

LEVEL 4 Diploma in Computing

**Relational Database Management System
{RDBMS}**

By
Emmanuel Kerich

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I want all to thank BIG ACADEMY for their concern and providence of every learning material to keep us in the line and stay focused on my studies. Also I acknowledge my friends whom they played a big role in helping me through thick and thin.

Last but not least, my loving parents who decided to make my dream come true by bringing me here to learn and gain new ideas that will help me thereafter.

INTRODUCTION

Scenario

You have recently been appointed as a database designer for honey comp Traders in Abu Dhabi , UAE. Honeycomb traders is a sole trader, which has setup and is selling honey to customers in UAE locals. The business has been doing really well and until now it has recorded sales and customers information by hand. However, the sales are increasing and the owner needs to start racking customers details, sales, beehives and batches of honey. The owner of Honeycomb has asked you to design a relational database that will sort and record the business information.

LO1.1: An Explanation of Data Management system

1. What is DBMS?

A data base management system (DBMS) is a software program that allows users to define, construct, maintain, and operate a database.

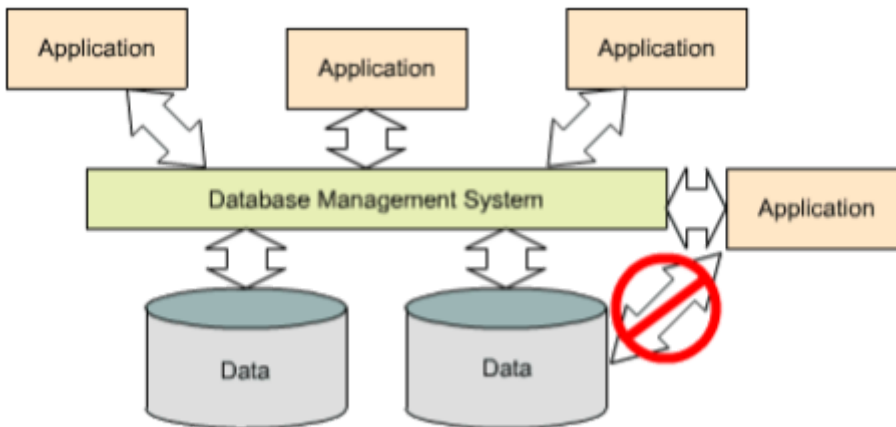


Fig. 1.1.1: DBMS {Anon, 2022}

Advantages of DBMS

- DBMS helps users to store information and refer it whenever they want
- It enables users to have better data that is well managed and synchronized data making it easy to handle
- It also minimizes data inconsistency making it easy for data users to detect any changes immediately
- It enables users to access data faster, accurately to produce quick answers to any queries
- It is simple, hence helps users understand data better with clear and simple view
- DBMS takes care of recovery and backups that help in restoration of database after system failure or crash to prevent its previous condition
- DBMS is serving as the backbone of several advanced technology practices like data modelling and machine learning.

Disadvantages of DBMS

- ❖ Despite of variety of advantages, DBMS has some flaws that makes it have drawbacks.
- ❖ High cost. The cost of DBMS software and hardware is relatively high.
- ❖ Integration of all data in a single database may be damaged due to power failure.
- ❖ Continuous usage of similar program by many users may lead to loss of data.

Examples of DBMS application

1. Railway reservation.

Data base is required to keep records of ticket booking, train departure, and arrival status.

2. Banking

Database manages all daily transactions that is done in and out of the bank

3. Universities and colleges

Database is required to keep all information related to students, faculty and other staff members

4. Social media sites

Database stores information that enables users to connect to other people

5. Telecommunication

DBMS store companies call details and monthly bills.

Types of Databases

Object-oriented

This is a database in which the characteristics are linked as an object.

Object-oriented programming languages like C++ and Java perform nicely with this database.

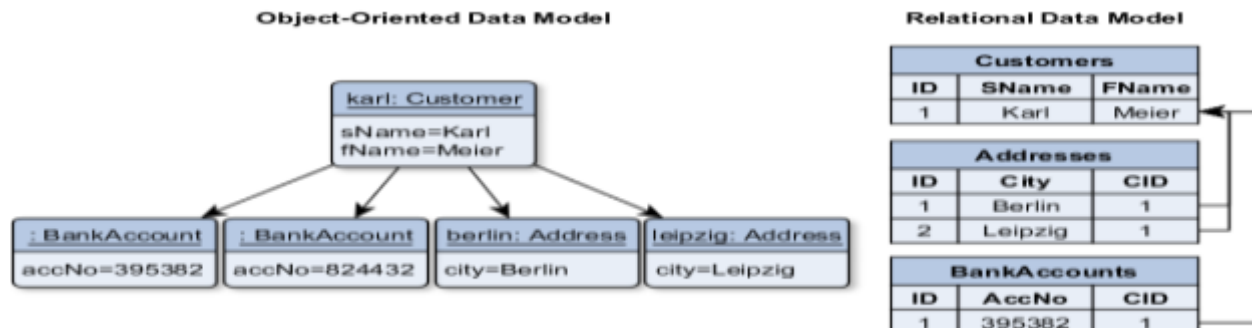


Fig 1.1.2: Object oriented data model{2021}

Key-value databases

A key-database saves data as a collection of key-value pairs, each of which contains two data items.

They're also known as a key-value store.

They are extremely scalable and capable of handling large volumes of traffic, making them suitable for activities like session management.

Key	Value
K1	AAA,BBB,CCC
K2	AAA,BBB
K3	AAA,DDD
K4	AAA,2,01/01/2015
K5	3,ZZZ,5623

Fig 1.1.3: key-valued database {Anon,2022}

Hierarchical databases

This type of data uses a parent-child model to store data. Its division of database from highest to lowest.

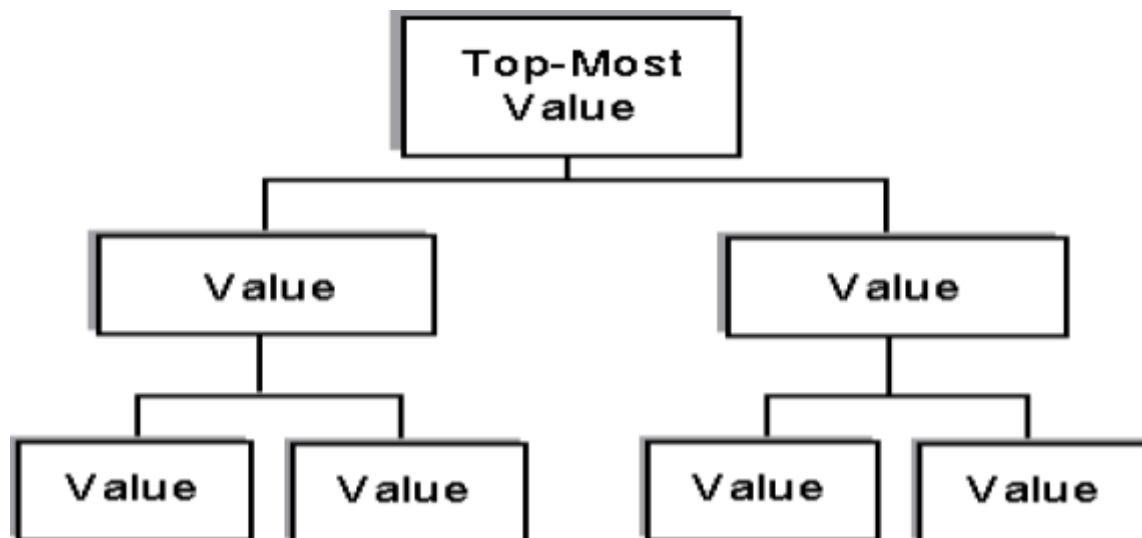


Fig 1.1.5: Hierarchical database {2022}

Relational databases

This is a paradigm in which data is kept in numerous tables that are connected to one another. Data is kept in columns and rows within the tables. They are arranged in columns and rows where each row in a table is marked with a unique value known as primary key and multiple tables can be related using a foreign key.

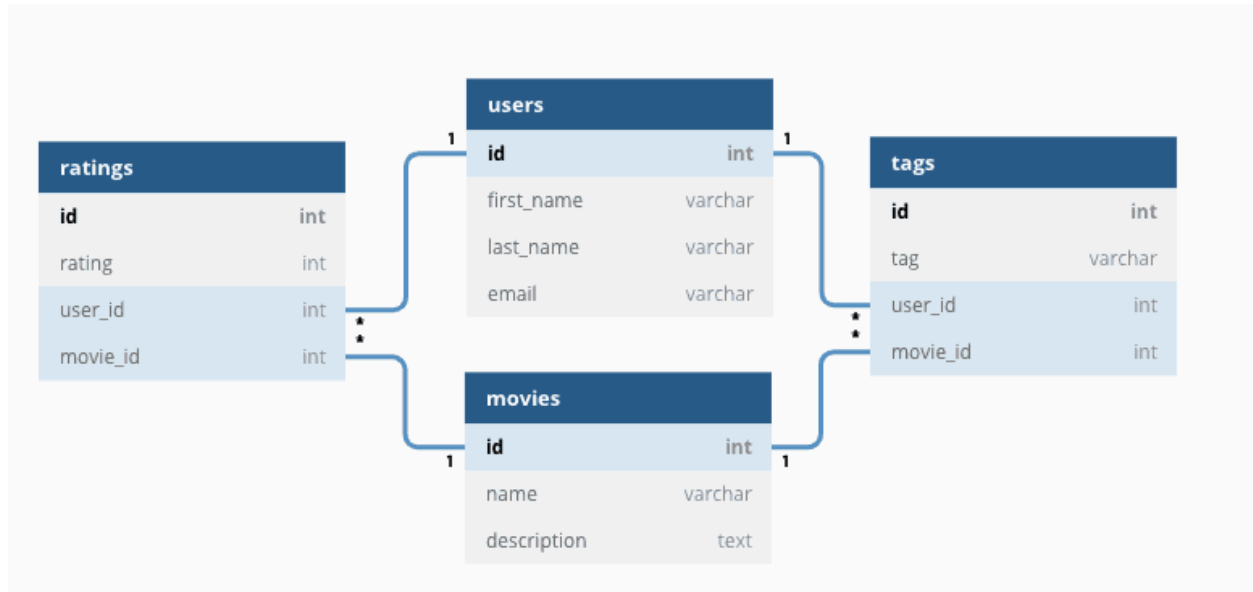


Fig 1.1.3: Relational database {2022}

Non-relational databases

Non-relational database refers to any database that does not employ SQL as its principal data access method.

Importance of non-relational database

- ❖ Non-relational database store massive dataset.
- ❖ They are flexible. Can be expanded easily.
- ❖ They have multiple data structures
- ❖ Cloud is the ideal home for non-relational database.

LO1.2. Explain the different level of database architecture

3 level database architecture

Three schema architecture shows how data is represented in by users in database system.

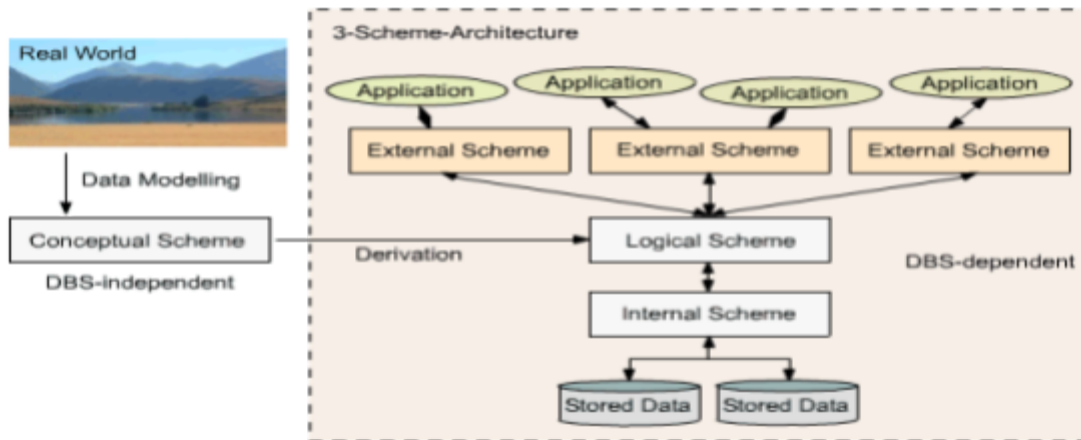


Fig 1.2.4: Architecture {2022}

This schema has three levels namely;

1. **External level-** It is also called view level because users are able to view their data.
2. **Conceptual level-** The whole design of a data is described in this level.
3. **Internal level-** This level shows how data is stored I storage devices.

Data model

Data model is a visual representation of an enterprise data element and the connection between them.

It helps to define and structure data in the context of relevant business processes and support the development of effective information system.

There are three types of data model;

Relational model

Relational data and their relationships are presented by collection of different inter-related tables. Each column in a table represents attributes while each row represents records.

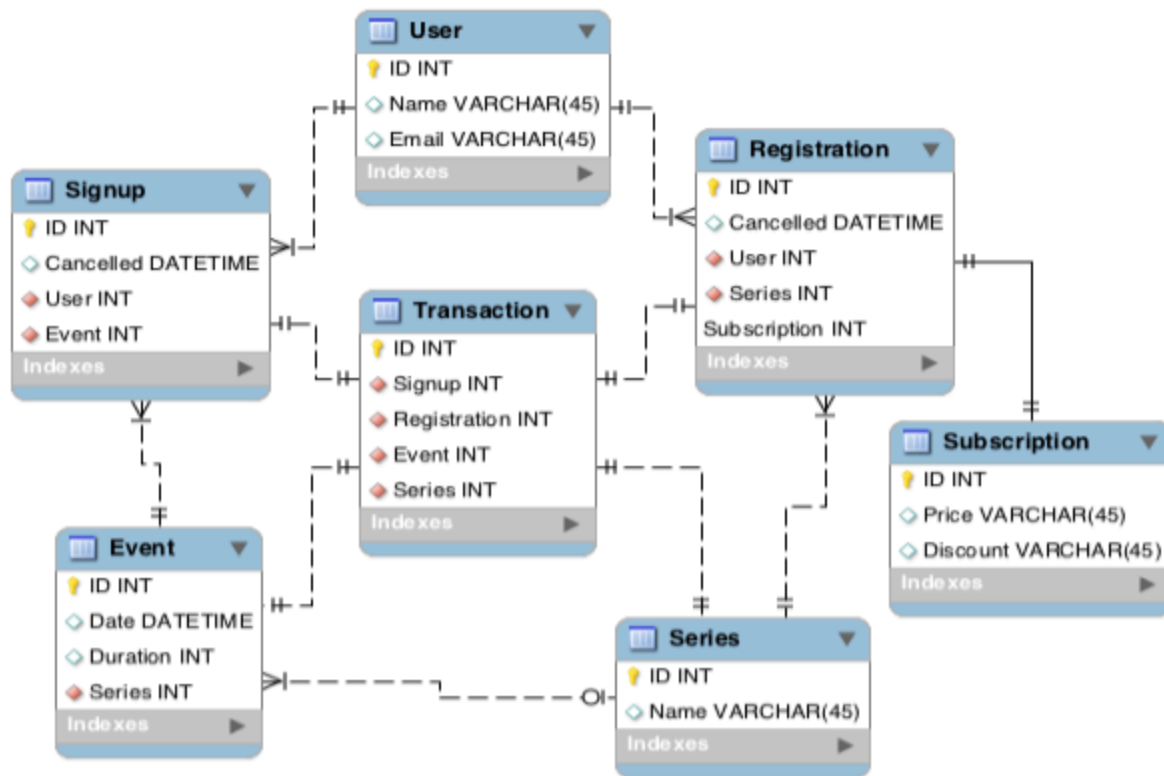


Fig 1.2.4: Relational model{Anon,2022}

Types of relational models

1. One-many model
2. One-one model
3. Many to many model

Relational integrity constraints

This are the condition needed for a valid relation.

Types of integrity constraints

1. Domain constraints

These specify the unique value. It can be violated if there is no attributes shown in an appropriate data type.

2. Key constraints

In a relation, every tuple in the relationship must have its own value for the attribute.

CustomerID	CustomerName	Status
1	Google	Active
2	Amazon	Active
3	Apple	Inactive

3. Referential constraints

These constraints happens when relations refer to a key attribute of different or same relation. It is based on the concept of foreign key.

Example

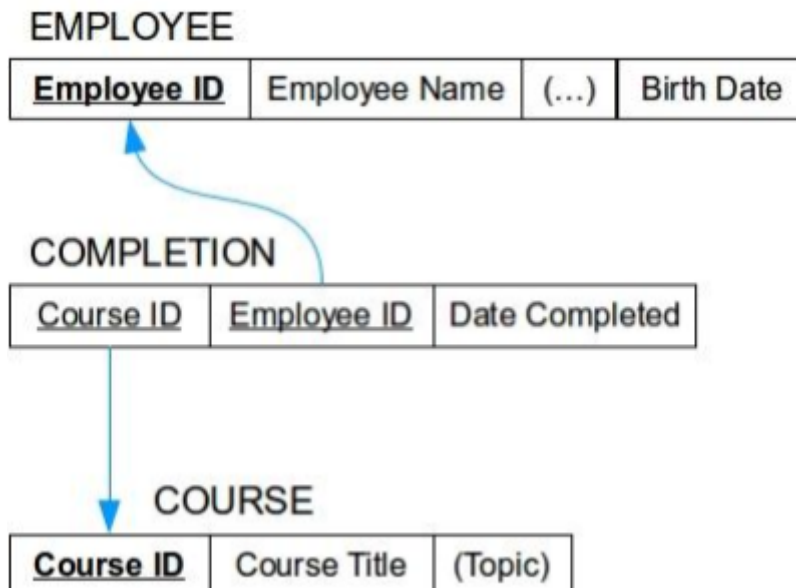


Fig 1.3.3: Referential constraints: {2022}

ER model

ER model is a design of a database that shows relationship of different set of entities stored in database.

1. Conceptual data model

They are also known as domain data model. They analyze and give details of your high-level, static structures and concepts.

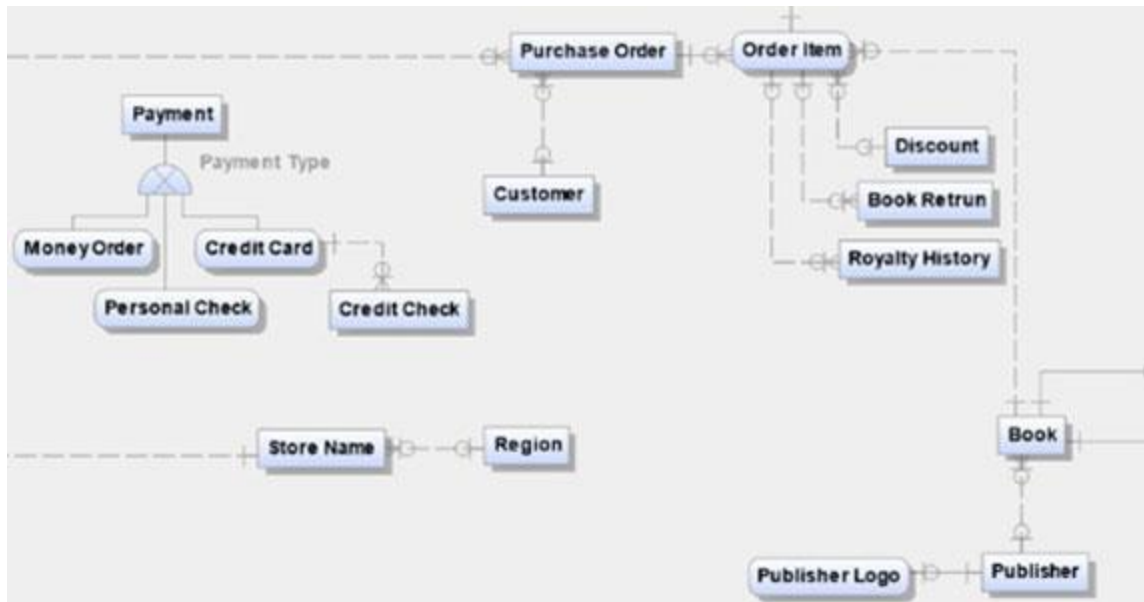


Fig 1.2.3: Conceptual model {Anon,2022}

1. Physical data model

They are used to design the internal schema of a database. It includes tables, columns and their relationships.

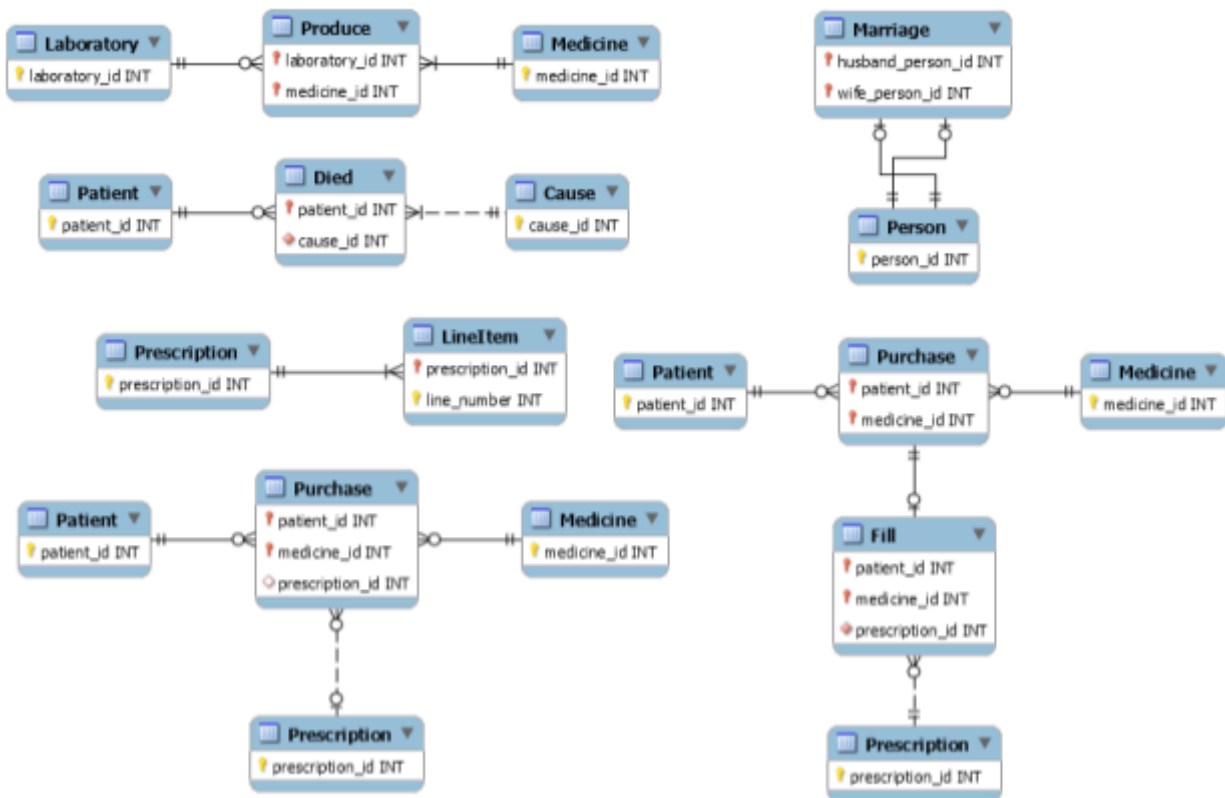


Fig 1.2.4: Physical data model{Anon,2022}

L01.3: A description of big data and how it can apply to DBMS

What is big data?

Big data is a collection of different massive amount of data from different sources for storing and processing structured data.

Types of big data

Big data is classified into three categories namely

❖ **Structured data**

Is a form of data that is standardized and well defined that complies a data model and follows persistent order hence easily accessible.

Example of structured data

Date	Voucher No	Check No	Payee	Amount
1/31/94	VRRE 7821	323620	WALKER-POPE INC	\$52,963.00
3/02/94	VRRE 8905	349977	POPE AND ASSOCS INC	\$46,880.00
4/28/94	VRRE 0015	420795	POPE AND ASSOCIATES, INC	\$58,020.90
5/03/94	VRRE 0721	399175	Apple inc	\$48,900.00
7/08/94	VRRE 0022	459922	POPE-WALKER AND ASSOCS	\$48,322
9/01/94	VRRE 0011	455310	WALKER-POPE & ASSCOS [sic] INC	\$55,851
11/02/94	VRRE 0019	404690	Samsung Corp	\$58,821
11/29/94	VRRE 0023	527540	POPE AND ASSOCIATES, INC	\$52,642
12/09/91	VRWW 3435	746456	Pope and Dell Associates	\$10,000.00

Fig 1.3.1: Structured data{2021}

2. Unstructured data

This are data with unknown form and have a lot of difficulties in processing and deriving values out of it.

Example of unstructured data

Google **squared** labs

African countries [Sign in](#) to save your Squares

African countries 7 items

Item Name	Image	Description	Capital	Internet Country C	Country Code
☒ Congo		... Nigeria, Senegal, Sierra Leone and Upper Volta. Western Sahara Maps · Zaire Maps (Democratic Republic of the Congo) · Zambia Maps · Zimbabwe Maps ...	Kinshasa	.cd	cd
☒ Kenya		Map of Kenya with the peoples discussed in "Art and Life in Africa" CD-ROM ... The minority party, Kenya African Democratic Union (KADU), representing a ...	Nairobi	.ke	ke
☒ South Africa		The Republic of South Africa, also known by other official names, is a country located at the southern tip of the continent of Africa. ...	Pretoria	.za	za
☒ Tunisia		The word Tunisia is derived from Tunis; a city and capital of modern-day Tunisia is one of the very few North African countries where synagogues and ...	Tunis 36°50'N 10°9'E / 36.833, 10.15	.tn	tn
☒ Sierra Leone		Sierra Leone, officially the Republic of Sierra Leone, is a country in West Africa. It is bordered by Guinea in the north, Liberia in the southeast, ...	Freetown	.sl	sl
☒ Swaziland		Bank Group assistance strategy to Swaziland for the period 2009-2023 is contained in its Results Based Country Strategy Paper that was being finalized in ...	Mbabane	.sz	sz

Fig 1.3.4: Unstructured data {2021}

3. Semi-structured data

This contain both different forms of data. Its representation is XML file. This toes the the lines between unstructured and structured data.

```

4
5 {
6     first_name : "Caroline",
7     last_name  : "Forsey",
8     order_id   : "124527",
9
10 }|

```

Characteristics of big data



- Velocity

It's the speed provided by data in real time. It contains the change rate, providing a link off the incoming data sets at varying speed and activity burst.

- **Variety**
It refers to data collected from different multiple sources in array forms like emails, PDFs, photos, videos and many more.
- **Volume**
As we know big data is collection of huge data, volume is a characteristic because large volume of data is required to make a big data.

Application of big data

1. **Hospitals**
It is used to keep track of all information regarding patients, diseases pattern, medical devices, and chain management.
2. **Financial institutions**
It is used in risk analysis and managements, credit risk, trade surveillance and fraud and security detection.
3. **Web and digital media**
It is used in social graph analysis, large scale analysis, abuse and fraud.
4. **Government**
Big data is used in government to run big processes such as elections and census.
5. **Call center analytics**
It is used in capturing and processing data from customers to provide quality resolution.

How is big data applied in DBMS?

1. Tableau

Tableau is a popular data visualization program that helps data analysts and business intelligence teams build engaging graphical analysis.



Fig 1.3.6: Tableau {2022}

2. MongoDB

MongoDB is a document-based database that replaces SQL-based rows and columns with document collections.



Fig 1.3.7: MongoDB (2022)

PROS	CONS
It is good when balancing	Processing speed is lower
It has serverless option	It had difficult integration
It is easy to use	Customer support is slow

3. Zoho analytics

It includes an easy-to-use user interface that allows you to quickly create sophisticated dashboards and identify the most critical data. It is accessible and affordable big data solution.

Pros	Cons
It is affordable	Lacking reporting capabilities
Integrate with other Zoho products	Larger enterprises with more complex requirements may find it less suitable.
Easy to use	

LO1.4: Explanation of transaction processing system within DBMS

Explain and define transaction processing system

Transaction processing system consist of software and hard ware hosting transaction-oriented application necessary for business. This includes, sales, reservation, payroll and employee records.

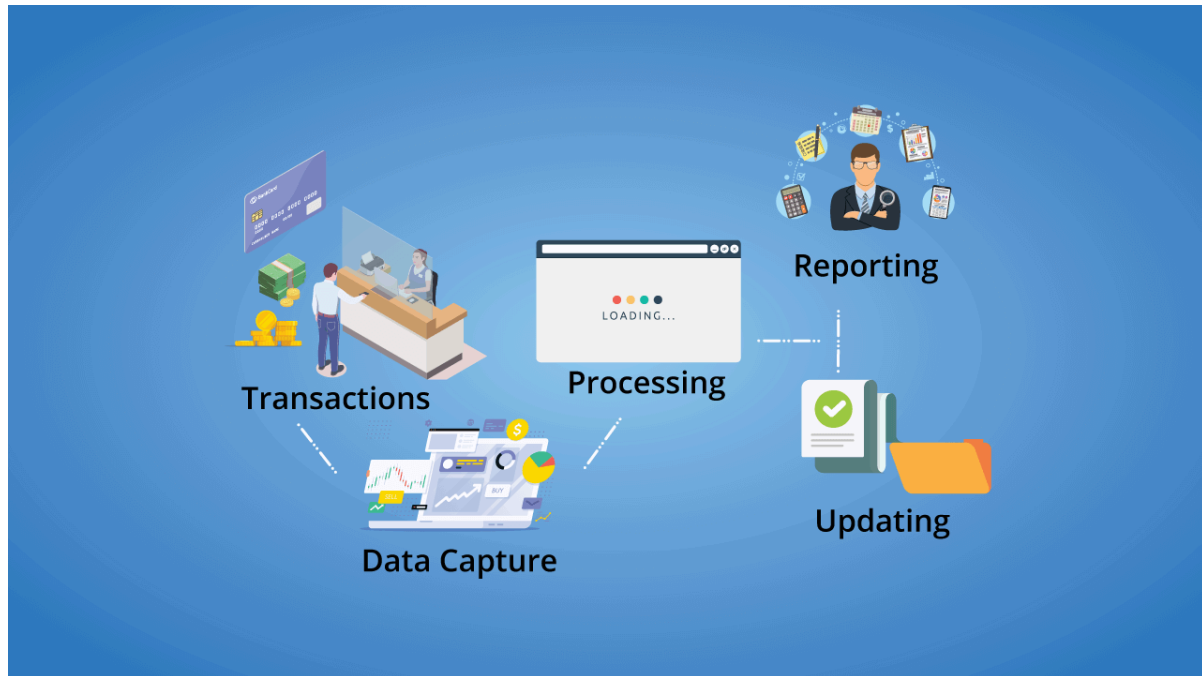
Components of TPS

Inputs- information received from customer or organisation related to money which may include invoices, bills.

Outputs- this are the outcomes or results after a complete transaction. These documents are called outputs.

Processing units- This is steps that is involve information provided at the input and processing it into required outcome.

Storage- the information in TPS is stored as a ledger in the memory.



Concepts of TPS

It is a type of information system that collect information, store it, modifies it to meet required purpose, and retrieves data transaction of an enterprise whenever it is needed.

Working of TPS in a database

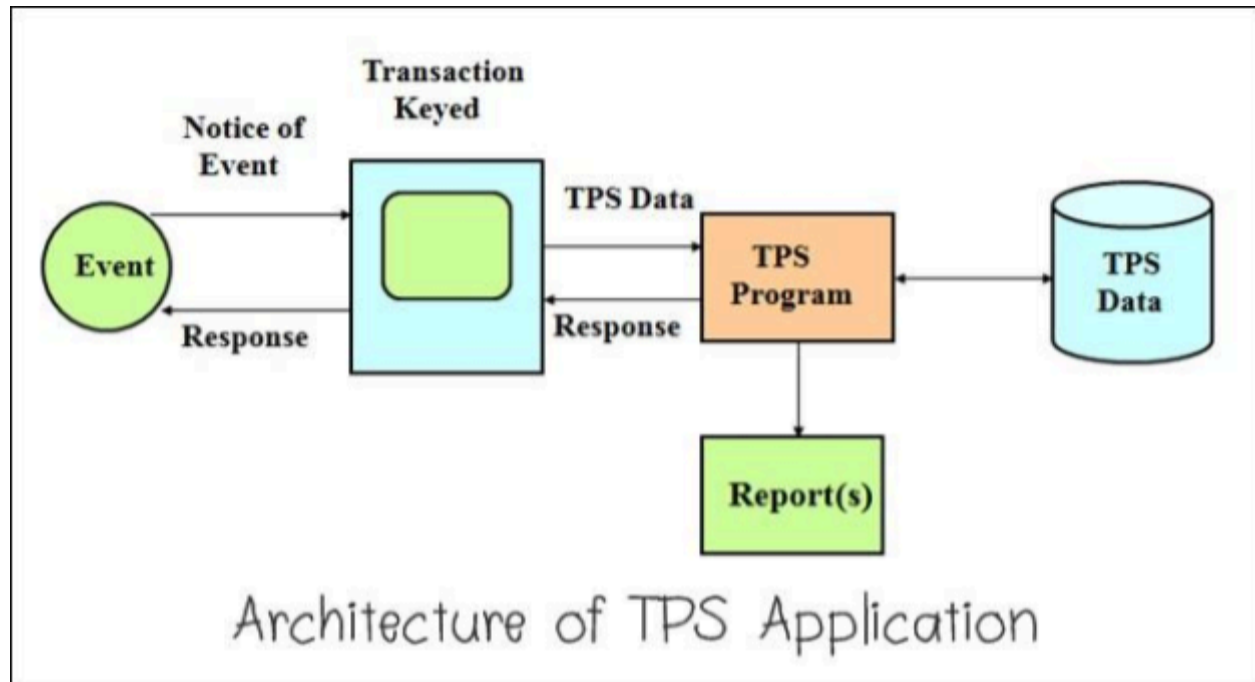


Fig 1.2.4:TPS architecture {Anon, 2022}

Importance of TPS

- ❖ Helps in managing and handling of information in different organisations.

Examples of TPS

1. Hotel reservation

TPS is used in day-day activities for all type of reservation for customers needs and immediate verification.

2. Cheque clearance

In banks, checks collected in drop box are processed together in batch.

3. POS

It helps in reducing work of sales executive. Information contain in the product is stored in the system making it easy to relate and complete transaction.

Advantages of TPS

- It works under reliable database that stores and retrieve information at any time without the risk of losing information.
- It can be used in remote areas across the globe freely.
- Can also be used in real-time and batch-processing manner

Disadvantages of TPS

- Each company have their own needs hence designing customized solution to meet different specification requirements.
- It is expensive to setup and install.
- Overloading may lead to system crashing therefore losing information.
- For TPS software to work effectively, it requires a precise set of hardware specifications.

OLTP

Database transaction is used for inserting information, deleting, or questions of data in databases. Most of the financial transactions we make every day are facilitated by OLTP systems including online banking, ATM transactions, e-commerce, and in-store purchases.

Transactions

Tid	Person	Time	Store	Cashier
0001	John Smith	14:00 GMT	Tesco E1	Ali
0002	Miley Cyrus	06:00 GMT	Tesco E8	Jess

Items

Itemid	Name	Type	Quantity
0001	Apple	Fruit	100
0002	PlayStation 4	Entertainment	50
0003	Headfirst Java	Book	12
0004	IPhone 5	Gadget	33

Sold

Tid	Itemid	Quantity
0001	0001	12
0001	0002	01
0001	0004	01
0002	0004	01
0002	0001	10

Fig 1.3.4: OLTP {Anon,2021}

Characteristics of OLTP

- Process variety of simple transactions.
- Allow numerous users to view the same data while protecting data integrity.
- Process at a very fast pace, with reaction times measured in milliseconds.
- Can be used any time needed because they are readily available.
- Provide index data sets.

Example of OLTP

1. ATM machines.
2. Credit cards
3. Order entry.
4. Online booking.
5. Record keeping.

OLAP

Online analytical processing allows rapid multidimensional analysis of large volumes of data.

Types of OLAP

Roll up- it summarizes data in dimension.

Drill-down- allows analysts to locate dimensions of data.

Slice- use while taking one information for display

Dice- it is use to select data in a collection of dimensions.

Pivot- used to rotate the axes of data to give a new view.

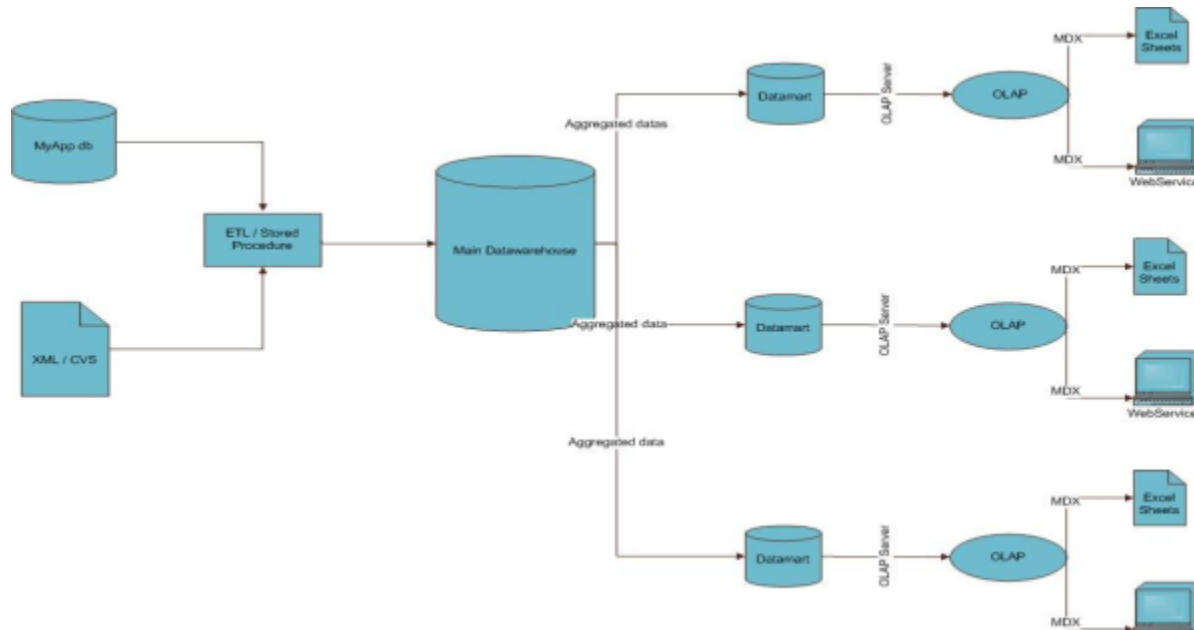


Fig 1.4.3: OLAP process {Anon,2022}

Types of OLAP systems

1. **Multidimensional OLAP-** Performs indexes directly into multidimensional database.

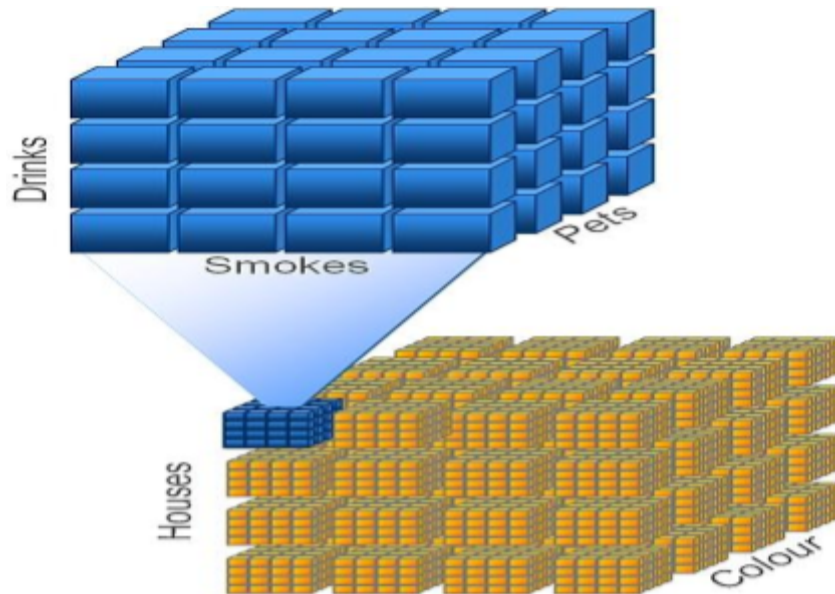
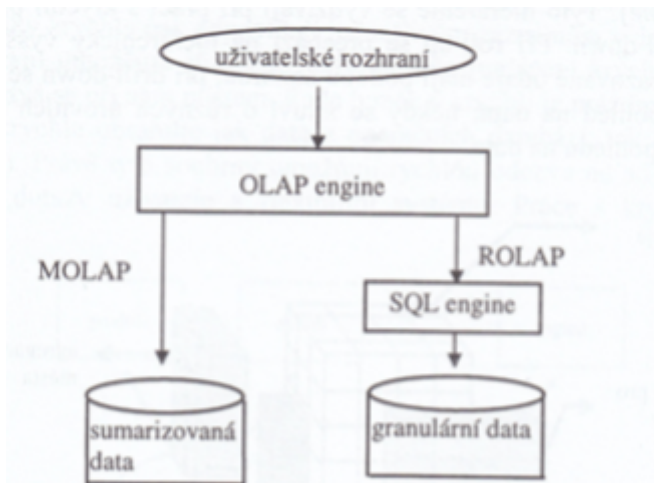


Fig 1.4.5: Multidimensional OLAP {2022}

2. **Relational OLAP-** Perform dynamic multidimensional analysis of data stored in a relational database.

The ROLAP is based on the idea that data does not need to be stored in multidimensional format in order to be viewed in multidimensional format, and that multidimensional data may be handled using well-proven relational database technology.

3. **Hybrid OLAP-** It is the combination of MoLAB and HoLAP.



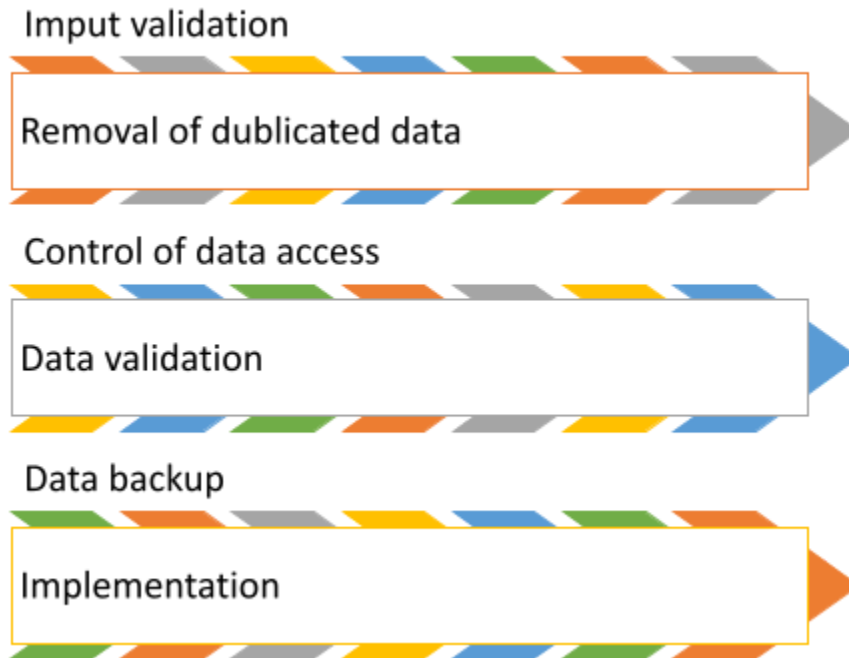
Obr. 17 Porovnání přístupu MOLAP a ROLAP.

Fig 1.5.6: HOLP architecture {2022}

LO1.5: An evaluation and importance of integrity and quality control within management system

Data integrity

Data integrity is the maintenance and assurance of data accuracy and consistency.



Types of data integrity in database

- ❖ **physical integrity**- this is the safeguarding of data and accuracy for storage and retrieval.
- ❖ **Logical integrity**- logical data keep data constant away from human interference.

Types of logical data

- **Entity integrity**- the main function for this is to create primary key. To ensure that data isn't listed more than once and that no field in a table is null, the unique values that identify bits of data are used.
- **Referential integrity**- The term referential integrity refers to a set of procedures that ensure that data is saved and used consistently.
- **Domain integrity**- Domain integrity is a set of operations that ensures that each piece of data in a domain is accurate.
- **User-defined integrity**- User-defined integrity refers to the rules and limitations that the user creates to meet their own requirements.

Risks of data integrity.

- Human errors
- Transfer errors
- Bags and viruses
- Compromised hardware

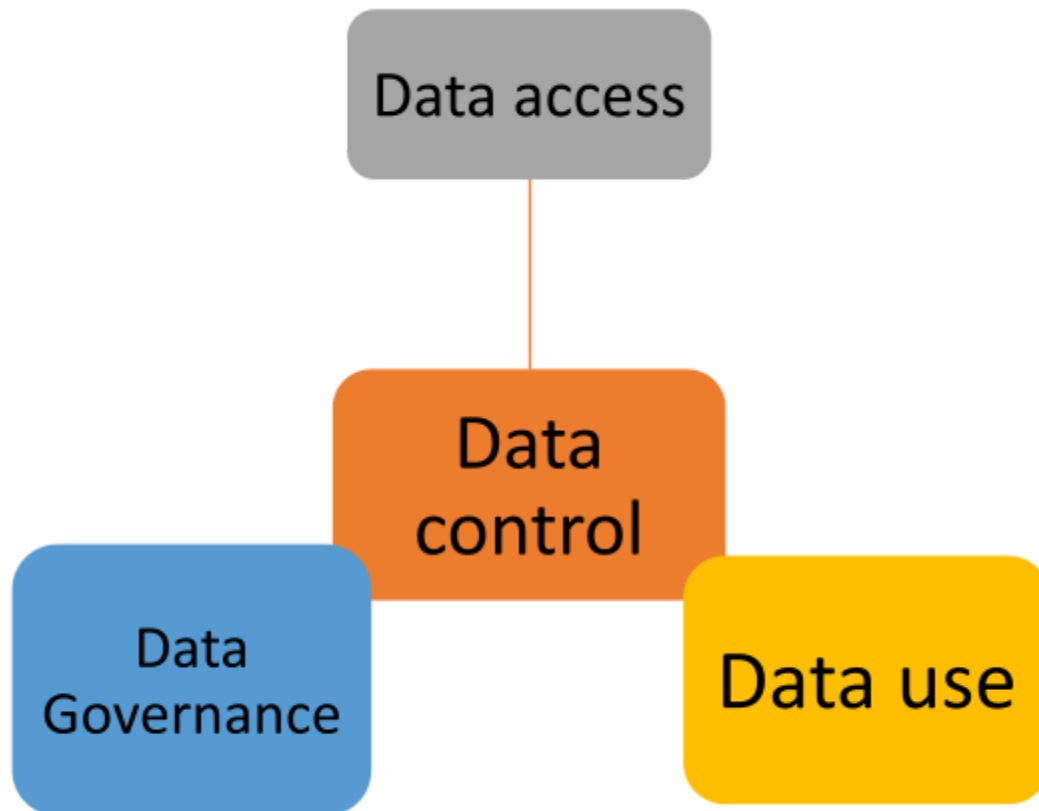
Solutions of risk in data integrity

- Limiting data access and modifying permissions to prevent unauthorized parties from making changes to data

- Validating data, when it's collected and when it's utilized, to ensure that it's accurate.
- Backing up data
- Using software to spot errors

Data control

Data control is management of information policies. It focuses on fixing problems, reporting on how processes are working and managing problems.



Objective of data control

- As data goes from users' computers to storage devices and applications, it is monitored and regulated.
- Data flaws are detected before they become a problem.
- The underlying causes of problems are discovered and addressed.
- Accidental data loss which is frequently caused by the mismanagement of sensitive information, is promptly detected.

Challenges of data control

Duplicate data- The issues of duplicate data produced as a consequence of human or technical error must be addressed.

Hidden data- The type of data that is not viewable with a typical reader must be considered in data control plans.

Inaccurate data- This occurs as a result of not discovering all of the concealed data, but it is more commonly caused by human error, such as entering wrong or incomplete data into a field when filling out a form.

Steps to ensure data integrity and control in DBMS

Data control

Focus on data validation to verify that data acquired or integrated is accurate.

To prevent unauthorised parties from making changes to data, restrict access to it and modify permissions.

Keep a backup of your data on a regular basis.

Use logs to monitor when data is entered, altered, or erased

Internal audits should be conducted on a regular basis to ensure that information is current.

Data control

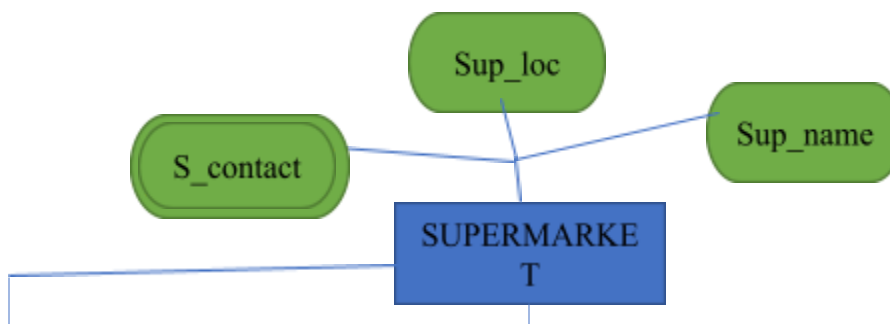
Maintaining the identification, reporting, and correction of data problems.

Keep track of data quality and manage it in accordance with service level agreements.

Ensure that key data items are properly protected and used.

Establish a structure for auditing

L0 3.1: The ER-Diagram for supermarket



M

O



O

M

M

M

|

M

Un-normalized table**Supermarket table**

Sup_n ame	sup_ loc	Sup_ contact	No of employ	Name of Empl	Age	salary	Contact s	Empl _id	Employee_ section
Safe- way	DXB	800200	30	John	28	4500	0554463	35562	Managemen t
Safe- way	DXB	800200	30	Amhe d	34	3800	0563334	77463	Sales
Safe- way	DXB	800200	30	Salim	22	1800	054336	64884	Accounting

Customer table

C_ID	C_N	C_A	C-C	P_ID	B_A	T-P	P_N	P_P	D-O-M	D-O-E
3347	Ann	32	0554 4454	Y24	AED 125	2	Sugar	50	12/ 2020	06/2021
3333	Jane	38	0554 4465	S33, A44	AED 200	1	Drinks	100	04/ 2021	05/2023
4443	Job	24	044 4455	P44, S33	AED 150	2	Juice	100	05/ 2021	08/2022

Supplier table

Supplier_ID	Supplier_name	Supplier_contact	Total-sale amount
PI221	Grace	066587432	AED 2,000
SD222	Job	646234729	AED 1,500
AS120	Hassan	057738373	AED 1,000

Manufacturer table

Manu_ ID	Manu_ name	Manu_ contact	Total_ amount
446673	Rohit	123564	AED 2,000
4457723	Japhan LLC	044000	AED 1,500
8577463	BBT company	08100	AED 1,000

1NF

In 1NF no multi-valued attribute is allowed. Attributes must be single valued.

Customer table

Sup_ name	Sup_ loc	Contact	No of employees	Empl_ name	Empl_ age	Empl_ salary	Empl_ contact	Empl_ ID	Empl_ section
Safe-way	DX B	800200	30	John	28	4500	0554463	35562	Management
Safe-way	DX B	800200	30	Amhed	34	3800	0563334	77463	Sales
Safe-way	DX B	800200	30	Salim	22	1800	054336	64884	Accounting

Customer table

C_ID	C_N	C_A	C-C	P_ID	B_A	T-P	P_N	P_P	D-O-M	D-O-E
3347	Ann	32	0554 4454	Y24	AED 125	1	Sugar	50	12/ 2020	06/2021
3333	Jane	38	0554 4465	S33	AED 200	2	Drinks	100	04/ 2021	05/2023
3333	Jane	38	0554 4465	A44	AED 200	2	Drinks	100	04/ 2021	05/2023
4443	Job	24	044 4455	S33	AED 150	2	Juice	100	05/ 2021	08/2022
4443	Job	24	044 4455	P44	AED 150	2	Juice	100	05/ 2021	08/2022

Supplier table

Supplier_ID	Supplier_name	Supplier_contact	Total-sale amount
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Manu_ID	Manu_name	Manu_contact	Total_amount
446673	Rohit	123564	AED 2,000
4457723	Japhan LLC	044000	AED 1,500
8577463	BBT company	08100	AED 1,000

2NF

All tables must be in 1NF

No functional dependency is allowed

Manufacturer table

Manu_ ID	Manu_ name	Manu_ contact	Total_ amount	Product_ ID
446673	Rohit	123564	AED 2,000	Y24
4457723	Japhan LLC	044000	AED 1,500	S33
8577463	BBT company	08100	AED 1,000	A44

Suppliers table

Supplier_ ID	Supplier_ name	Supplier_ contact	Product_ ID	Total- amount
PI221	Grace	066587432	Y24	AED 2000
SD222	Job	646234729	S33	AED A500
AS120	Hassan	057738373	A44	AED 1000

Supermarket table

Sup_ name	Sup_ loc	Contact	No of employees
Safe-way	DXB	800200	30
Safe-way	DXB	800200	30
Safe-way	DXB	800200	30

Customer table

C_ID	C_N	C_A	C-C	P_ID	B_A	T-P
3347	Ann	32	0554 4454	Y24	AED 125	1
3333	Jane	38	0554 4465	S33	AED 200	2
3333	Jane	38	0554 4465	A44	AED 200	2
4443	Job	24	044 4455	S33	AED 150	2
4443	Job	24	044 4455	P44	AED 150	2

Product table

Prod_ID	Prod_name	Prod_price	D-0-M	D-O-E	Cus_ID	Supp_ID
Y24	Sugar	50	12/2020	06/2021	3347	PI221
S33	Drinks	100	04/2021	05/2023	3333	SD222
A44	juice	100	04/2021	05/2023	3333	AS120

Employees table

Empl_name	Empl_age	Empl_salary	Empl_contact	Empl_ID	Empl_section
John	28	4500	0554463	35562	Management
Amhed	34	3800	0563334	77463	Sales
Salim	22	1800	054336	64884	Accounting

3NF

All tables must be in 1NF, 2NF and all fields must depend on primary key

Manufacturer table.

Manu_ ID	Manu_ name	Manu_ contact	Total_ amount
446673	Rohit	123564	AED 2,000
4457723	Japhan LLC	044000	AED 1,500
8577463	BBT company	08100	AED 1,000

Manu_ ID	Prod_ ID
446673	Y24
4457723	S33
8577463	A44

Suppliers table

Supplier_ ID	Supplier_ name	Supplier_ contact	Supply_ amount
PI221	Grace	066587432	AED 2,000
SD222	Job	646234729	AED 1,500
AS120	Hassan	057738373	AED 1,000

Supply- product

Supplier_ ID	Product_ ID
PI221	Y24
SD222	S33
AS120	A44

Supermarket table

Sup_name	Sup_loc	Contact	No of employees
Safe-way	DXB	800200	30
Safe-way	DXB	800200	30
Safe-way	DXB	800200	30

Customer table

C_ID	C_N	C_A	C-C	B_A	T-P
3347	Ann	32	0554 4454	AED 125	1
3333	Jane	38	0554 4465	AED 200	2
3333	Jane	38	0554 4465	AED 200	2
4443	Job	24	044 4455	AED 150	2
4443	Job	24	044 4455	AED 150	2

Customer- product table

Cus_ID	Prod_ID
3347	Y24
3333	S33
4443	A44

Product table

Prod_ ID	Prod_ name	Prod_ price	D-0-M	D-O-E
Y24	Sugar	50	12/2020	06/2021
S33	Drinks	100	04/2021	05/2023
A44	juice	100	04/2021	05/2023

Employee table

Empl_ name	Empl_ age	Empl_ salary	Empl_ contact	Empl_ ID	Empl_ section
John	28	4500	0554463	35562	Management
Amhed	34	3800	0563334	77463	Sales
Salim	22	1800	054336	64884	Accounting

Logical design.

Manufacturer table- {Man_ ID, Man_ name, Man_ contact, total_ amount}

Manufacturer_Product table- {Prod_ ID, Manu_ ID}

Suppliers table- {Supp_ ID, Supp_ name, Supp_ contact, total-supply amount}

Supply_ product table- {Supplier_ ID, Product_ ID}

Supermarket table- {Sup_ ID, Sup_ loc, Sup_ contact, No. of employees}

Customer-product table- {Cus_ ID, Prod_ ID}

Customer table- {Cus_ ID, Cus_ name, Cus_ age, Cus_ contact, bill- amount, total- product}

Product table- {Prod_ ID, Prod_ name, Prod_ price, Date of manufactured, Date of expiry}

Employees table- {Empl_ ID, Emp_ name, Empl_ age, Empl_ salary, Empl_ contact, Empl_ section}

DATA DICTIONARY**Manufacturer data dictionary tableA3Y**

Field name	Data type	Size	Description
Man_ name	Short_ Text	10	Manufacturer name
Man_ ID	Number	10	Manufacturer identity
Manu_ contact	Number	20	Manufacturer contact
Total_ Amount	Long text	20	Total amount

Manufacture-Product data dictionary

Field name	Data type	Size	Description
Prod_ ID	Long text	20	Product identity
Manyu			

Supplier data dictionary table

Field name	Data type	Size	Description
Supp- ID	Number	10	Supplier identity
Supp_ name	Short-text	10	Supplier name
Supp_ contact	Long-text	20	Supplier contact
T-A	Long-text	10	Total- amount

Supply- product data dictionary

Field name	Data type	Size	Description
Supp_ID	Long text	15	Product identity
<u>Prod_ID</u>	Long text	10	Product identity

Supermarket data dictionary

Field name	Data type	Size	Description
Sup ID	Number	10	Supermarket identity
Sup name	Short text	10	Supermarket name
Sup_loc	Short text	10	Supermarket dictionary
No. of empl	Number	10	Number of employees

Customer product dictionary table

Field name	Data type	Size	Description
Cus ID	Number	10	Customer identity
Prod ID	Number	8	Product identity

Customer data dictionary table

Field name	Data type	Size	Description
Cus name	Long text	15	Customer name
Cus ID	Number	10	Customer identity
Cus age	Number	5	Customer age
Cus contact	Number	20	Customer contact
Bill- A	Number	10	Bill amount
T. Amt	Number	10	Total amount

Product table data dictionary

Field name	Data type	Size	Description
Prod_name	Short text	10	Product name
Prod_ID	Short text	5	Product identity
Prod_D.O.M	Number	10	Product date of manufactured
Prod_D.O.E	Number	10	Product date of expiry
Prod_price	Number	5	Product price

Employee data dictionary

Field name	Data type	Size	Description
Empl_ID	Number	10	Employee identity
Empl_name	Short text	15	Employee name
Empl_age	Number	10	Employee age
Empl_contact	Number	10	Employee contact
Empl_salary	Number	10	Employee salary
Empl_section	Long text	20	Employee section

Physical design**Customer product table**

Customer_product_table	
Cus_ID	Prod_ID
3333	Y24
4443	A44
33470	S33

Customer table

Customer_table				
Cus_ID	Cus_name	Cus_age	Cus_contact	Bill_amount
3333	Jane	38	55544465	\$200.00
3347	Ann	32	55544454	\$125.00
4443	Job	24	444455	\$150.00

Employee table

Employees_table					
Empl_ID	Empl_name	Empl_age	Empl_salary	Empl_contac	Empl_sectio
35562	John	28	\$4,500.00	554463	Management
64884	Salim	22	\$1,800.00	54336	Accounting
77463	Amhed	34	\$3,800.00	563334	Sales

Manufacturer table

manufacture_table			
Man_ID	Man_name	Man_contac	Total amoun
445723	Japhan LLC	044000	\$1,500.00
446673	Rohit	123564	\$2,000.00
8577463	BBT company	081000	\$1,000.00

Manufacture product table

Manufacture_product_table	
Prod_ID	Man_ID
446673	Y24
4457723	S33
8577463	A44

Product table

Product_table				
Prod_ID	Prod_name	Prod_price	Date_of_ma	Date_of_exp
A44	Juice	\$100.00	12/2020	06/2021
S33	Drinks	\$100.00	04/2021	005/2023
Y24	Sugar	\$50.00	04/2021	05/2023

Supermarket table

Supermarket_table			
Sup_name	Sup_loc	Sup_contact	No_of_empl
Safe-way	DXB	800200	30
safe-way	DXB	800200	30
safe-way	DXB	800200	30

Supply product table

Supply_product_table	
Supp_ID	Prod_ID
AS120	A44
PI221	Y24
SD222	S33

Activity three

LO 2.1: The Relationships within the database

This shows how tables are related to each other using different forms.

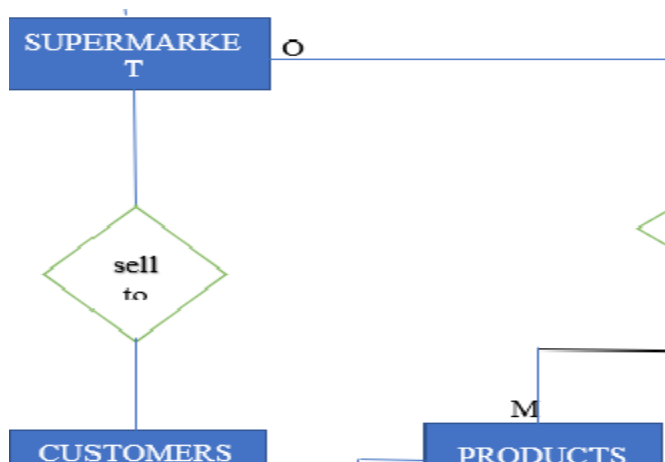
❖ One to one

This type of tables show that one table can relate to other tables only once in the ER diagram. In this table one employee can work for one supermarket making a relation of one-one.



❖ One-many

Here, relationships represented show that one table can have many relations. In the following example it shows that one supermarket can have many products making the relation of one-many.



❖ Many-many

In this table, it shows that many customers can go to many supermarkets.



❖ Primary key

They are keys used to identify unique entities in every row of a table.

Rules of primary key

- Two rows cannot have similar primary keys
- Every row must have a primary key
- Primary key cannot be null
- It must be underlined

Example

manufacture_table			
Man_ID	Man_name	Man_contac	Total amoun
445723	Japhan LLC	044000	\$1,500.00
446673	Rohit	123564	\$2,000.00
8577463	<u>BBT company</u>	081000	\$1,000.00

Manufacture id is the primary key.

❖ Candidate keys

They identify tuples in a table.

Properties of candidate keys

- Must have unique values
- May have multiple attributes
- Identified in tables uniquely

Example

manufacture_table			
Man_ID	Man_name	Man_contac	Total amoun
445723	Japhan LLC	044000	\$1,500.00
446673	Rohit	123564	\$2,000.00
8577463	BBT company	081000	\$1,000.00

Here manufacture name is the candidate key

❖ Foreign key

Foreign key creates a relationship between tables. It is used to maintain data integrity and allow navigation between two different tables.

Example

manufacture_table			
Man_ID	Man_name	Man_contac	Total amoun
445723	Japhan LLC	044000	\$1,500.00
446673	Rohit	123564	\$2,000.00
8577463	BBT company	081000	\$1,000.00

Manufacture_product_table	
Prod_ID	Man_ID
446673	Y24
4457723	S33
8577463	A44

In the following tables, foreign key is used to show the relationship between manufacture table and product ID.

LO 2.2: Normalization and functional dependency

What is normalization?

Normalization is the process of eliminating redundancy in tables to meet specific requirements.

1NF

In 1NF all table must be single-valued. This means that if the values in the table are multi-valued another table will be created for related tables.

Example 1

In the first table, it is not in 1NF because it has multivalued attributes.

C_ID	C_N	C_A	C-C	P_ID	B_A	T-P	P_N	P_P	D-O-M	D-O-E
3347	Ann	32	0554	Y24	AED	2	Sugar	50	12/	06/2021

			4454		125				2020	
3333	Jane	38	0554 4465	S33, A44	AED 200	1	Drinks	100	04/ 2021	05/2023
4443	Job	24	044 4455	P44, S33	AED 150	2	Juice	100	05/ 2021	08/2022

Example 2

In the second table is said to be in 1NF it has no multi valued attributes.

Un-normalized table

C_ID	C_N	C_A	C-C	P_ID	B_A	T-P	P_N	P_P	D-O-M	D-O-E
3347	Ann	32	0554 4454	Y24	AED 125	1	Sugar	50	12/ 2020	06/2021
3333	Jane	38	0554 4465	S33	AED 200	2	Drinks	100	04/ 2021	05/2023
3333	Jane	38	0554 4465	A44	AED 200	2	Drinks	100	04/ 2021	05/2023
4443	Job	24	044 4455	S33	AED 150	2	Juice	100	05/ 2021	08/2022
4443	Job	24	044 4455	P44	AED 150	2	Juice	100	05/ 2021	08/2022

2NF

In 2NF, all tables must be in 1NF and every attribute must be fully dependent on each candidate key of the relation.

Example 1

The table below is not in 1NF, and depend on Supermarket hence we cannot say it is in 2NF.

Supermarket table

Sup_n ame	sup_ loc	Sup_ contact	No of employ	Name of Empl	Age	salary	Contact s	Empl _id	Employee_ section
----------------------	---------------------	-------------------------	-------------------------	-----------------------------	------------	---------------	----------------------	---------------------	------------------------------

Safe-way	DXB	800200	30	John	28	4500	0554463	35562	Management
Safe-way	DXB	800200	30	Amhed	34	3800	0563334	77463	Sales
Safe-way	DXB	800200	30	Salim	22	1800	054336	64884	Accounting

Example 2

In this table we consider it to be in 2NF because, it is 1NF and has no functional dependency. Each table is dependent on candidate key.

Product table

Prod_ID	Prod_name	Prod_price	D-O-M	D-O-E
Y24	Sugar	50	12/2020	06/2021
S33	Drinks	100	04/2021	05/2023
A44	juice	100	04/2021	05/2023

3NF

In this form, all tables must be in 1st and 2nd normal form and every non-key attribute of relation. We create separate tables with attributes and field that are functionally dependent. In this form, duplication of data is reduced and data integrity is achieved.

Example 1

The table below is not in 3NF because fields do not depend on key.

Supplier table

Supplier_ID	Supplier_name	Supplier_contact	Total-sale amount
PI221	Grace	066587432	AED 2,000
SD222	Job	646234729	AED 1,500
AS120	Hassan	057738373	AED 1,000

Example 2

In this table, we split tables to bring the relation between supply table and the product supplied hence we add product id in the second table hence said the table is in 3NF.

Supplier table

Supplier_ ID	Supplier_ name	Supplier_ contact	Supply_ amount
PI221	Grace	066587432	AED 2,000
SD222	Job	646234729	AED 1,500
AS120	Hassan	057738373	AED 1,000

Supply-product table

Supplier_ ID	Product_ ID
PI221	Y24
SD222	S33
AS120	A44

In the table above, data integrity and reducing duplication of data is achieved because of the creation of another table for supplier-product table to show the relation between product and the supplier.

Functional dependency

In a Database Management System, functional dependency is a condition that determines the relationship of one attribute to another.

The use of functional dependencies aids in the maintenance of database data quality.

It's crucial for distinguishing between good and bad database design.

Types of functional dependency**1. Multivalued dependency**

This occurs when there are numerous independent multivalued attributes. A complete constraint between two sets of attributes in a relation is a multivalued dependency.

Example**Product table**

Prod_ ID	Prod_ name	Prod_ price	D-0-M	D-O-E

Y24	Sugar	50	12/2020	06/2021
S33	Drinks	100	04/2021	05/2023
A44	juice	100	04/2021	05/2023

In this table, when we know the product_ name, product_ price, are dependent to product_ ID, hence it is a multivalued attribute,

2. Trivial dependency

If the set of attributes are included in that attribute then trivial attribute is obtained.

Example

Empl_ ID	Empl_ name
35562	John
77463	Amhed
64884	Sayed

In this table, Empl_ ID is trivial dependency of Empl_ ID and subset of {Empl_ ID, Empl_ name}.

3. Non-trivial dependency

In non-trivial, dependent is followed strictly not the subset of the dependent.

Supplier table

Supplier_ ID	Supplier_ name	Supplier_ contact	Supply_ amount
PI221	Grace	066587432	AED 2,000
SD222	Job	646234729	AED 1,500
AS120	Hassan	057738373	AED 1,000

Here, supplier_ contact and supplier name are non trivial since contact is not a subset of determinant supplier_ ID

4. Transitive dependency

The determinant is indirectly dependent on dependant.

Employee table

Empl_name	Empl_age	Empl_salary	Empl_contact	Empl_ID	Empl_section
John	28	4500	0554463	35562	Management
Amhed	34	3800	0563334	77463	Sales
Salim	22	1800	054336	64884	Accounting

Here, employee age and section is a valid dependency on employee name hence called transitive dependency.

LO 2.3: Data integrity and security control

Data integrity- is the accuracy and consistency of data in database. Maintaining data integrity is the assurance of making data unchanged throughout the entire life.

Types of data integrity

❖ Entity integrity

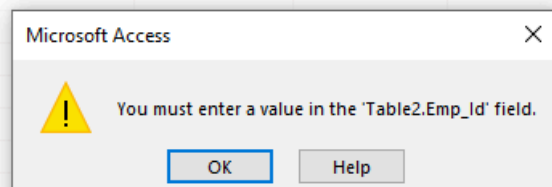
The term entity integrity refers to the requirement that each row in a table be unique and there are no identical rows.

The value of primary should not be null.

Employee table

Example

Emp_Id	Empl_name	Empl_age	Empl_salary	Empl_sectio	Click to Add
	Amhed	32	\$4,500.00	management	
23435	John	22	\$2,500.00	accounting	
55460	Salim	18	\$1,800.00	sales	
0		0	\$0.00		



In this table, primary key should not be left null, To address these concerns, primary keys are provided to each table, and they uniquely identify each table entry.

❖ Domain integrity

It refers to the range of values that will be accepted and stored in a given database column. The database that are used are integers, text, number etc. any entry should be available in domain of datatype.

Example

Employee table

Emp_Id	Empl_name	Empl_age	Empl_salary	Empl_section		
23435	John	22	\$2,500.00	accounting		
55460	Salim	18	\$1,800.00	sales		
63777	Amhed	dggfh	\$4,500.00	management		
0						

The value you entered does not match the Number data type in this column.

Enter new value.

[Help with data types and formats.](#)

In the above table it shows that for a value to be accepted, it must meet the requirement available in the domain of datatype.

❖ Referential integrity

This is use to maintain consistency between two tables. According to referential integrity constraints, if a foreign key in the first table relates to the primary key in the second table, every value of the foreign key in the first table must be null or present in the second table.

Example

Suppliers table

Supplier_ ID	Supplier_ name	Supplier_ contact	Supply_ amount
PI221	Grace	066587432	AED 2,000
SD222	Job	646234729	AED 1,500
AS120	Hassan	057738373	AED 1,000

Supply- product

Supplier_ ID	Product_ ID
PI221	Y24
SD222	S33
AS120	A44

In the tables above we the relationship between both of the is showed in the second table that contain supply_ ID and product_ ID to show which product is supplied by which supplier.

❖ **User-defined integrity**

User-defined integrity refers to the rules and limitations that the user creates to meet their own requirements.

Emp_id ▾	Empl_name ▾	Empl_age ▾	Empl_salary ▾	Empl_sectio ▾	Click to Add ▾
44353	John	28	\$2,500.00	Accounting	
64377	Salim	18	\$1,800.00	Sales	
shdf746	Amhed	32	\$4,500.00	Management	
The value you entered does not match the Number data type in this column.					

In the table above, user-defined integrity because the value entered does not match with the requirements set in the table by the user. In **Empl_ ID** is a number hence when mixed with letters error occurs.

Security control**Confidentiality.**

It means protecting of data from access by unauthorized personnel. This help to keep the data safe and secure from being exposed.

For this to be achieved, we use different ways like;

1. Passwords
2. Encryptions
3. Authentication
4. Biometric verification.

Integrity

The authenticity and consistency of data are referred to as integrity.

Integrity-focused security procedures that are intended to prevent data from being altered or misused by an unauthorised user.

Integrity involves keeping the consistency and reliability of data across its full life cycle.

To maintain data integrity we use;

1. Encryption
2. Access control
3. Back up and recovery procedures
4. Error detection software.

Availability

The authenticity and consistency of data are referred to as integrity.

Integrity-focused security procedures that are intended to prevent data from being altered or misused by an unauthorised user.

Integrity involves keeping the consistency and reliability of data across its full life cycle.

Security measure to make sure that availability is achieved we use;

1. Off-site backups
2. Redundancy
3. Proper monitoring.

Implementation of database administration

Database Administration- These are the operations conducted by a database administrator to ensure that a database is always readily accessible.

Software used in database management are, mongo DB, SQL server, Oracle and tableau.

All this software are controlled by an expert known as **Data administrator**.

In my database management, there are variety of work to be followed;

- ❖ **Installation** of SQL server to make sure that everything is intact to run the program then upgrading is done to catch up with new features for easier and effective handling of database.
- ❖ **Monitoring**-this is the day to day check up of the system to make sure that it is running according to the set instructions or not.
- ❖ **Establishing back up and recovery options**- This will help clients to back up and recover their lost data.
- ❖ **24/7 access**- This is the important point to allow clients access the database at anytime they want without any restrictions.
- ❖ **Security**- This help to keep data stored in the database safe and only authorized users have access.
- ❖ **Future improvement**- This is mandatory aspect to be carried out after sometime to make sure that database is up to date for the newly incoming features.

LO2.5: How the design document met the design brief.

Evaluation of design documentation

Client requirement

Safe-way supermarket proposed a database that will help them store and safeguard the record details for the entire supermarket. In this database, there is a unique key that's used to identify each and every detail stored in the database.

Security is set to keep information safe from unauthorized persons.

The database design for Safeway supermarket meets the client requirements perfectly because of the following reasons;

- Information of the stakeholders is available that's related to supermarket.
- ID for each stakeholder is available for easy identification and management.
- There are separate tables to identify each and every stakeholder and their duties in database.

In my database, the logical design is the best example to show brief information of how client requirement was fulfilled in the database design.

Example

Logical design.

Manufacturer table- {Man_ID, Man_name, Man_contact, total_amount}

Manufacturer_Product table- {Prod_ID, Manu_ID}

Suppliers table- {Sup_name, Sup_contact, total-supply amount}

Supply_product table- {Supplier_ID, Product_ID}

Supermarket table- {Sup_ID, Sup_loc, Sup_contact, No. of employees}

Customer-product table- {Cus_ID, Prod_ID}

Customer table- {Cus_ID, Cus_name, Cus_age, Cus_contact, bill-amount, total-product}

Product table- {Prod_ID, Prod_name, Prod_price, Date of manufactured, Date of expiry}

Employees table- {Empl_name, Emp_ID, Empl_age, Empl_salary, Empl_contact, Empl_section}

Benefits of this design

- Storing and retrieving of information in the database is simple and clear.
- Information of each and every stakeholder is arranged in a systematic manner. This helps in smooth running of the design.
- It is equipped with security features that ensure continuous well-being of the system.
- It is easy to track each and every information required because of their unique ID, hence reducing **a lot of troublesome activities.**

In addition, for this database to last long and function properly, here are some future improvements that will ensure this goal is met.

For the future improvement I can make more relation in my design between attributes and in my ER diagram I can make more joints and relation by adding more attributes than it used to be. Maybe I can change my design language into SQL for getting more accurate and realistic results,

in another hand One of the most effective strategies to improve database speed is to optimize SQL queries.

Other improvements includes

1. For identification, we can introduce biometric identification for employees to make it easy and fast.
2. Add new features for online shopping customer that will enable them to ease some troubles of online shopping.
3. Improvement of security features like creating of combinations keys that are kept by different stakeholder therefore making hard for intruders to have access to confidential information.
4. Develop a new electronic system that will automatically fill every field of the employees when unique value is entered.

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