurred (APU, n.d.). For example, when an organization can ensure that their data would not be lost due to hardware failures, human errors, or nature disaster because of the data recovery.

1.2.2 Data Security

Data security is also one of the advantages of Database and DBMS. This is because DBMS could encrypt the data if the organization needed and it also could control over who can access the database (Valcheva, n.d.). The case study for this advantage is that the database administrator can lay out different access rights for different users. So that the authorized user can only access can access the specific data through providing the username and passwords (Josephk, n.d.).

1.2.3 Data Redundancy Control

Furthermore, the advantage of Database and DBMS is control of data redundancy because they enforce the data integrity through data validation rules and standards (Anon, n.d.). These rules and standards can ensure that the data follow the specific database formats and prevent invalid entries to minimize the risk of data corruption. For example, a rule has specified that the dates must be entered in the format of YYYY-MM-DD when an organization implements data validation rules and standards to their database and DBMS.

1.2.4 Data Dictionary Management

DBMS performs many functions to manage and manipulate data efficiently within the database, one of the functions is data dictionary management. This function is to maintain the data dictionary or the metadata repository which contain the information about the database's objects, security, performance and more. Through this function, the programmer is unnecessary to be concerned to use complex coding for storing the relationship in the database because the DBMS provides data abstraction and eliminates data dependence on the system (Javatpoint, n.d.).

1.3 Database Management System (DBMS) Functions

1.3.1 Database Access Language and Application Programming Interface

Moreover, DBMS requires application programming interface to enable the users to create databases or access data which constantly in the form of data access language (Nutanix, 2023). Structured query language (SQL) is one of the examples for the data access language. The case study for this function of DBMS, the organization can use SQL to grant or cancel the access to different users to ensure that the sensitive data like customer information is protected from unauthorized access.

1.3.2 Log Management

Another function that has provided by DBMS is log management as it conducts log manager. The log manager will keep records on the time and the method for the data in the database is modified, created, or even deleted (Nutanix, 2023). So that, the log manager can integrate with database utilities to restore data or perform backups (Nutanix, 2023). For example, an organization can perform database recovery and restore the data of the system to the latest status before the accident happens.

2.0 Business Rules & Normalization

2.1 Business Rules

Business rules is well-signified as a brief, precise, and unambiguous descriptions of the mechanisms, definitions, and constraints governed within an organization (APU, n.d.). In terms of data model, business rules represent a paramount element in developing a robust database structure, with clearly defined rules and standards that the database is enforced to comply. With the well-structured business rules in place, APU Café can implement a comprehensive database system that could potentially dealt with the concern of long lines in the Café and inefficiency in order management. For a durable database system for the APU Café Ordering system, the business rules are defined as follows:

Table 2.1.1 Business Rules for Menu

Menu
1. Menu contains many food items that can be categorized into separate menu categories. 2. Menu can have many categories. 3. Each menu category has a unique category ID. 4. Each food item has a unique food ID. 5. Each chef is assigned with many food items that they can prepare.

Table 2.1.2 Business Rules for Employees

Employees
1. Each employee has a unique employee ID. 2. Employee can have different roles, which are either manager, chef, or a dispatch worker.

Table 2.1.3 Business Rules for Members

Members
1. Each member has a unique member ID. 2. Member can be a student or a lecturer.

Table 2.1.4 Business Rules for Orders

Shopping Carts	Orders
1. Each shopping cart has a unique cart ID. 2. One member can create many shopping carts. 3. Each shopping cart is a potential order that is pending, once confirmed will be placed as an official order. 4. One shopping cart can have many food items.	1. One member can make many orders. 2. One order can have many food items. 3. Each order comes with a table number. 4. Each manager can read many orders.
Cooked Meals	**Order Status**
1. Each meal cooked has a unique cooked meal ID. 2. Each order must contain one or more cooked meals. 3. Each food items in an order must be marked as cooked for order completion. 4. Each dispatch worker can send many cooked meals. 5. Each cooked meal must be sent to the members that placed the order within 15 minutes.	1. Status for each order is updated throughout the order placement, order preparation, and order completion process. 2. Status for each order can be 'pending', 'confirmed', 'preparing', 'completed', and 'delivered'.

Table 2.1.5 Business Rules for Payments

Payments	Payment Methods
1. Each member can make many payments. 2. One payment can be made for each order. 3. One member can make one payment for each order.	1. Each payment is made using one gateway.

Table 2.1.6 Business Rules for Feedback

Feedback
1. Each member can leave multiple feedback. 2. Each member can only give one feedback for each food item. 3. Each member can only leave feedback on the food item they ordered. 4. Each order may have one or much feedback given based on the number of variety of food items ordered.

2.2 Normalization

Normalization is a process used in database management systems to reduce data redundancies (Rouse, 2023). It involves evaluating and restructuring table structures to eliminate unnecessary repetition of data in the database. By following normalization rules, a database that is well-organized, efficient, and free from anomalies of data can be created (GeeksforGeeks, 2023). There are a few types of normalization which are known as normal forms. For the entities in the database system of the APU Café, only three basic normal forms are applied, which are 1NF, 2NF and 3NF.

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CafeOrder (MemberID, MemberName, BirthDate, Gender, RegisterDate, Email, EmailPassword, Allergies, CartID, CartDateTime, MenuCategoryID, CategoryName, CategoryLastDateUpdated, FoodID, FoodType, FoodName, Description, UnitPrice, FoodLastDateUpdated, ChefID, ItemDateTime, DispatchWorkerID PaymentID, PaymentMethod, Amount, PaymentDateTime, OrderID, OrderDate, OrderStartTime, OrderEndTime, TableNumber, OrderManagerID)

1NF

Step 1: Eliminate Repeating Groups.

Step 2: Identfiy Primary Keys.

Primary Keys:

- MemberID
- CartID
- MenuCategoryID
- FoodID
- PaymentID
- OrderID

Step 3: Identify all dependencies.

Partial Dependencies:

- MemberID -> MemberName, BirthDate, Gender, RegisterDate, Email, EmailPassword, Allergies
- CartID , MemberID -> CartDateTime
- MenuCategoryID -> CategoryName, CategoryLastDateUpdated, FoodID, FoodType, FoodName, Description, UnitPrice, FoodLastDateUpdated
- CartID, FoodID -> ItemDateTime
- PaymentID -> MemberID, CartID, PaymentMethod, Amount, PaymentDateTime
- PaymentID, MemberID, CartID -> PaymentMethod, Amount
- OrderID -> PaymentID, MemberID, CartID, OrderDate, OrderStartTime, OrderEndTime, TableNumber, OrderManagerID

Transitive Dependencies:

- MenuCategoryID -> FoodID -> FoodType, FoodName, Description, UnitPrice, FoodLastDateUpdated, ChefID

2NF

Step 1: Must be in 1NF.

Step 2: Remove Partial Dependencies/ Create Table from Partial Dependencies.

Existing Tables:

- Members(MemberID, MemberName, BirthDate, Gender, RegisterDate, Email, EmailPassword, Allergies)
- ShoppingCarts(CartID, MemberID, CartDateTime)
- MenuCategory(MenuCategoryID, CategoryName, CategoryLastDateUpdated, FoodID, FoodType, FoodName, Description, UnitPrice, FoodLastDateUpdated)
- CartItems(CartID, FoodID, ItemDateTime)
- PaymentMethods(PaymentID, PaymentMethod)
- Payments(PaymentID, MemberID, CartID, Amount, PaymentDateTime)
- Orders(OrderID, PaymentID, MemberID, CartID, OrderDate, OrderStartTime, OrderEndTime, TableNumber, OrderManagerID)

3NF

Step 1: Must be in 2NF.

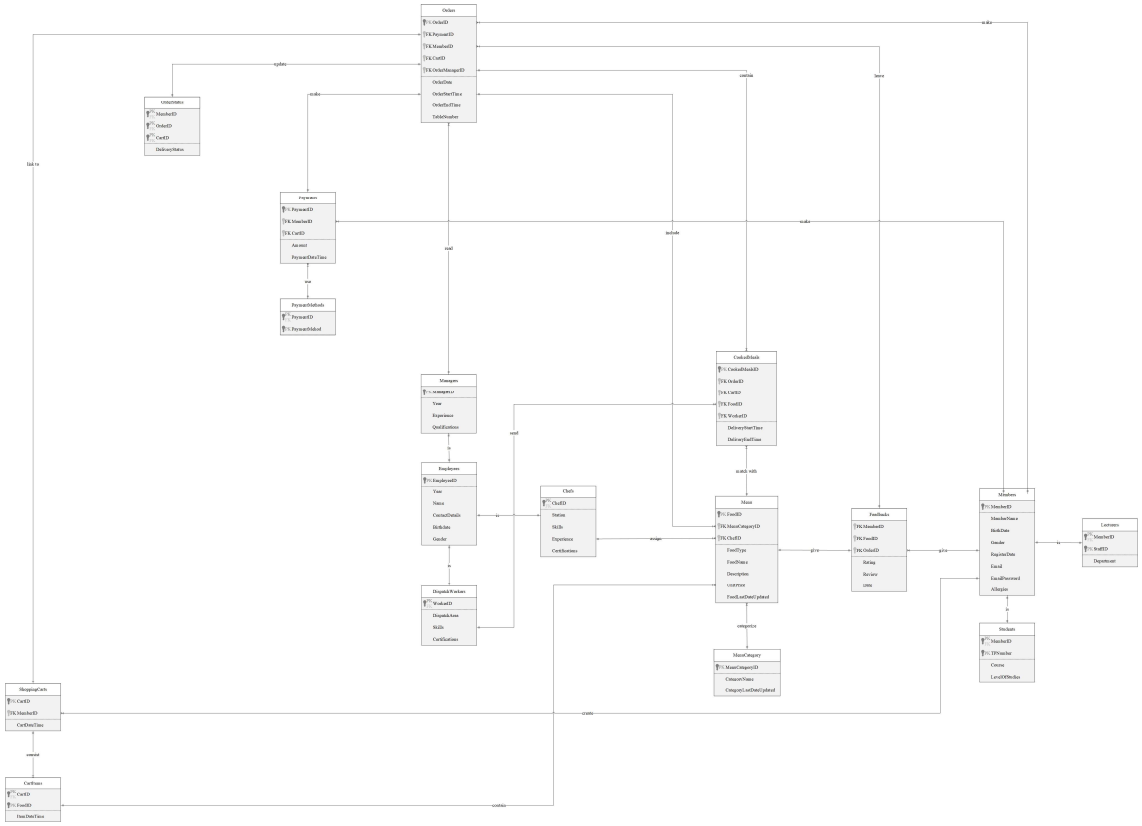
Step 2: Remove Transitive Dependencies/ Create Table from Transitive Dependencies.

Existing Tables:

- Members(MemberID, MemberName, BirthDate, Gender, RegisterDate, Email, EmailPassword, Allergies)
- ShoppingCarts(CartID, MemberID, CartDateTime)
- MenuCategory(MenuCategoryID, CategoryName, CategoryLastDateUpdated)
- CartItems(CartID, FoodID, ItemDateTime)
- PaymentMethods(PaymentID, PaymentMethod)
- Payments(PaymentID, MemberID, CartID, Amount, PaymentDateTime)
- Orders(OrderID, PaymentID, MemberID, CartID, OrderDate, OrderStartTime, OrderEndTime, TableNumber, OrderManagerID)
- Menu(MenuCategoryID, FoodID, FoodType, FoodName, Description, UnitPrice, FoodLastDateUpdated, ChefID)

Through this normalization, we created several tables that improve the database's organization. For example, the "Members" table stores member details. The "ShoppingCarts" table tracks which member's cart, including the cart ID and creation date and time. The "MenuCategory" table contains the details of menu categories and their last updated date. The "CartItems" table includes the cart ID, the foods in the cart and the assigned dispatch worker who will deliver the items to members. The "PaymentMethods" table stores payment ID and the payment methods for customers to pay for their cart items. The "Payments" table specific payments, including which payment the member made using which cart, the amount paid and the payment date. The "Orders" table contains order details, such as order ID, payment ID, associated member and cart, order date, start and end times, table number of the customer and the manager handling the order. The "Menu" table stores chef ID and food details, including type, name, description, price, and the last date updated of the food.

3.0 Entity Relationship Diagram



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5.0 Workload Matrix

Part	Component	Lim Chee Xuan	Paureen Tan Nie Nie	Phang Shea Wen	Total
1	a) Database and Database Management System	100 %	0 %	0 %	100 %
1	b) Business Rules & Normalization	0 %	50 %	50 %	100 %
1	c) Entity Relationship Diagram	0 %	50 %	50 %	100 %