Lecturer's Name — Code	: SAN KARYA, S.Kom., MMSI — D5211b	
Course Name	: Data and Information Management	
Group	: Group 4	
Group Members	: - Delwyn Cio Hutagalung	2602183514
	- Muhammad Hauzan Ariq	2602185072
	- Rainer Ariel Timothy	2602186610
	- Erlangga Rizky Nugroho	2602181710
	- Adriano Simbar	2602185463
	- Aiko Machfuudzoh	2602194240
	- Huandika Ekaputra	2602193912
	- Tomy Khosasi	2602181023
Class	: LE11	
Assignment	: Procurement System in The Harvest / Sistem Pengadaan Barang di The Harvest	

Procurement System in The Harvest

Company Profile

The Harvest adalah pelopor jaringan toko kue bergaya Eropa di Indonesia yang didirikan pada tahun 2004. Saat ini The Harvest merupakan jaringan toko roti dan kue bergaya Eropa terbesar di Indonesia yang memiliki lebih dari 91 toko dan terus berkembang di kota-kota besar dan kecil di Indonesia.

Fact-Finding Techniques

a. **Interviews**:
   The interview technique can help us in gathering the information and data about The Harvest's current process in procuring, requirements of the raw materials, and the pain points in which they experience in the procurement process.

b. **Observation**:
   The observation technique can help us to improve the obstacles which The Harvest experienced in their business process by witnessing the current procurement processes in action and identifying the workflow and areas that need improvement.

c. **Document Review**:
   The document review technique can help us to analyze the documentation needed for The Harvest in the procurement process to avoid any disputes and misunderstandings between buyers and suppliers and to help in ensuring that the payments are made in a fair and efficient manner.

Problem Statement

Harvest memerlukan database yang dapat membantu mengotomatisasi proses procurement, mengurangi error, dan meningkatkan visibilitas tingkat inventaris. Database juga harus diintegrasikan dengan sistem perusahaan lainnya untuk memberikan gambaran lengkap tentang proses procurement.

Database Planning

1. Mission Statement
    - Menyediakan informasi yang akurat dan on-time untuk mendukung proses procurement perusahaan. Database akan digunakan untuk tracking inventory level, melakukan pemesanan dengan supplier, dan tracking shipment dan penerima barang.

2. Mission Objectives
    - Tujuannya database The Harvest adalah untuk:
        - Meningkatkan akurasi dan efisiensi proses procurement.
        - Mengurangi biaya procurement.
        - Meningkatkan kualitas barang yang diterima.
        - Meningkatkan customer experience dengan memastikan bahwa produk selalu tersedia.
    - Supaya mencapai tujuan misi ini, database akan dirancang untuk:
        - Mudah digunakan dan dinavigasi.
        - Aman dan melindungi kerahasiaan data perusahaan.
        - Bersikap terukur untuk mengakomodasi pertumbuhan perusahaan.
        - Terintegrasi dengan sistem perusahaan lainnya, seperti sistem ERP-nya.
    - Database akan digunakan oleh berbagai pengguna, termasuk:
        - Procurement Staff
        - Warehouse Staff
        - Finance Staff
        - Management

Systems Definition

Define Terms of Reference of Study

To store data: Database yang dapat menyimpan data

a. Objectives, Scope and the description of the Criteria

Objectives

a. Efficient Management

- Suppliers (MsSupplier); Able to store, update, and retrieve supplier information efficiently, that includes details like supplier name, contact information, and materials supplied.
- Materials (MsMaterial): Able to manage materials effectively, keep the track of material details, quantities, and payments.

b. Streamlined Data

- Purchase Orders (PurchaseOrder) and Invoices (Invoice); Able to facilitate the creation, tracking, and management of purchase orders and invoices.
- Purchase Requisitions (PurchaseRequisition); Has the ability to streamline the process of creating and approving purchase requisitions.
    - Accurate Payment (Payment); Has the ability to accurately track payments made to suppliers, including payment dates and amounts.
    - Staff Accountability (MsStaff): Has the ability to keep track of which staff members are responsible for which procurement tasks.

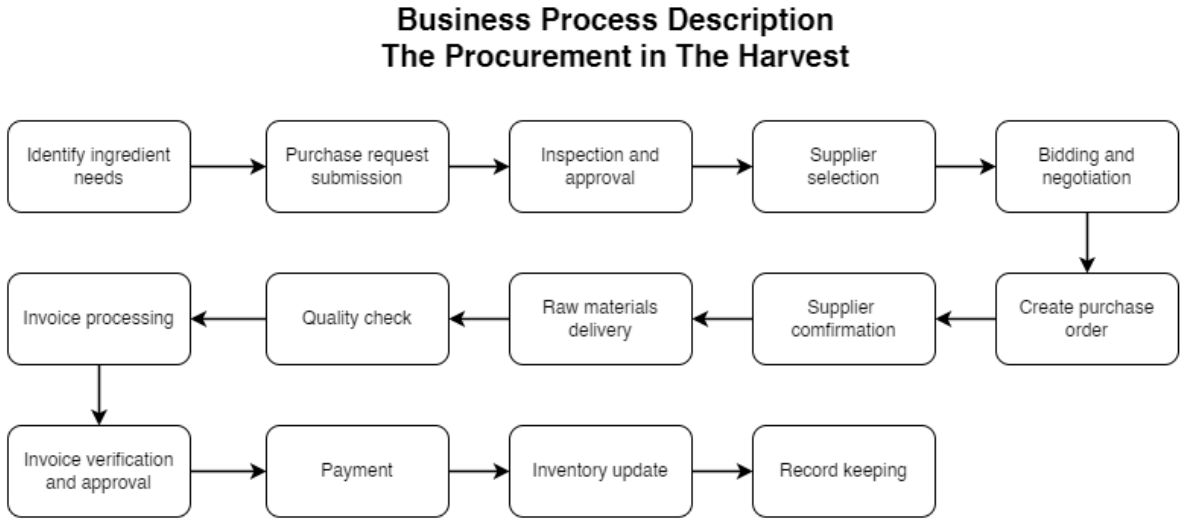
Scope

1. **Supplier Management**: Adding, updating, and deleting suppliers.
2. **Material Management**: Managing material information and inventory levels.
3. **Purchase Order Processing**: Creating, updating, and tracking purchase orders.
4. **Invoice Processing**: Generating and managing invoices.
5. **Payment Processing**: Recording and tracking payments.
6. **Staff Management**: Assigning tasks to staff members and tracking their progress.
7. **Purchase Requisition Processing**: Handling the creation and approval of purchase requisitions.

Criteria

1. **Data Integrity**: The system should ensure that data is accurate, consistent, and reliable across all entities and maintain referential integrity between related entities.
2. **Usability**: The system should be user-friendly, with intuitive interfaces for managing between the entities.
3. **Performance**: The system should be able to handle the expected volume of data and user requests without significant delays or performance issues.
4. **Security**: The system should protect sensitive data (such as supplier details, payment information, employee details) from unauthorized access or modification.
5. **Cost-effectiveness**: The cost of implementing and maintaining the system should be reasonable in relation to the benefits it provides

Business Process Description for The Harvest's Procurement Process



1. **Identify ingredient needs**:
   The first step in the procurement process is to identify the need for raw material like flour, eggs, margarine, and others.

2. **Purchase request submission**:
   After the need is identified, the procurement department submits a purchase request that contains details about the materials that are needed, their quantity, and the reason why they are needed.

3. **Inspection and approval**:
   After the purchase request is submitted, it is then reviewed by the warehouse manager to ensure that they comply with the company policy and budget.

4. **Supplier selection**:
   The Harvest procurement department will search for potential suppliers for the requested materials. Suppliers will be selected based on their price, product quality, reputation, and other factors.

5. **Bidding and negotiation**:
   The procurement department will make offers with the selected suppliers. Once an offer is accepted, there are possible negotiations to reach the best deal.

6. **Create purchase order**:
   Once an agreement has been made with the supplier, the purchase of raw materials is then made by placing a purchase order with the selected supplier.

7. **Supplier confirmation**:
   The suppliers then accept the purchase order and confirm their ability to fulfill the order.

8. **Raw materials delivery**:
   After it is confirmed, the supplier will ship out the raw materials on the requested date and time.

9. **Quality check**:
   The warehouse keeper will check the delivered items for the items' quality and accuracy.

10. **Invoice processing**:
    The supplier sends an invoice to the company for the delivered raw materials that includes the details of the items delivered and the total cost.

11. **Invoice verification and approval**:
    The Harvest's finance department verifies the received invoice using the purchase order and the actual delivery. After it is verified, it is approved for payment.

12. **Payment**:
    The approved invoice is processed for payment and will be made to the supplier.

13. **Inventory update**:
    The Harvest’s inventory system will be updated after receiving the newly shipped stock of raw materials.

14. **Record keeping**:
    All documents related to the procurement process, including purchase request, purchase orders, invoices, and payment processed, are properly filed for future reference and auditing.

Table Instance Chart

Column Name	SupplierID	SupplierName	SupplierContact	Address
Key Type	PK			
Null/Not Null	Not Null	Not Null	Not Null	Not Null
Sample Data	SU001	Tepung Emas Ltd	088812349032	Jl. Kampak Terbang
	SU002	Indo Berkah	081382733095	Jl. Matoa al Kahfi
	SU003	Ingredients company	082219218767	Jl. Timur berkah

Table Name: **MsSupplier**

MsSupplier
SupplierID
* SupplierName
* SupplierName
* SupplierContact
* Address

Table Name: **MsMaterial**

Column Name	MaterialID	MaterialName	Quantity	Price
Key Type	PK			
Null/Not Null	Not Null	Not Null	Not Null	Not Null
Sample Data	M001	Flour (per kilo)	250	10,000
	M002	Egg (per kilo)	250	26,000
	M003	Margarine (per kilo)	250	21,000

MsMaterial
MaterialID
* MaterialName
* Quantity

Table Name: **PurchaseOrder**

Column Name	OrderID	StaffID	SupplierID	MaterialID	Quantity	Date
Key Type	PK	FK	FK	FK		
Null/Not Null	Not Null	Not Null	Not Null	Not Null	Not Null	Not Null
Sample Data	OD001	ST002	SU001	M001	250	14-09-2023
	OD002	ST002	SU002	M002	250	16-09-2023
	OD003	ST002	SU001	M003	250	17-09-2023

PurchaseOrder
OrderID
StaffID
SupplierID
MaterialID
* Quantity
* Date

Table Name: **Invoice**

Invoices	InvoiceID	OrderID	TotalAmount
Key Type	PK	FK	
Null/Not Null	Not Null	Not Null	Not Null
Sample Data	I001	OD001	2.500.000
	I002	OD002	6,500.000
	I003	OD003	5.250.000

Invoice
InvoiceID
OrderID
* TotalAmount

Table Name: **Payment**

Column Name	PaymentID	InvoiceID	StaffID	Amount
Key Type	PK	FK	FK	
Null/Not Null	Not Null	Not Null	Not Null	Not Null
Sample Data	PM001	I001	ST003	2.500.000
	PM002	I002	ST003	6,500.000
	PM003	I003	ST003	5.250.000

Payment
PaymentID
InvoiceID
StaffID
* Amount

Table Name: **MsStaff**

Column Name	StaffID	StaffPosition	StaffName	StaffDoB	StaffContact
Key Type	PK				
Null/Not Null	Not Null	Not Null	Not Null	Not Null	Not Null
Sample Data	ST001	Manager	Rendy Kurniawan	29-05-1995	086857579011
	ST002	Warehouse Staff	Justin	07-02-2000	083478294612
	ST003	Finance Staff	Syauqi	19-04-1998	081462856293

MsStaff
StaffID
* StaffPosition
* StaffName
* StaffDOB
* StaffContact

Table Name: **PurchaseRequsition**

Column Name	PrID	MaterialID	StaffID	Approved_by	Date
Key Type	PK	FK	FK		
Null/Not Null	Not Null	Not Null	Not Null	Not Null	Not Null
Sample Data	PR001	M001	ST002	ST001	01-09-2023
	PR002	M002	ST002	ST001	01-09-2023
	PR003	M003	ST002	ST001	01-09-2023

PurchaseRequisition
PrID
MaterialID
StaffID
* Approved_by
* Date

Structural Business Rules

These are the Structural Business Rules in the Procurement System in The Harvest.

- **SupplierID in the MsSuppliers Table is the Primary Key (PK)**:
  - Every entry in the MsSuppliers table must have a unique value for SupplierID.
  - This ensures that no two suppliers have the same ID.

- **SupplierID in the PurchaseOrder Table is a Foreign Key (FK) Linked to the MsSuppliers Table**:
  - The SupplierID in the PurchaseOrder table must always refer to entries in the MsSuppliers table.
  - This ensures that every purchase order is associated with a supplier listed in the MsSuppliers table.

- **ProductID in the MsProducts Table is the Primary Key (PK)**:
  - Every product in the MsProducts table must have a unique value for ProductID.
  - This ensures that no two products have the same ID.

- **ProductID in the PurchaseOrder Table is a Foreign Key (FK) Linked to the MsProducts Table**:
  - The ProductID in the PurchaseOrder table must always refer to entries in the MsProducts table.
  - This ensures that each item in a purchase order is always associated with a product listed in the MsProducts table.

- **OrderID in the PurchaseOrder Table is the Primary Key (PK)**:
  - Every purchase order must have a unique value for OrderID.
  - This ensures that no two purchase orders have the same ID.

- **OrderID in the Invoices Table is a Foreign Key (FK) Linked to the PurchaseOrder Table**:
  - The OrderID in the Invoices table must always refer to entries in the PurchaseOrder table.
  - This ensures that each invoice is always associated with a purchase order listed in the PurchaseOrder table.

- **InvoiceID in the Invoices Table is the Primary Key (PK)**:
  - Every invoice must have a unique value for InvoiceID.
  - This ensures that no two invoices have the same ID.

- **InvoiceID in the Payments Table is a Foreign Key (FK) Linked to the Invoices Table**:
  - The InvoiceID in the Payments table must always refer to entries in the Invoices table.
  - This ensures that each payment is always associated with an invoice listed in the Invoices table.

- **PaymentID in the Payments Table is the Primary Key (PK)**:
  - Every payment must have a unique value for PaymentID.
  - This ensures that no two payments have the same ID.

- **PrID in the PurchaseRequisition table is the Primary Key(PK):**
  - Every purchase requisition must have a unique value for PrID.
  - This ensures that no two purchase requisitions have the same ID.
  - The MaterialID in the PurchaseRequisition table must always refer to entries in the MsMaterial table.
  - The StaffID in the PurchaseRequisition table must always refer to entries in the MsStaff table.

Procedural Business Rules

These are the Procedural Rules for the Procurement System in The Harvest.

1. **Purchase requisition submission**:
   - Before making a purchase order, the procurement department must submit a purchase requisition.
   - The purchase requisition should detail the items required, quantities, and a short explanation for the purchase.

2. **Manager approval**:
   - Upon receiving a purchase requisition, the warehouse manager must review and approve it.
   - If the manager rejects the requisition, they should provide a reason for the rejection.

3. **Purchase order generation**:
   - After manager approval, the procurement department generates a purchase order based on the approved requisition.
   - The purchase order specifies the supplier, products, quantities, and delivery date.

4. **Supplier selection**:
   - The procurement department selects a supplier based on factors like price, product availability, and supplier performance.

5. **Purchase order approval**:
   - The generated purchase order must be reviewed and approved by the procurement manager.
   - Only approved purchase orders are sent to suppliers.

6. **Product receipt and inspection**:
   - After delivery of products from the supplier, the warehouse keeper must inspect the products to ensure that they meet quality and quantity standards.
   - Any mistakes or damages must be documented and reported to the procurement department.

7. **Invoice matching**:
   - The finance department matches supplier invoices with the corresponding purchase orders and product receipts.
   - Payments are processed only if there is a match and no mistakes exist.

8. **Payment authorization**:
   - Payments to suppliers are authorized by the finance department.
   - Authorization is based on the approved invoice and payment terms.

9. **Payment processing**:
    - Payments are made to suppliers within the agreed payment terms.

10. **Supplier performance evaluation**:
    - Evaluations of supplier performance are conducted based on criterias such as on-time deliveries, product quality, and pricing.

Entities, Attributes, Supertypes and Subtypes
Identifying the Entities, Attributes and, Supertypes and Subtypes (if any).

a. Attributes and Entities

Entities	Attributes
MsSupplier	SupplierID, SupplierName, SupplierContact, Address
MsMaterial	MaterialID, MaterialName, Quantity
PurchaseOrder	OrderID, StaffID, SupplierID, MaterialID, Quantity, Date
Invoice	InvoiceID, OrderID, TotalAmount
Payment	PaymentID, InvoiceID, Amount
MsStaff	StaffID, StaffPosition, StaffName, StaffDoB, StaffContact
PurchaseRequisition	PrID, MetarialID, StaffID, Approved_by, Date

b. Supertypes and Subtypes
- Tidak ada.

Relationship Transferable
a. Transferable
- Transferable — **MsStaff** who sends the Purchase requisition can be replaced
- Transferable — **PurchaseOrder** that is sent to the MsSupplier can be replaced

b. Non-Transferable
- Non-Transferable — The **Payment** must be in accordance with the **Invoice**
- Non-Transferable — The **PurchaseRequisition** can only be given to the specific manager who has the right to approve the requisition
- Non-Transferable — The **MsMaterial** cannot be changed once it has been input into the PurchaseOrder

Unique Identifier

Identifying the Unique Identifier based on your group project:

1. Simple UID
2. Composite UID
3. Artificial UID
4. Secondary UID

Entity	Simple UID	Composite UID	Artificial UID	Secondary UID
MsSupplier	SupplierID	NONE	SupplierID	SupplierContact
MsMaterial	MaterialID		MaterialID	-
PurchaseOrder	OrderID		OrderID	-
Invoice	InvoiceID		InvoiceID	-
Payment	PaymentID		PaymentID	-
MsStaff	StaffID		StaffID	StaffContact
PurchaseRequisition	PrID		PrID	-

Conceptual Database Design

1.1) Identify Entity Types

Entity	**Description**	**Aliases**	**Occurrence**
MsSupplier	General term describing for supplier who supply the materials for the Harvest's company	Supplier	Each of supplier specializes in supplying the materials needed
MsMaterial	General term describing for the items by the supplier of the Harvest's company	Material	The material consist of different ingredients needed
PurchaseOrder	General term describing for the materials that have been issued to the supplier of the Harvest's company	PO	Each purchase order is formed by the employee of the company
Invoice	General term describing for the purchased materials that have been issued by the supplier of the Harvest's company	Invoice	Each invoice is created by the supplier
Payment	General term describing for the Harvest's company to pay the materials of the purchase order.	Payment	The payment is made by the employee to the supplier
MsStaff	General term describing for the people who work under the Harvest's company.	Employee	Each staff manages the process from procuring the materials until proceeding to the payment
PurchaseRequisition	General term describing for requesting a purchase order by the Harvest company.	PR	Each purchase requisition is being produced by the materials needed

1.2) Identify Relationship Types

Entity Name	Multiplicity	Relationship	Multiplicity	Entity Name
MsSupplier	-	-	-	-
MsMaterial	-	-	-	-
PurchaseOrder	1…1 1…1	Delivered to Convert	1…1 1…1	MsSupplier Invoice
Invoice	-	-	-	-
Payment	1…1	To fulfill	1…1	Invoice
MsStaff	1…1 0…1 1…1	Creates Manages Makes a	1…1 1…1 1…1	PurchaseRequisition PurchaseOrder Payment
PurchaseRequisition	1…1 1…1	Contains Converts to	1…1 1…*	MsStaff MsMaterial

1.3) Identify and associate attributes with entity or relationship types

Entity Names	Attributes	Description	Data type and Length	Null	Multi-valued
MsSupplier	SupplierID SupplierName SupplierContact Address	Supplier's unique identify Name of the supplier Supplier's contact Supplier's address	Char(5) Varchar(50) Varchar(12) Varchar(200)	No	No
MsMaterial	MaterialID MaterialName Stock Price	Materials' unique identify Materials' name Stock availability level Materials' price for each	Char(4) Varchar(50) Integer(12) Double(11.2)	No	No
PurchaseOrder	OrderID StaffID SupplierID MaterialID Quantity Date	PO's unique identify Staffs' unique identify Suppliers' unique identify Materials' unique identify Materials' requested quantity PO's date of being made	Char(5) Char(5) Char(5) Char(4) Integer(12) Date	No	No
Invoice	InvoiceID OrderID TotalAmount	Invoice's unique identify PO's unique identify Invoice's total amount	Char(4) Char(4) Integer(12)	No	No
Payment	PaymentID InvoiceID	Payment's unique identify Invoice's unique identify	Char(5) Char(4)	No	No

	StaffID Amount	Staff's unique identify Final amount altogether	Char(5) Integer(12)		
MsStaff	StaffID StaffPosition StaffName StaffDoB StaffContact	Staffs' unique identify Staffs' position holds Staffs' name Staffs' birthday date Staff's contact information	Char(5) Varchar(50) Varchar(50) Date Varchar(12)	No	No

1.4) Determine attribute domains

Entity Name	**Attribute**	**Attribute Domain**
MsSupplier	SupplierID SupplierName SupplierContact Address	'SU[0-9][0-9][0-9]' 'Tepung Emas Ltd' 'Indo Berkah' 'Ingredients company' 088812349032 081382733095 082219218767 'Jl. Kampak Terbang' 'Jl. Matoa al Kahfi' 'Jl. Timur berkah'
MsMaterial	MaterialID MaterialName Quantity Price	'M[0-9][0-9][0-9]' 'Flour (per kilo)' 'Egg (per kilo)' 'Margarine (per kilo)' 250 250 250 10,000 26,000 21,000
PurchaseOrder	OrderID Quantity Date	'OD[0-9][0-9][0-9]' 250 250 250 '14-09-2023' '16-09-2023' '17-09-2023'
Invoice	InvoiceID TotalAmount	'I[0-9][0-9][0-9]' 2.500.000 6.500.000 5.250.000
Payment	PaymentID Amount	'PM[0-9][0-9][0-9]' 2.500.000

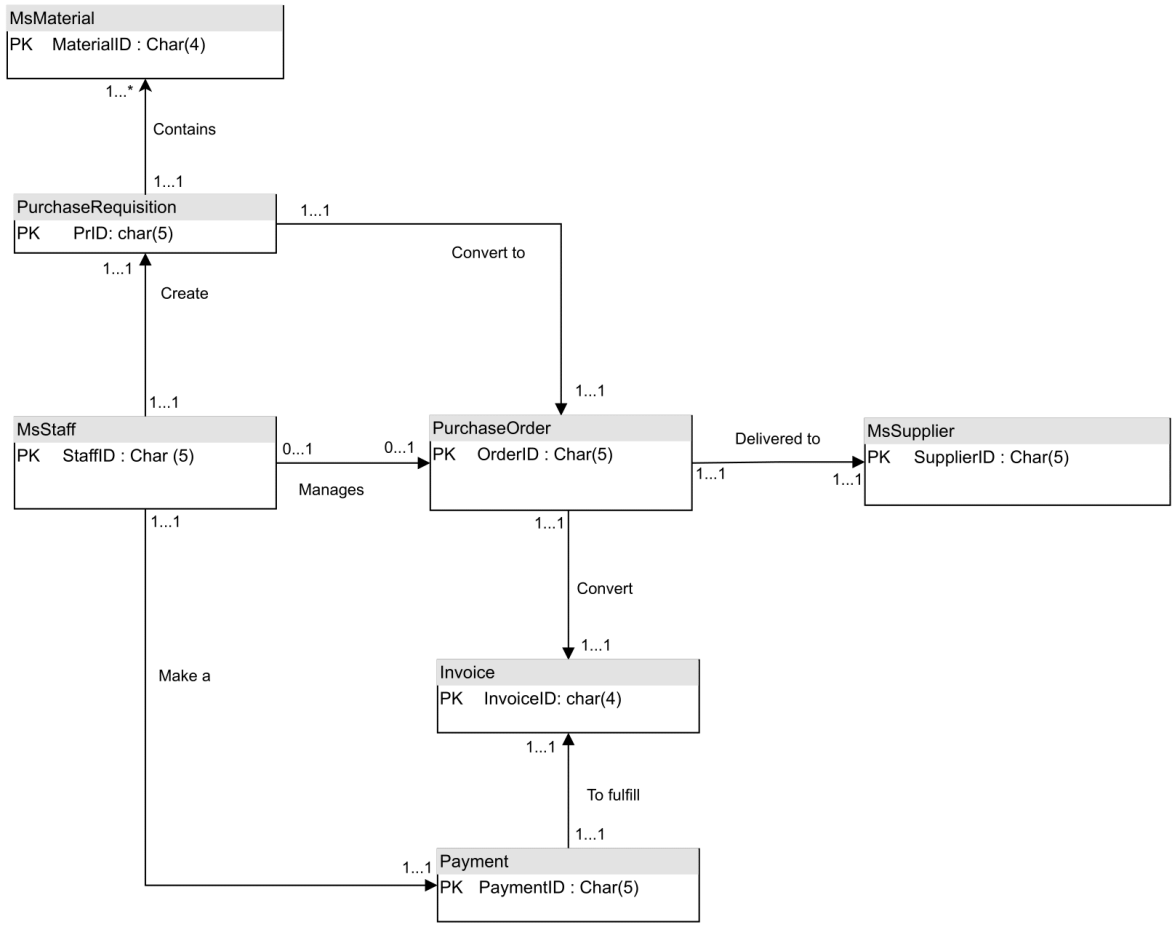
		6.500.000 5.250.000
MsStaff	StaffID StaffPosition StaffName StaffDoB StaffContact	‘ST[0-9][0-9][0-9]’ ‘Manager’ ‘Warehouse Staff’ ‘Finance Staff’ ‘Rendy Kurniawan’ ‘Justin’ ‘Syauqi’ ‘29-05-1995’ ‘07-02-2000’ ‘19-04-1998’ 086857579011 083478294612 081462856293

1.5) Determine candidate, primary, and alternate key attributes

Entity Name	**Candidate Key**	**Primary Key**	**Alternate Key**
MsSupplier	SupplierID	SupplierID	-
MsMaterial	MaterialID	MaterialID	-
PurchaseOrder	OrderID	OrderID	-
Invoice	InvoiceID	InvoiceID	-
Payment	PaymentID	PaymentID	-
MsStaff	StaffID	StaffID	-
PurchaseRequisition	PrID	PrID	-

Conceptual ERD

[Conceptual Diagram Week 4]



DBMS Selection

1. Shortlist two or three products
   - Microsoft SQL Server
   - MySQL

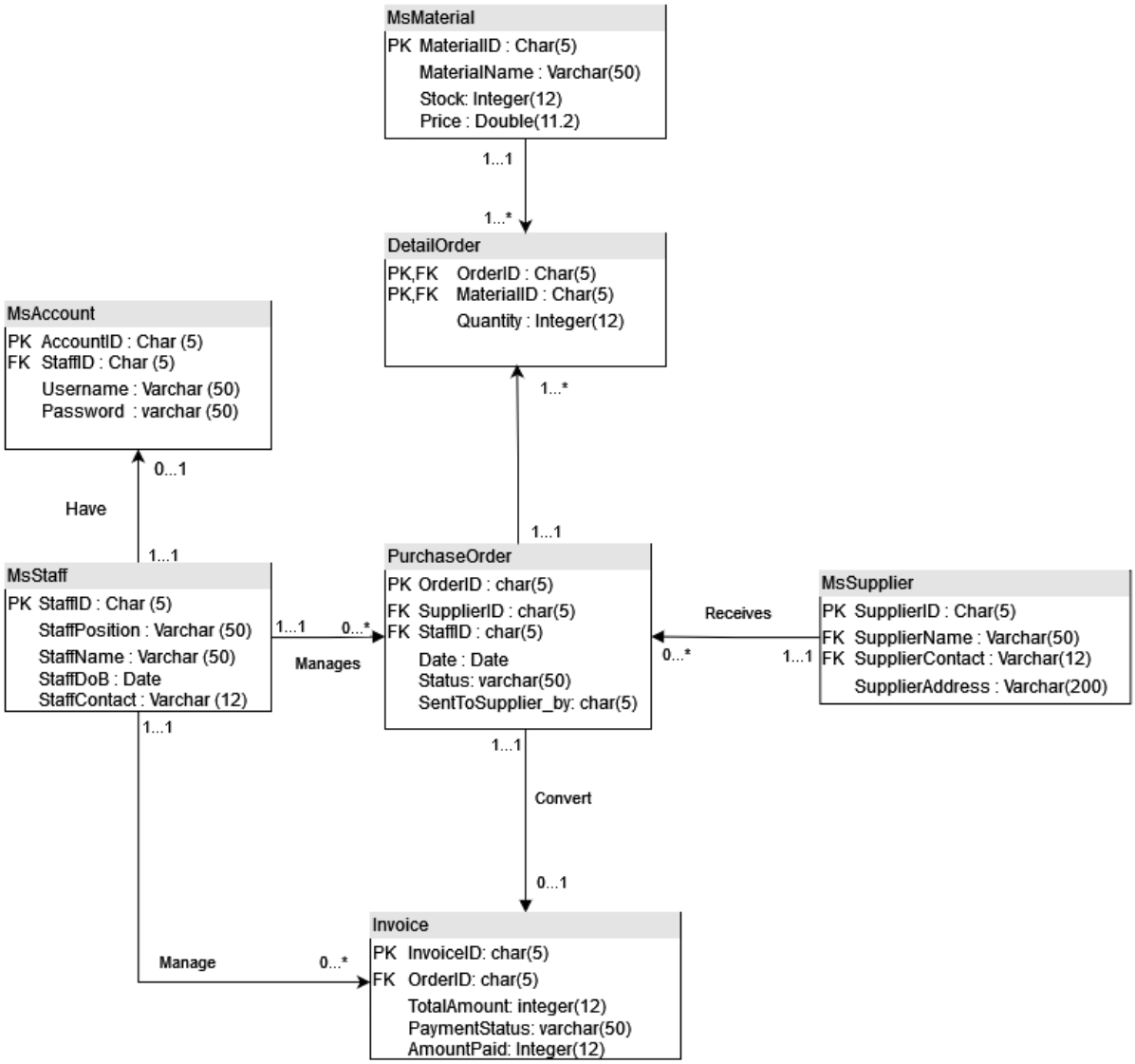
2. Evaluate Products
   Data Evaluations Features
   1. Data Definition
   2. Accessibility
   3. Utilities
   4. Other Features

DBMS Evaluation Comparisons						
Features	Microsoft SQL Server [Microsoft]			MySql [Microsoft]		
	Rating	Weigh(%)	Score	Rating	Weigh(%)	Score
Analysis service	4	12	0.48	1	12	0.12
File structure maintenance	4	4	0.16	3	4	0.12
Ease of reorganization	4	4	0.16	3	4	0.12
Indexing	5	12	0.6	4	12	0.48
Training and user support	5	14	0.7	3	14	0.42
Integration service	4	10	0.4	3	10	0.3
View Mechanism	4	4	0.16	4	4	0.16
Data Compressing	4	4	0.16	4	4	0.16
Machine learning service	3	22	0.66	1	22	0.22
Upgradability	4	14	0.56	5	14	0.7
Total Overall Evaluation	**Total Score is 4.2 of 5**			**Total Score is 2.8 of 5**		

3. Recommend Selection and Produce Report
   Recommendation: Microsoft SQL Server

<table>
<tr><td colspan="2">Database Management System Selection Report</td></tr>
<tr><td>Project</td><td>Harvest Procurement Information System</td></tr>
<tr><td>Summary</td><td>The report based on the recommendation for the selection of a Database Management System (DBMS) for the Harvest Procurement Information System. The evaluation went under the procedure according to predefined criteria and weights outlined in the Terms of Reference (ToR).</td></tr>
<tr><td>Evaluation Criteria and Weights</td><td>
<table>
<tr><th>Rating</th><th>Weigh</th><th>Score</th></tr>
<tr><td>4</td><td>12</td><td>0.48</td></tr>
<tr><td>4</td><td>4</td><td>0.16</td></tr>
<tr><td>4</td><td>4</td><td>0.16</td></tr>
<tr><td>5</td><td>12</td><td>0.6</td></tr>
<tr><td>5</td><td>14</td><td>0.7</td></tr>
<tr><td>4</td><td>10</td><td>0.4</td></tr>
<tr><td>4</td><td>4</td><td>0.16</td></tr>
<tr><td>4</td><td>4</td><td>0.16</td></tr>
<tr><td>3</td><td>22</td><td>0.66</td></tr>
<tr><td>4</td><td>14</td><td>0.56</td></tr>
<tr><td colspan="3">Total Score is 4.2 of 5</td></tr>
</table>
</td></tr>
<tr><td>Recommendation</td><td>Based on the evaluation results and the user requirements of the Harvest Procurement Information System, we recommend selecting Microsoft SQL Server as the Database Management System. This recommendation is primarily driven by SQL Server's superior performance, robust security features, and strong support for data integrity, which are critical for a procurement system.</td></tr>
<tr><td>Conclusion</td><td>The decision of choosing the DBMS is a critical decision for the success of the Harvest Procurement Information System. We choose Microsoft SQL Server as the DBMS because it aligns well with the project's objectives of efficient data management, streamlined processes, accurate payment tracking, and staff accountability.</td></tr>
</table>

Logical ERD


MsMaterial
PK MaterialID : Char(5)
MaterialName : Varchar(50)
Stock: Integer(12)
Price : Double(11.2)
1...1
1...*
DetailOrder
PK,FK OrderID : Char(5)
PK,FK MaterialID : Char(5)
Quantity : Integer(12)
1...*
MsAccount
PK AccountID : Char (5)
FK StaffID : Char (5)
Username : Varchar (50)
Password : varchar (50)
0...1
Have
1...1
1...1
PurchaseOrder
PK OrderID : char(5)
FK SupplierID : char(5)
FK StaffID : char(5)
Date : Date
Status: varchar(50)
SentToSupplier_by: char(5)
MsStaff
PK StaffID : Char (5)
StaffPosition : Varchar (50)
StaffName : Varchar (50)
StaffDoB : Date
StaffContact : Varchar (12)
1...1
0...*
Manages
Receives
0...*
1...1
MsSupplier
PK SupplierID : Char(5)
FK SupplierName : Varchar(50)
FK SupplierContact : Varchar(12)
SupplierAddress : Varchar(200)
1...1
Convert
0...1
1...1
Manage
0...*
Invoice
PK InvoiceID: char(5)
FK OrderID: char(5)
TotalAmount: integer(12)
PaymentStatus: varchar(50)
AmountPaid: Integer(12)

Physical Database Design for Relational Database
3.1 Design Base Relations

```
-- CREATE
DROP DATABASE TheHarvest

CREATE DATABASE TheHarvest
GO
USE TheHarvest
GO

CREATE TABLE MsMaterial (
    MaterialID CHAR(5) PRIMARY KEY CHECK(MaterialID LIKE ('MA[0-9][0-
9][0-9]')) NOT NULL,
    MaterialName VARCHAR(255) UNIQUE(MaterialName) NOT NULL,
    Stock INT CHECK(Stock >= 0) NOT NULL,
    Price INT NOT NULL
);

CREATE TABLE MsStaff (
    StaffID CHAR(5) PRIMARY KEY CHECK(StaffID LIKE ('ST[0-9][0-9][0-
9]')) NOT NULL,
    StaffName VARCHAR(50) NOT NULL,
    StaffPosition VARCHAR(50) DEFAULT 'Employee',
    StaffDoB DATE NOT NULL,
    StaffContact VARCHAR(12) NOT NULL
);

CREATE TABLE MsAccount(
    AccountID CHAR(5) PRIMARY KEY CHECK(AccountID LIKE ('AC[0-9][0-
9][0-9]')) NOT NULL,
    StaffID CHAR(5) REFERENCES MsStaff(StaffID) NOT NULL,
    Username VARCHAR(50) NOT NULL,
    Password VARCHAR(50) NOT NULL
);

CREATE TABLE MsSupplier (
    SupplierID CHAR(5) PRIMARY KEY CHECK(SupplierID LIKE ('SU[0-9][0-
9][0-9]')) NOT NULL,
    SupplierName VARCHAR(255) NOT NULL,
    SupplierContact VARCHAR(12) NOT NULL,
    SupplierAddress VARCHAR(255) NOT NULL
);
```

```sql
CREATE TABLE DetailOrder(
    OrderID CHAR(5) NOT NULL,
    MaterialID CHAR(5) NOT NULL,
    Quantity INT NOT NULL,
    PRIMARY KEY (OrderID, MaterialID),
    FOREIGN KEY (OrderID) REFERENCES PurchaseOrder(OrderID),
    FOREIGN KEY (MaterialID) REFERENCES MsMaterial(MaterialID)
);

CREATE TABLE PurchaseOrder (
    OrderID CHAR(5) PRIMARY KEY CHECK(OrderID LIKE ('OD[0-9][0-9][0-
9]')) NOT NULL,
    SupplierID CHAR(5) REFERENCES MsSupplier(SupplierID) NOT NULL,
    StaffID CHAR(5) REFERENCES MsStaff(StaffID) NOT NULL,
    Date DATE NOT NULL,
    SentToSupplier_by CHAR(5)
);

CREATE TABLE Invoice (
    InvoiceID CHAR(5) PRIMARY PRIMARY CHECK(InvoiceID LIKE ('IN[0-9][0-
9][0-9]')) NOT NULL,
    OrderID CHAR(5) REFERENCES PurchaseOrder(OrderID) NOT NULL,
    TotalAmount INT NOT NULL,
    PaymentStatus VARCHAR(50) NOT NULL,
    AmountPaid INT NOT NULL
);


-- INSERT

INSERT INTO MsMaterial (MaterialID, MaterialName, Stock, Price)
VALUES
('MA001', 'Flour', 250, 10000),
('MA002', 'Egg', 250, 26000),
('MA003', 'Margarine', 250, 21000),
('MA004', 'Water', 300, 25000),
('MA005', 'Sugar', 350, 50000),
('MA006', 'Cheese', 200, 30000),
('MA007', 'Milk', 150, 15000),
('MA008', 'Chocolate', 100, 40000),
('MA009', 'Bread', 250, 20000),
('MA010', 'Butter', 200, 25000);
```

```
INSERT INTO MsStaff (StaffID, StaffName, StaffPosition, StaffDoB,
StaffContact)
VALUES
('ST001', 'Rendy', 'Manager', '1995-05-29', '081325256463'),
('ST002', 'Justin', 'Warehouse Staff', '2000-02-07', '082855672156'),
('ST003', 'Syauqi', 'Finance Staff', '1998-04-19', '087716599918'),
('ST004', 'Yusuf', 'Warehouse Staff', '2000-11-11', '086577193324'),
('ST005', 'Andika', 'Finance Staff', '1999-09-21', '082235397619');

INSERT INTO MsSupplier (SupplierID, SupplierName, SupplierContact,
SupplierAddress)
VALUES
('SU001', 'Tepung Emas Ltd.', '088812349032', 'Jl. Kapak Terbang'),
('SU002', 'PT. Indo Berkah', '081382733095', 'Jl. Matoa al Kahfi'),
('SU003', 'Ingredients Inc.', '082219218767', 'Jl. Timur Berkah'),
('SU004', 'Shoogar Ltd.', '081635264839', 'Jl. Ahmudin'),
('SU005', 'Berkah Antoni TBK', '083627482946', 'Jl. Barat Berkah');

INSERT INTO DetailOrder (OrderID, MaterialID, Quantity)
VALUES
('OD001', 'MA001', 250),
('OD001', 'MA003', 150),
('OD001', 'MA006', 250),
('OD002', 'MA004', 300),
('OD002', 'MA002', 450),
('OD002', 'MA001', 150),
('OD003', 'MA002', 235),
('OD003', 'MA007', 240),
('OD004', 'MA004', 100),
('OD004', 'MA009', 350),
('OD004', 'MA010', 250),
('OD005', 'MA005', 250),
('OD005', 'MA008', 130),
('OD005', 'MA004', 300),
('OD005', 'MA001', 350);

INSERT INTO PurchaseOrder (OrderID, SupplierID, StaffID, Date, Status,
SentToSupplier_by)
VALUES
('OD001', 'SU001', 'ST002', '2023-09-02', 'Accepted', 'SU001'),
('OD002', 'SU004', 'ST004', '2023-09-02', 'Finished', 'SU001'),
8('OD003', 'SU003', 'ST002', '2023-09-03', 'Declined', 'SU001'),
```

```
('OD004', 'SU002', 'ST002', '2023-09-04', 'Pending', NULL),
('OD005', 'SU005', 'ST004', '2023-09-04', 'Pending', NULL);

INSERT INTO Invoice (InvoiceID, OrderID, TotalAmount, PaymentStatus,
AmountPaid)
VALUES
('IN001', 'OD001', 2500000, 'Paid', 2500000),
('IN002', 'OD002', 6500000, 'Paid', 6500000),
('IN003', 'OD003', 5250000, 'Paid', 5250000),
('IN004', 'OD004', 7500000, 'Unpaid', 0),
('IN005', 'OD005', 1750000, 'Unpaid', 0);
```

Step 3.2 Design representation of derived data

```
-- Derived Query

-- Total Cost per material
SELECT
    do.DetailOrder,
    do.MaterialID,
    do.Quantity,
    [Total Cost] = mm.Price * do.Quantity
FROM DetailOrder do
JOIN MsMaterial mm ON do.MaterialID = mm.MaterialID;

-- Total Cost per purchase order
SELECT
    do.DetailOrder,
    [Grand Total] = SUM(mm.Price * do.Quantity)
FROM DetailOrder do
JOIN MsMaterial mm ON do.MaterialID = mm.MaterialID
GROUP BY do.DetailOrder;
```

Step 3.3 Design general constraints

```
CREATE TABLE MsMaterial (
    MaterialID CHAR(5) PRIMARY KEY CHECK(MaterialID LIKE ('MA[0-9][0-
9][0-9]')) NOT NULL,
    MaterialName VARCHAR(255) UNIQUE(MaterialName) NOT NULL,
    Stock INT CHECK(Stock >= 0) NOT NULL,
    Price INT NOT NULL
);
```

```
CREATE TABLE MsStaff (
    StaffID CHAR(5) PRIMARY KEY CHECK(StaffID LIKE ('ST[0-9][0-9][0-
9]')) NOT NULL,
    StaffName VARCHAR(50) NOT NULL,
    StaffPosition VARCHAR(50) DEFAULT 'Employee',
    StaffDoB DATE NOT NULL,
    StaffContact VARCHAR(12) NOT NULL
);
```

Denormalization