Group Assignment

AICT005 - DAS

Database Systems

UCDF2005(1)ICT(DI)

Lecturer: **Mrs. Seetha Letchumy**

Weightage: **50%**

Hand out date: **23 March 2021**

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Group name: **Group 1**

Part: **Part 1**

Group member:

No.	Name	TP No.
1	Cheong Sheng Kui	TP060652
2	Lai Kai Yong	TP059040
3	Lim Wye Yee	TP059371

Workload Matrix

Name / TP Number	Responsibilities
Lai Kai Yong (TP059040)	Responsible for researching and writing introduction, functions of DBMS, business rules, normalization, the Entity Relationship Diagram and conclusion.
Cheong Sheng Kui (TP060652)	Responsible for researching and writing introduction, disadvantages of the file-based system, business rules, normalization, the Entity Relationship Diagram and conclusion.
Lim Wye Yee (TP059371)	Responsible for researching and writing introduction, advantages of database and database management system, business rules, normalization, the Entity Relationship Diagram and conclusion.

Introduction

The assignment aims to conduct analyzation on disadvantages of file-based system comparing with advantages and functionalities of database management system (DBMS). The scenario is set in Asia Pacific University's (APU) library and bookshop, where an e-bookstore should be created due to the growth of population. The existing library is bounded with many restrictions, limited availability and choices. While the small bookshop within APU is unable to cater the need of members within the enterprise. The project team is assigned to design and implement APU's online e-bookstore system to resolve this issue. This includes stating business rules with entities, database relationship and cardinalities. Students as the project team members are required to design the entity-relationship diagram for database using Chen's notation and normalization of data. The project team has to design the database based on analyzation on database research and illustration of the database assumption diagram. It allows concurrent access of admins and provides appropriate function for APU's daily operation in this scenario. Features of data storage and dictionary management functionalities enables efficient and effective working processes which fulfills the heavy workloads and requirements of APU's members.

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I. Database and Database Management System

A. Disadvantages of the file-based system

A file-based system allows us to arrange data in many different file formats such as .doc, .ppt, .mp3 and .mp4. The files are organized and grouped into their respective directories and stored in storage mediums like hard disk drives (HDD), solid-state drives (SSD) and pen drives. Each file stored is independent of other files. The integration of data from a different file can only be done by writing a single program for every application (Parmar, 2018). Although the process of handling the approach towards data reading and writing to the storage seems simple, it also carries several disadvantages. The file-based system could be ideal if the user stores a limited number of files with less data, but the advantages lessen as the data and files stored starts to expand with limited flexibility.

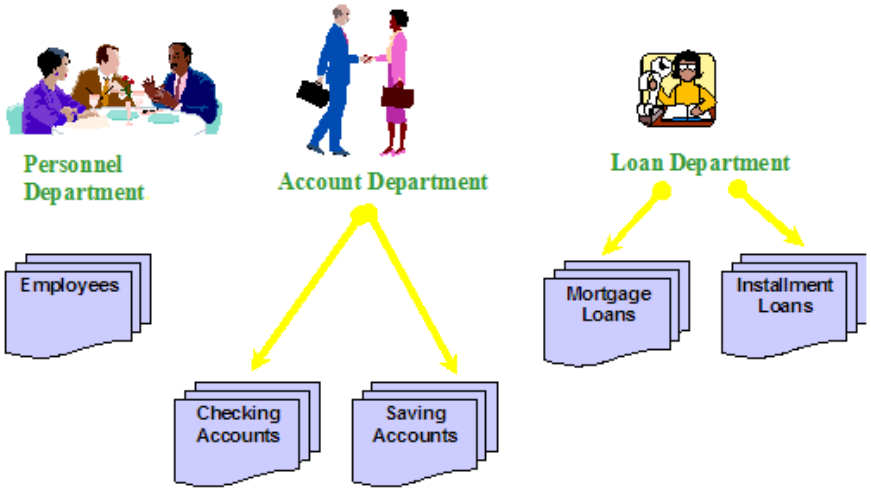

Figure 1 : File-based system for banking
(Anh, 2021)

- **Data Redundancy**

The file-based system contributes to data redundancy of data stored. Data redundancy is when conflicting, and distinct versions of the same data appear in different files. When complicated and massive entries are being made in different files or repeatedly in several files, errors are more likely to occur. As flat-file databases depend on files containing records as text, it has no structural data, and they cannot be related from one file to another. APU bookstore's file-based system includes several files. The main file contains data about the publisher, genre, id, and stock of the books. If the second file requires data about book id, redundancy of data occurs as the same data about book id exists in two files simultaneously (Jackson, 2021). The administration and management of the expanding file system have become time-consuming and difficult. This also causes limited data sharing as data records are scattered in several files (Guru99, 2021). Duplication of data wastes memory as it increases file size, and data might be mishandled due to confusion. This wastes access time as larger file size takes a longer time to load, and it is proven to be cost-inefficient (Singh, 2015).

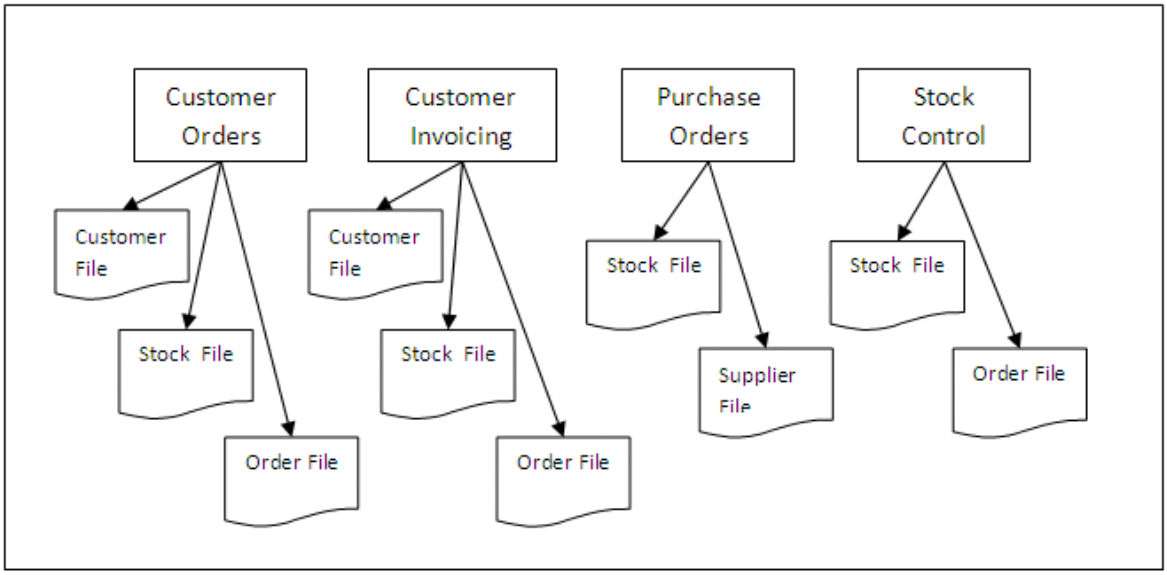

Figure 2: Example of Data Redundancy
(Massachusetts Institute of Technology, 2021)

- **Lack of Data Dependency**

Furthermore, data dependency is deemed to be one of the disadvantages of the file-based system. Data are stored in files described by certain formats, comma, semicolon or say tab. Therefore, there are also chances that the file formats of the bookstore's data are incompatible as the file structures are dependent on the programming language embedded in the application, which makes the bookstore's file management process more challenging (Thakur, 2021). Besides, changing the existing file format leads to change the program used for file processing. As many programs are dependent on this file, like the books' information, the member's data and feedback, such changes involve modifications on programs that depend on data in the file (Asia Pacific University , 2019). Therefore, it is crucial to know each program's dependence as the application's code contains data storage and access instructions. Such modifications will produce a high chance of obtaining errors that will fail the application if one part is neglected from change (Tutorial Cup, 2021). Additional time are needed to fix the program instead. For instance, if a member of APU E-Bookstore decides to update his contact information, the bookstore then has to make changes to the records in the master file. Thus, it is also necessary for the bookstore to edit the data in the dependent application program to maintain consistent data.

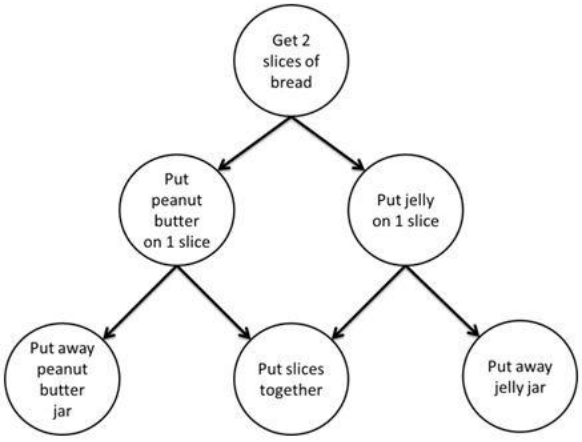

Figure 3: Example of data dependency
(USTC, 2015)

- **Data Isolation**

Moreover, the file-based system is also prone to data isolation and separation. Data isolation is defined as a property that becomes visible to other concurrent users after deciding when and the way changes should be made by an operation (Guru99, 2021). In some scenarios, the staff of APU E-Bookstore might need to take data from two different files to understand their decision-making better. However, they will face some problems and difficulties with retrieving the appropriate data scattered within the files or other file formats (Singh, 2015). Other than that, the staffs will face complications in data representation from the isolated data as data from specific files must be combined, and relationships between isolated data can be hard to determine while contributing to data inflexibility (Thakur, 2021). For instance, a member of the bookstore provided ratings and feedbacks towards a book. A negative rating was given to the book, the staff of the bookstore will have to check that specific member's data which is located in another file, to determine whether the feedback is reliable- based on the member's favourite and disliked genre so that they can decide to take in more of such genre of books to suit the audiences' preference. Moreover, the manager needs to relate data such as the books' genre with the ones he held in the master data file to maintain data consistency. Hence, he might find some difficulties in managing that from time to time.

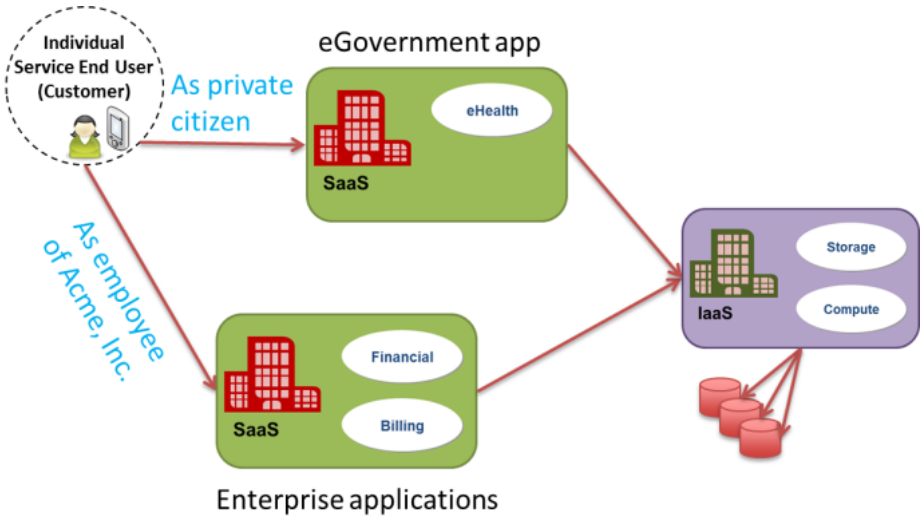

Figure 4: Visualization of data isolation
(Jaatun, et al., 2013)

B. Advantages of Database and Database Management System

A database is a collection of interrelated data in a shared and integrated computer architecture that serves to solve data management needs. On the other hand, a database management system, known as DBMS, is a complex software made by collecting programs that administer a database structure while authorizing access to data. Users can share data among various applications, contributing to the efficiency and effectiveness of data management (Asia Pacific University , 2019). There are many promising advantages through database and DBMS that can be utilized for a more organized data management system.

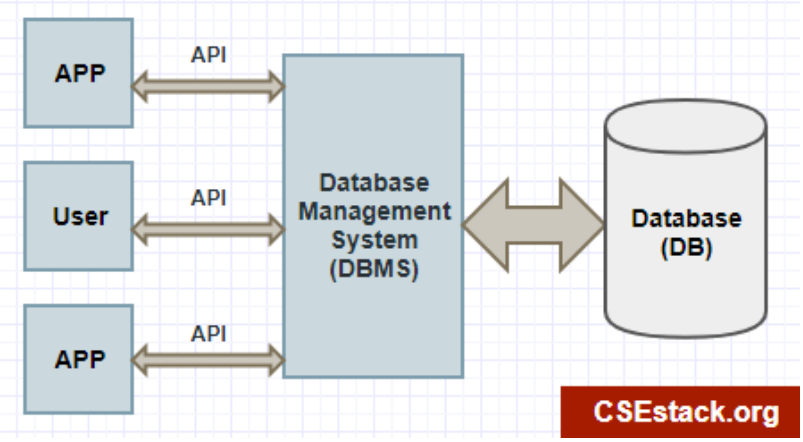

Figure 5: Difference between database and DBMS
(Chaudhari, 2020)

- **Prevent Data Redundancy**

When implementing the database and DBMS for APU's e-Bookstore, data redundancy is less likely to occur or even not present, unlike the file-based system. Such problems can be reduced through data normalization and having a centralized database for every data stored for the bookstore rather than developing individual locations to store the data for each application by every staff working in the bookstore (Pedamkar, 2020). While changes involve in only a single database, storage wastage due to duplication of data can also be eliminated (Castro, 2018). For instance, an employee holds the job of processing all of the members' orders and is also in charge of forwarding some book requests to the manager for compilation. While working on orders and book requests, she needs to store the users' personal information like name, address, age, phone

number, and birth date. Instead of accessing the data from separate file systems and having difficulties maintaining the same data, she can access the members' information through the centralized database. Hence, that information will not need to be stored repeatedly as joining relations for common columns can be done (Thakur, 2021).

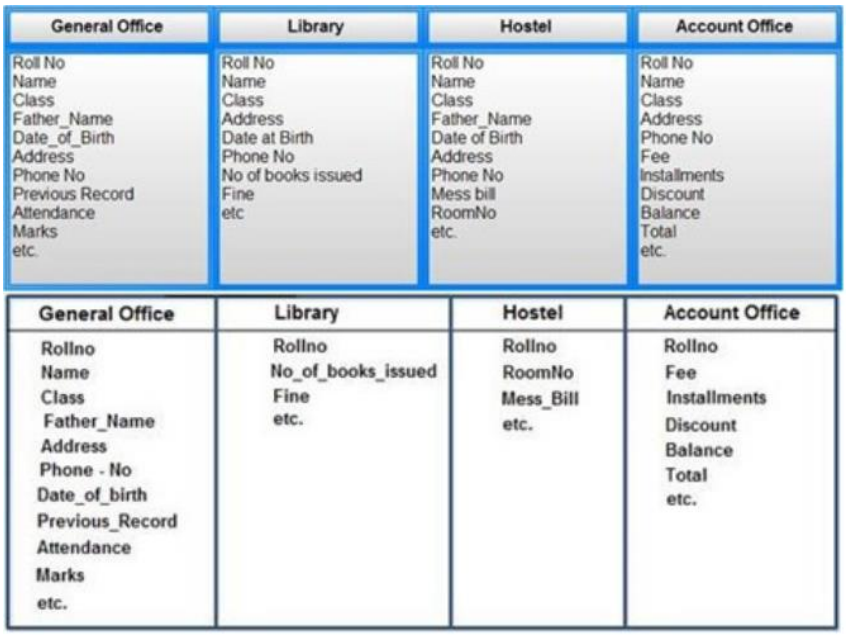

Figure 6: Data redundancy
(Thakur, 2021)

- **Maintain Data Consistency**

Database and DBMS are widely used nowadays due to one of the advantages of obtaining consistent data comparing to the traditional file-based system. Data redundancy are often the root cause of issues in getting inconsistent data. Data inconsistency is the condition whereby two or more data do not agree due to the lack of propagation to another application (Thakur, 2021). Therefore, when data normalization or database redesignation is implemented by the bookstore's DBMS to solve data redundancy issues, data inconsistencies are also solved (Singh, 2015). The database and DBMS systems contain a defined single data repository that many users can access, such as the manager and employee (Pedamkar, 2020), while preventing same data in different versions appearing in other places within the bookstore's system. Moreover, the DBMS can instantly reflect any changes made to the staff's database (Castro, 2018). Therefore, the data displayed in the bookstore's DBMS are always consistent for all users from the bookstore. For

example, the record of a member's name "Alicia Lee" has been mistyped as "Alicia Li". With the implementation of the DBMS, the bookstore's admin can update the mistyped name in the database to the correct spelling. After updating the database, the propagation of update will be executed where only a single update is sufficient to propagate the latest data to other applications automatically, maintaining the consistency of data (Thakur, 2021).

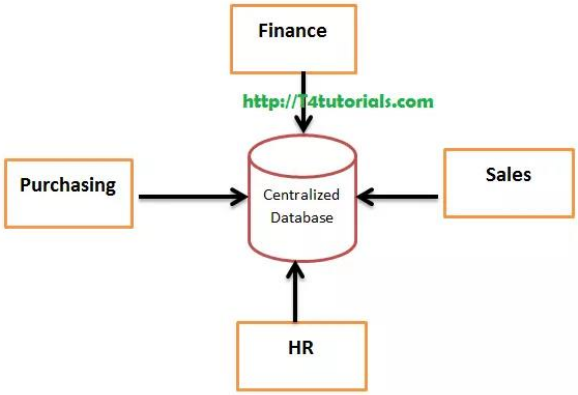

Figure 7: The centralized database used in APU E-Bookstore
(Shamil, 2020)

- **High Data Integrity**

Furthermore, database and DBMS carry the advantage of integrating data by merging data from different locations and generates a unified view of data for the bookstore's employees with much feasibility (Pedamkar, 2020). Data integrity can be achieved by obtaining accurate data, such that the database cannot store inaccurate information that might affect the bookstore's system. The data in the DBMS is visible to multiple employees of the bookstore. Hence, it becomes easy to handle data as it is simple to see and keep track the actions and conditions in one department or segment of the bookstore that might affect other segments with a synchronized form of data (GeeksforGeeks, 2019). The DBMS carries abilities on characterizing and administering some integrity constraints (Thakur, 2021). Integrity constraints are essential parts of the DBMS so that a certain set of rules can be entered to make sure that data insertion, updates, and other processes are done in the desired way based on the bookstore's requirements. For instance, supposing that the bookstore consists of only scores ranging from 1 to 10 for each book rating. In order to enforce suitable input of data and prevent inaccurate information such as entering "11" in the book ratings

within the database, an error message will occur as members can only give “10” as the maximum rating score. DBMS enables the bookstore’s employees to apply this integrity constraint only once in the rating field of the book processing department as the rating field only appears a single time within the whole database. After that, all of the other applications in the bookstore’s system will retrieve the rating information about the book from the book processing department. Therefore, the integrity constraint can be applied to the whole database (Thakur, 2021) . To conclude this, the centralized DBMS system can enforce integrity constraint.

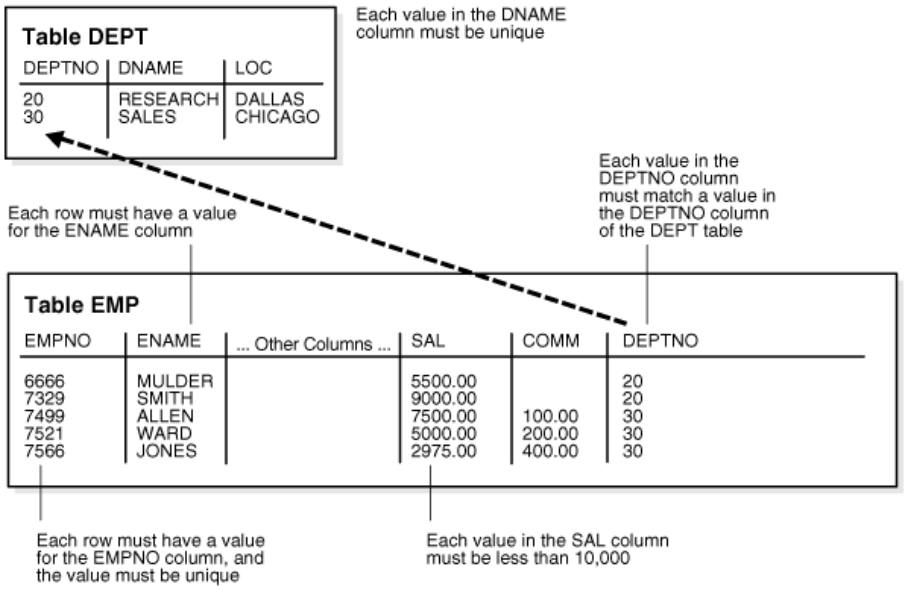

Figure 8: Example of determining data integrity
(Oracle, 2003)

C. Function of DBMS

Database Management System (DBMS) is defined as a software application that is capable to perform various functions which is well-known on its data integrity and consistency (Owlgen, 2021). The latest version of DBMS has a strong guarantee on the database manipulation, moreover it is also transparent to end-users (Thakur, 2021). Relating to the scenario whereby APU decided to establish an online e-bookstore, DBMS perfectly matches the requirements with its functionalities. In order to provide the APU population which includes lecturers, staffs, and students with an impeccable educational environment, APU bookstore should convert their e-bookstore system under DBMS schema. E-bookstore as a transactional system is much more suitable to be administered through DBMS instead of file-based management. APU E-Bookstore will need to execute several series of database operations such as books selling transactions, collecting members' feedback, and adding new books into the system from time to time (Guru99, 2021). DBMS as the main application program is strong enough to support the actions listed above by accessing the data contents with DBMS application program.

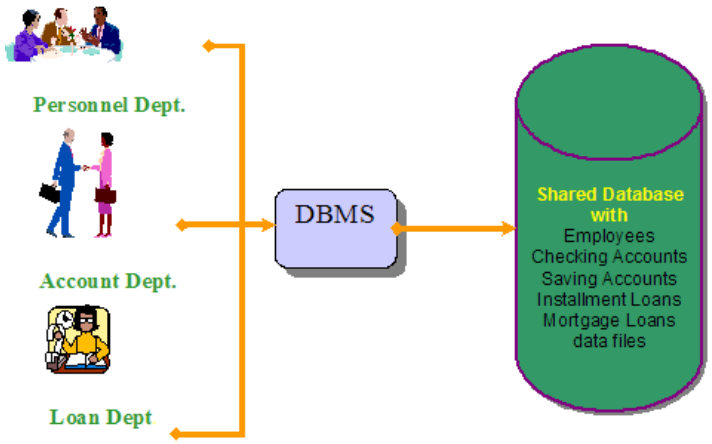

Figure 9: Database approach for banking system
(Anh, 2021)

- **Data Dictionary Management**

A feature in DBMS that makes it outstanding is data dictionary management, it stores the metadata of each columns in the database by its definitions and relationships. Furthermore, this dictionary system also enables every change made by users to be automatically recorded in the system catalog where users can check and modify it anytime (Owlgen, 2021). As for APU bookstore, it is flexible for the project team to edit the database because they are able to toggle the database system catalog if they want to get back to the previous version especially when the team accidentally delete important columns like book names. APU E-Bookstore can use this function to set up their database so that error rarely occurs in the system and end-users will have a better experience using the system. The project team can construct the database based on requirements in terms of data types, data size and accurate relationship to link the data. (Owlgen, 2021) APU bookstore can limit and validate the inputs from end-users in terms of e-mail and bank account number to make sure that columns of data are in the correct data types. Besides, the project teams do not need to be experienced or understand the coding of the complex structure of database. It is adequate for the project team to have understanding on some settings such as data component relationships in the data dictionary. DBMS is a strong tool for developers which can be easily acquired and used. Shortly, DBMS provides a data dictionary function that works on data extraction, data structure removal and data independence from the entire system. (Thiru, 2021) APU bookstore can limit their data in a proper setting likewise book ID should not be accepting any null value and make it constraint.

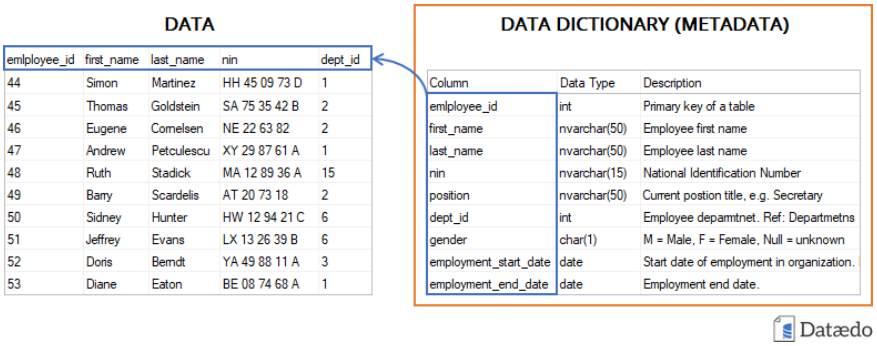

Figure 10: Difference between data and data dictionary (Kononow, 2018)

- **Data Storage Management**

DBMS has a high capacity in storage management especially hosting the database in a cloud service. Even if the database is launched locally in the bookstore's device, the capacity is also large enough to support a functional database. By using a DBMS software, it will create and manage a complex structure required for storing the data by default once a database is generated. Based on the latest version of DBMS, the storage management is not only specified on the data but also stores data entry forms, data validation rules, procedural code, image and video format structure handler (Thiru, 2021). Therefore, APU bookstore will not need to be concern on the capacity of their hardware storage, even if the local storage is full. APU bookstore can just attach it to the cloud and host it online with encryption of passcode.

Furthermore, data storage management is useful for database performance tuning which relates to the database activities on storage and speed. Other than that, DBMS provides a mechanism on permanent data storage, there is an internal schema that decides on how the data should be stored in the operating system. (Thakur, 2021) APU bookstore can use these features to create a fast-paced and systematic database and upload as many books details as they want with the storage available.

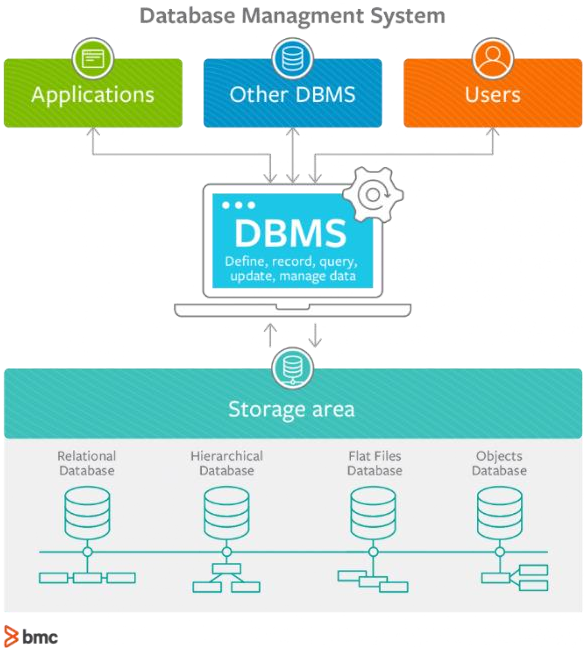

Figure 11: DBMS Storage Management
(Raza, 2018)

- **Multi-User Access Control**

As a powerful tool, DBMS allows multi-user access to control concurrently, likewise the access control on user-accessible catalog. By implementing a multi-user control features, data integrity and data consistency are most likely secured and being maintained in a proper manner. In order to achieve such result, DBMS utilize sophisticated algorithms to make sure users access the database at the same time without affecting the database integrity (Thiru, 2021). APU bookstore plans to operate their system with this feature as they want the end-users such as employees and members to get access on the system while it keeps on updating throughout 24 hours. At the meantime, DBMS does support data sharing among users, the system has a mechanism operating behind to manage concurrent access on a database (Thakur, 2021). To wrap up everything, DBMS can provide high level of data integrity and consistency to the users, and at the same time everyone can access it concurrently. In a simple example, APU e-bookstore database with up-to-date information is accessible to everyone no matter how many active users are in the system.

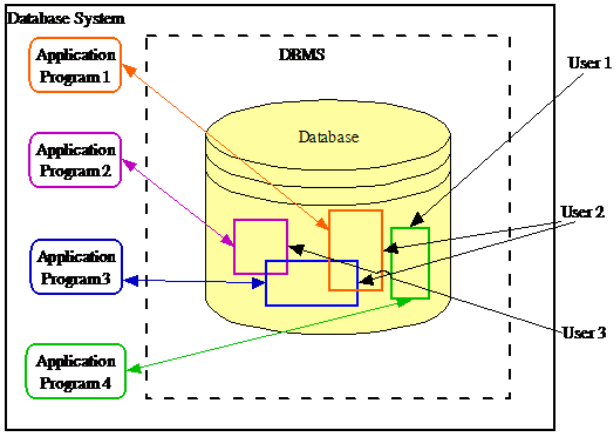

Figure 12: Components of a database system
(Anh, 2021)

II. Business Rules & Normalization

A. Business Rules

1. APU e-bookstore is comprise of books, registered members, publishers, and e-bookstore manager.
2. E-bookstore manager cooperates with the publishers and records every order made with them.
3. All books will be displayed in the APU e -Bookstore. Customers can view the books, but they cannot make a purchase without registering as a member in the bookstore system.
4. Registered members have access to view all the books in the e-bookstore and make a purchase, provide feedbacks on a purchased book.
5. Members can add the books they are interested to buy in the shopping cart, then selecting and compiling the wanted books to an order.
6. Members will need to pay within 7 days, else the orders will be cancelled automatically.
7. Publishers are the one who supplies the books to the bookstore and are identified by publisher id (primary key), publisher name, publisher address (Street, Zip Code, City, State, Country), publisher phone number, publisher email and publisher quantity on the books supplied.
8. Bookstore orders are made by e-bookstore manager and are recorded by order id (primary key), order date, order quantity, and order status.
9. Each book is identified by book id (primary key), book title, book ISBN, book genre, book author, published year, book edition, book section, book price and the in-stock quantity of the book.
10. Members are recognized by their unique member id (primary key), name, gender, date of birth, the date member acquires bookstore membership, address (Street, Zip Code, City, State, Country) and contact number.
11. Shopping cart collects and records the books selected to be purchased by members. Shopping cart is identified by purchase id (primary key), purchase quantity, purchase date, and total purchase price.

12. Member orders are identified by the member's order ID, order date, order quantity, payment status, delivery status, total price for the order and the book warranty end date.
13. Member orders will arrive within seven days, an estimated arrival date will be stated.
14. E-books orders receipt will be emailed to members for 1 month warranty from the estimated book arrival date. The warranty end date is recorded in the bookstore system and is displayed to the members as well.
15. The member feedback contains feedback ID (primary key), ratings and remarks which applied on a particular book in the bookstore.
16. Publishers can respond to many bookstore orders, and a bookstore order only can be supplied by one publisher.
17. Each book can only be published by one publisher while each publisher can publish many books.
18. Every book is obtained from bookstore orders, and bookstore orders are consisting of many books in APU e-bookstore.
19. Books are recorded into book inventory records, and book inventory records are dependent on books in APU e-bookstore.
20. Every book can be viewed by many registered members and registered members can view many books.
21. Many books can be included in a shopping cart to be purchased by members, and many shopping carts can include many same or different books.
22. A member can create only one shopping cart, but each shopping cart only belongs to one member.
23. Shopping cart which then proceeds to transfer into different member orders after members confirm their selection in the shopping cart to make a purchase. Each member order can only be referred to one shopping cart.
24. Every member can make many member's order while a member order with unique id only belongs to one member.
25. A registered member can provide many member feedbacks on different books, and each member feedback can only be provided by a registered member.
26. One member feedback can correspond to a book while a book can contain many member feedbacks. The feedback can only be provided by a member once on a same book.

B. Normalization

- **UNF**

ORDER								
MemOrder_ID	MemOrder_Date	Member_ID	Member_Name	Book_ID	Book_Title	Book_Genre	Book_Qty	Book_Price
MO001	2021-04-20	ME001	Kim Jong	BO003	Java Fundamentals	Coding	1	RM19.00
				BO004	C++ Computer	Coding	1	RM24.00
MO002	2021-04-24	ME006	Ibrahim Mustafa	BO001	Jungle Book	Fantasy	1	RM20.00
				BO005	Alien VS Cheong Chicki Dee	Horror	1	RM10.00
MO003	2021-04-23	ME002	Ji Eun	BO006	Tales of Charkolol	Fantasy	1	RM20.00
MO004	2021-04-25	ME003	Wayne Bryan	BO003	Java Fundamentals	Coding	1	RM19.00
MO005	2021-04-23	ME003	Wayne Bryan	BO001	Jungle Book	Fantasy	1	RM20.00
MO006	2021-04-25	ME001	Kim Jong	BO003	Java Fundamentals	Coding	1	RM19.00
				BO004	C++ Computer	Coding	1	RM24.00
MO007	2021-04-27	ME005	Bean Superman	BO002	Python Bible	Coding	1	RM30.00
				BO004	C++ Computer	Coding	1	RM24.00
MO008	2021-04-28	ME002	Ji Eun	BO001	Jungle Book	Fantasy	1	RM20.00
				BO002	Python Bible	Coding	1	RM30.00
				BO003	Java Fundamentals	Coding	1	RM19.00
				BO004	C++ Computer	Coding	1	RM24.00
MO009	2021-04-28	ME003	Wayne Bryan	BO001	Jungle Book	Fantasy	1	RM20.00
MO010	2021-04-29	ME006	Ibrahim Mustafa	BO003	Java Fundamentals	Coding	1	RM19.00

Table 1: UNF Table

ORDER (MemOrder_ID, MemOrder_Date, Member_ID, Member_Name, (Book_ID, Book_Title, Book_Genre, Book_Qty, Book_Price))

The UNF (un-normalized data) is the initial stage of normalization where it is utilized for gaining and grouping required attributes (DBS211, 2021). In this phase, duplicated attributes exist in the table. For example, the Book_ID are duplicated attributes in the table as it contains several same records in different fields.

- **1NF**

ORDER								
MemOrder_ID	MemOrder_Date	Member_ID	Member_Name	Book_ID	Book_Title	Book_Genre	Book_Qty	Book_Price
MO001	2021-04-20	ME001	Kim Jong	BO003	Java Fundamentals	Coding	1	RM19.00
MO001	2021-04-20	ME001	Kim Jong	BO004	C++ Computer	Coding	1	RM24.00
MO002	2021-04-24	ME006	Ibrahim Mustafa	BO001	Jungle Book	Fantasy	1	RM20.00
MO002	2021-04-24	ME006	Ibrahim Mustafa	BO005	Alien VS Cheong Chicki Dee	Horror	1	RM10.00
MO003	2021-04-23	ME002	Ji Eun	BO006	Tales of Charkolol	Fantasy	1	RM20.00
MO004	2021-04-25	ME003	Wayne Bryan	BO003	Java Fundamentals	Coding	1	RM19.00
MO005	2021-04-23	ME003	Wayne Bryan	BO001	Jungle Book	Fantasy	1	RM20.00
MO006	2021-04-25	ME001	Kim Jong	BO003	Java Fundamentals	Coding	1	RM19.00
MO006	2021-04-25	ME001	Kim Jong	BO004	C++ Computer	Coding	1	RM24.00
MO007	2021-04-27	ME005	Bean Superman	BO002	Python Bible	Coding	1	RM30.00
MO007	2021-04-27	ME005	Bean Superman	BO004	C++ Computer	Coding	1	RM24.00
MO008	2021-04-28	ME002	Ji Eun	BO001	Jungle Book	Fantasy	1	RM20.00
MO008	2021-04-28	ME002	Ji Eun	BO002	Python Bible	Coding	1	RM30.00
MO008	2021-04-28	ME002	Ji Eun	BO003	Java Fundamentals	Coding	1	RM19.00
MO008	2021-04-28	ME002	Ji Eun	BO004	C++ Computer	Coding	1	RM24.00
MO009	2021-04-28	ME003	Wayne Bryan	BO001	Jungle Book	Fantasy	1	RM20.00
MO010	2021-04-29	ME006	Ibrahim Mustafa	BO003	Java Fundamentals	Coding	1	RM19.00

Table 2: 1NF Table

ORDER (MemOrder_ID, Book_ID, MemOrder_Date, Member_ID, Member_Name, Book_Title, Book_Genre, Book_Qty, Book_Price)

Within the 1NF, the table is flattened, which can be described as having only single valued attributes which is not supposed to hold several values (tutorialspoint, 2021). For instance, the table is rearranged to a single value manner such as the MemOrder_ID and Member_ID attributes.

Functional dependencies

MemOrder_ID → MemOrder_Date, Member_ID, Member_Name (Partial)

Book_ID → Book_Title, Book_Genre, Book_Price (Partial)

Member_ID→ Member_Name (Transitive)

- **2NF**

ORDER2		
MemOrder_ID	Book_ID	Book_Qty
MO001	BO003	1
MO001	BO004	1
MO002	BO001	1
MO002	BO005	1
MO003	BO006	1
MO004	BO003	1
MO005	BO001	1
MO006	BO003	1
MO006	BO004	1
MO007	BO002	1
MO007	BO004	1
MO008	BO001	1
MO008	BO002	1
MO008	BO003	1
MO008	BO004	1
MO009	BO001	1
MO010	BO003	1

BOOK			
Book_ID	Book_Title	Book_Genre	Book_Price
BO001	Jungle Book	Fantasy	RM20.00
BO002	Python Bible	Coding	RM30.00
BO003	Java Fundamentals	Coding	RM19.00
BO004	C++ Computer	Coding	RM24.00
BO005	Alien VS Cheong Chicki Dee	Horror	RM10.00
BO006	Tales of Charkolol	Fantasy	RM20.00

MEMBERORDER			
MemberOrder_ID	MemOrder_Date	Member_ID	Member_Name
MO001	2021-04-20	ME001	Kim Jong
MO002	2021-04-24	ME006	Ibrahim Mustafa
MO003	2021-04-23	ME002	Ji Eun
MO004	2021-04-25	ME003	Wayne Bryan
MO005	2021-04-23	ME003	Wayne Bryan
MO006	2021-04-25	ME001	Kim Jong
MO007	2021-04-27	ME005	Bean Superman
MO008	2021-04-28	ME002	Ji Eun
MO009	2021-04-28	ME003	Wayne Bryan
MO010	2021-04-29	ME006	Ibrahim Mustafa

Table 3: 2NF Table

ORDER2 (MemOrder_ID, Book_ID, Book_Qty)

MEMBERORDER (MemOrder_ID, Member_ID, MemOrder_Date, Member_Name)

BOOK (Book_ID, Book_Title, Book_Genre, Book_Price)

In 2NF, partial dependencies such as MEMBERORDER and BOOK are removed from the main table. This is done by creating a new table containing the Primary Key and related attributes. Partial dependencies are data tables with non-primary attributes functionally depend on the primary attribute itself (Onsman, 2018).

- **3NF**

MEMBERORDER2		
MemberOrder_ID	MemOrder_Date	Member_ID
MO001	2021-04-20	ME001
MO002	2021-04-24	ME006
MO003	2021-04-23	ME002
MO004	2021-04-25	ME003
MO005	2021-04-23	ME003
MO006	2021-04-25	ME001
MO007	2021-04-27	ME005
MO008	2021-04-28	ME002
MO009	2021-04-28	ME003
MO010	2021-04-29	ME006

MEMBER	
Member_ID	Member_Name
ME001	Kim Jong
ME002	Ji Eun
ME003	Wayne Bryan
ME004	Donny Tom
ME005	Bean Superman
ME006	Ibrahim Mustafa

Table 4: 3NF Table

ORDER2 (MemOrder_ID, Book_ID, Book_Qty)

MEMBERORDER2 (Mem_OrderID, Mem_OrderDate, Member_ID)

BOOK (Book_ID, Book_Title, Book_Genre, Book_Price)

MEMBER (Member_ID, Member_Name)

In 3NF, transitive dependency such as MEMBER is removed by creating a table containing the non-primary attribute transitively dependent on the primary key. Transitive dependency is data table that contains indirect relationship which causes functional dependency (Onsman, 2018). It can be understood as when X maps to Y and Y maps to Z, then X equals to Z.

III. Entity Relationship Diagram

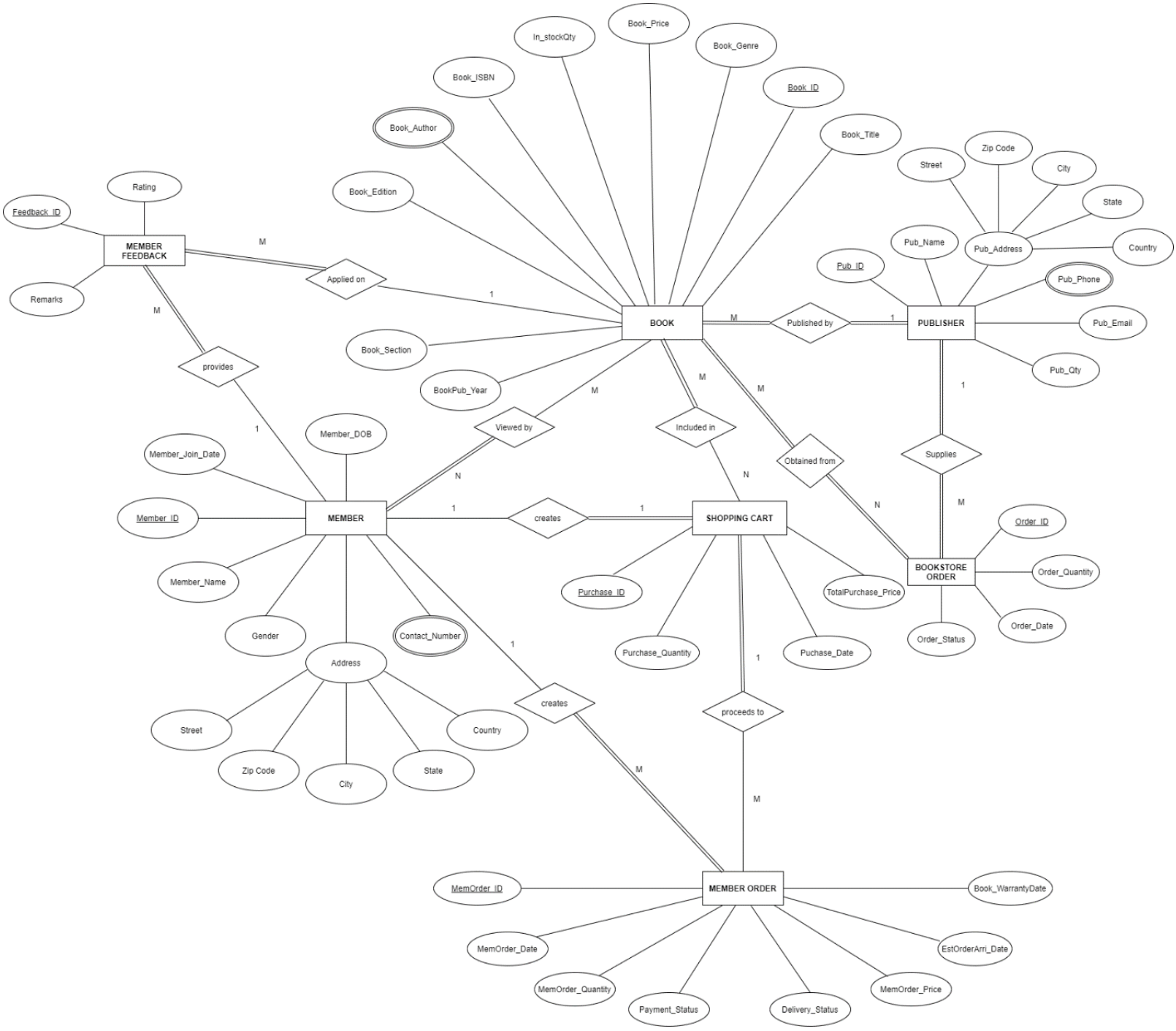

Figure 13: Entity Relationship Diagram based on Chen's notation

IV. Conclusion

In conclusion, the problems of APU library and small bookshop in managing the file-based system can be improved by utilizing the Database Management Systems (DBMS). This DBMS which then contributed to the creation of a data error-free e-bookstore. The traditional file handling method brings many issues in managing records such as data redundancy, lack of data dependency and data isolation. Meanwhile, the DBMS overcomes the issues with high consistency and data uniqueness which stands out with advantages like maintaining the integrity of data. Besides, the DBMS consists of several important functionalities that are widely used by the workplace, the functions include data dictionary management, data storage management and multi-user access control. Looking into how an e-bookstore DBMS is designed and implemented, there are a few important steps taken to ensure the database design is effective to the users. The steps required are stating business rules, illustrating data normalization and creating entity relationship diagram (ERD). Those components serve as a guide for a well-functioned DBMS to operate in a neat and concise manner to ease daily operations.

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