DAMG6210 - Data Management and Database Design

Homework 02

4-34.

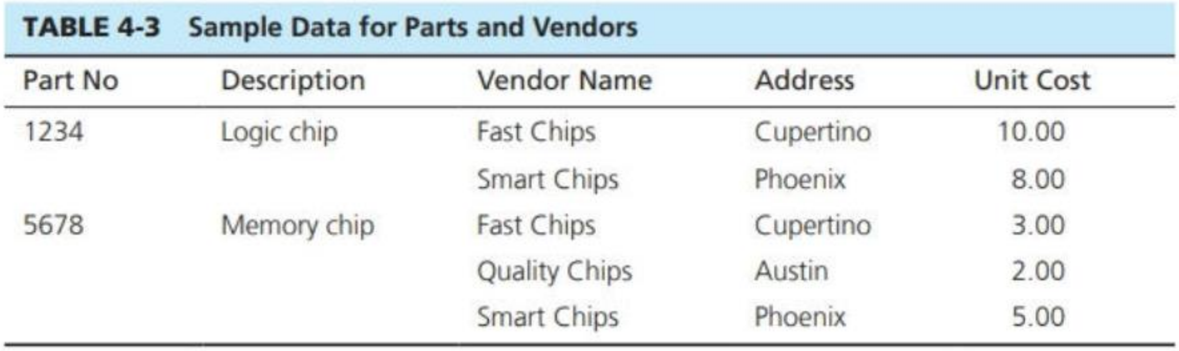


TABLE 4-3 Sample Data for Parts and Vendors

Part No	Description	Vendor Name	Address	Unit Cost
1234	Logic chip	Fast Chips	Cupertino	10.00
		Smart Chips	Phoenix	8.00
5678	Memory chip	Fast Chips	Cupertino	3.00
		Quality Chips	Austin	2.00
		Smart Chips	Phoenix	5.00

a. Converting to First Normal Form (1NF)

For a relation to be in First Normal Form requires that all attributes contain only atomic values and have no repeating groups

PART_SUPPLIER

Part No	Description	Vendor Name	Address	Unit Cost
1234	Logic chip	Fast Chips	Cupertino	10.00
1234	Logic chip	Smart Chips	Phoenix	8.00
5678	Memory chip	Fast Chips	Cupertino	3.00
5678	Memory chip	Quality Chips	Austin	2.00
5678	Memory chip	Smart Chips	Phoenix	5.00

b. Candidate Key: The combination of **Part No** and **Vendor Name** can uniquely identify a row in the table.

Functional Dependencies (FDs):

Partial Functional Dependency: A **partial dependency** occurs when a non-key attribute is dependent on **part** of a composite primary key (not the entire key).

Part No -> Description

Vendor Name -> Address

Full Functional Dependency: A functional dependency is considered **full** if a non-key attribute is dependent on the entire primary key (and not just part of it).

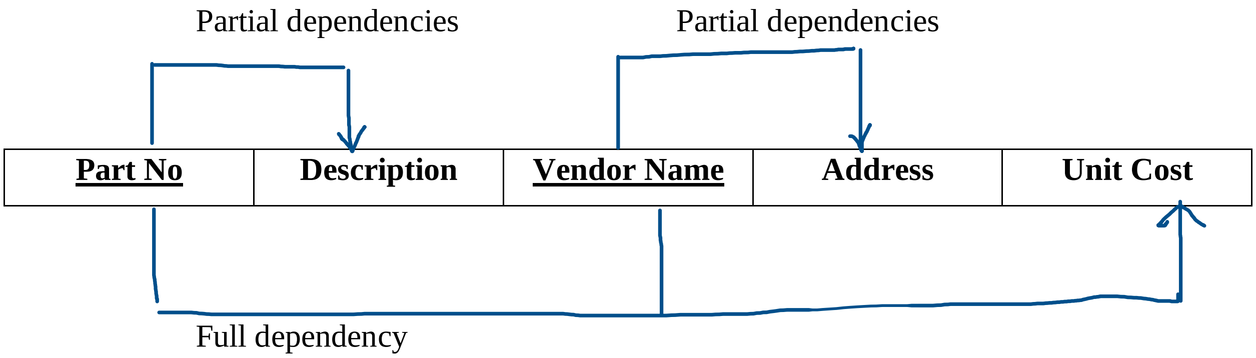
Part No, Vendor Name -> Unit Cost

c. **Insert anomaly:** We can't add a new vendor without associating it with a part.

Delete anomaly: If we delete the last tuple for a particular part, we lose the part's description.

Modification anomaly: If we change the Address for a Vendor Name, we need to update it in multiple rows.

d. PART_SUPPLIER



Part No	**Description**	**Vendor Name**	**Address**	**Unit Cost**

e. The relation PART_SUPPLIER is in 1NF (First Normal Form) because:

- All attributes are atomic
- There are no repeating groups However, it's not in 2NF because there are partial dependencies (Part No → Description and Vendor Name → Address).

f. Remove partial dependency and convert to Second Normal Form(2NF):

PART **(2NF)**

Part No	**Description**

PART_SUPPLIER **(2NF)**

Part No	**Vendor Name**	**Unit Cost**

SUPPLIER **(2NF)**

Vendor Name	**Address**

To achieve Third Normal Form (3NF), we need to eliminate partial and transitive dependencies. The relation PART_SUPPLIER is already in Third Normal Form as there is no transitive dependencies

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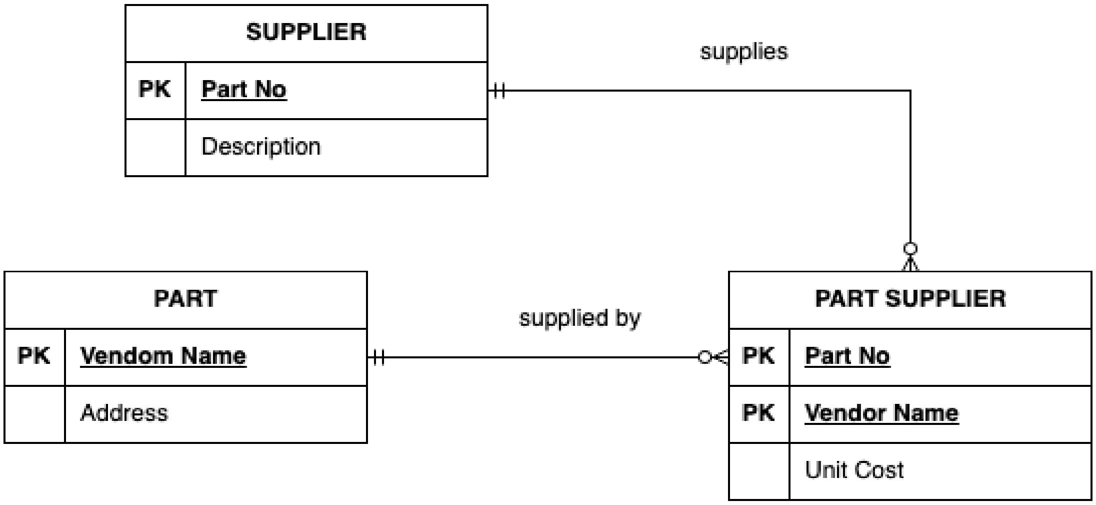


4-35.
a.

SEATING

Seating ID	**Nbr of Guests**	**Start DateTime**	**End DateTime**	**RTable Number**	**M-Employee ID**

RTABLE

RTable Number	**RTable Nbr of Seats**	**RTable Rating**

ASSIGNMENT

Seating ID	**W-Employee ID**	**Start DateTime**	**End DateTime**	**Tips Earned**

EMPLOYEE

Employee ID	**Employee Lname**	**Employee Fname**

WAITER

W-Employee ID	**Hourly Wage**	**M-Employee ID**

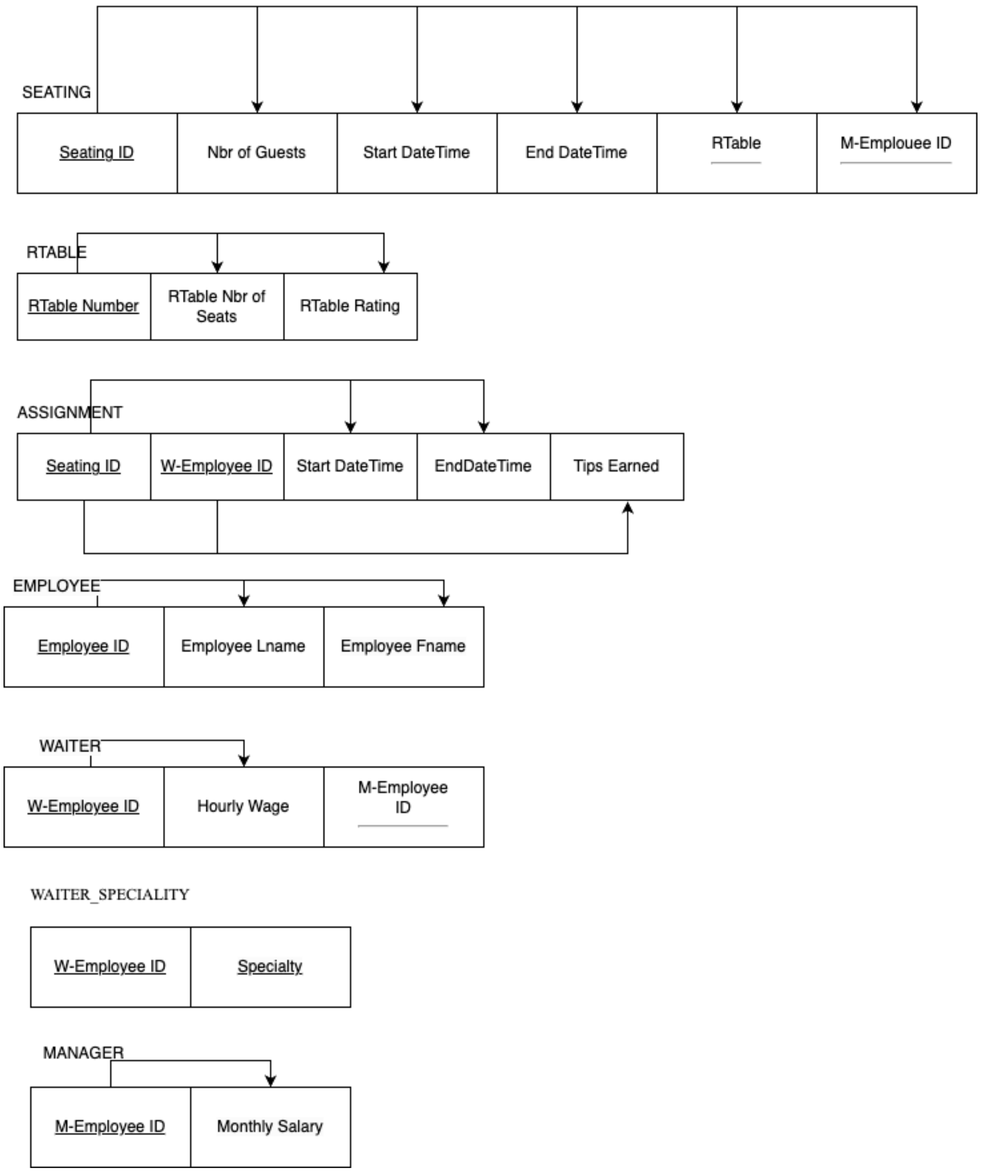
WAITER_SPECIALITY

W-Employee ID	**Specialty**

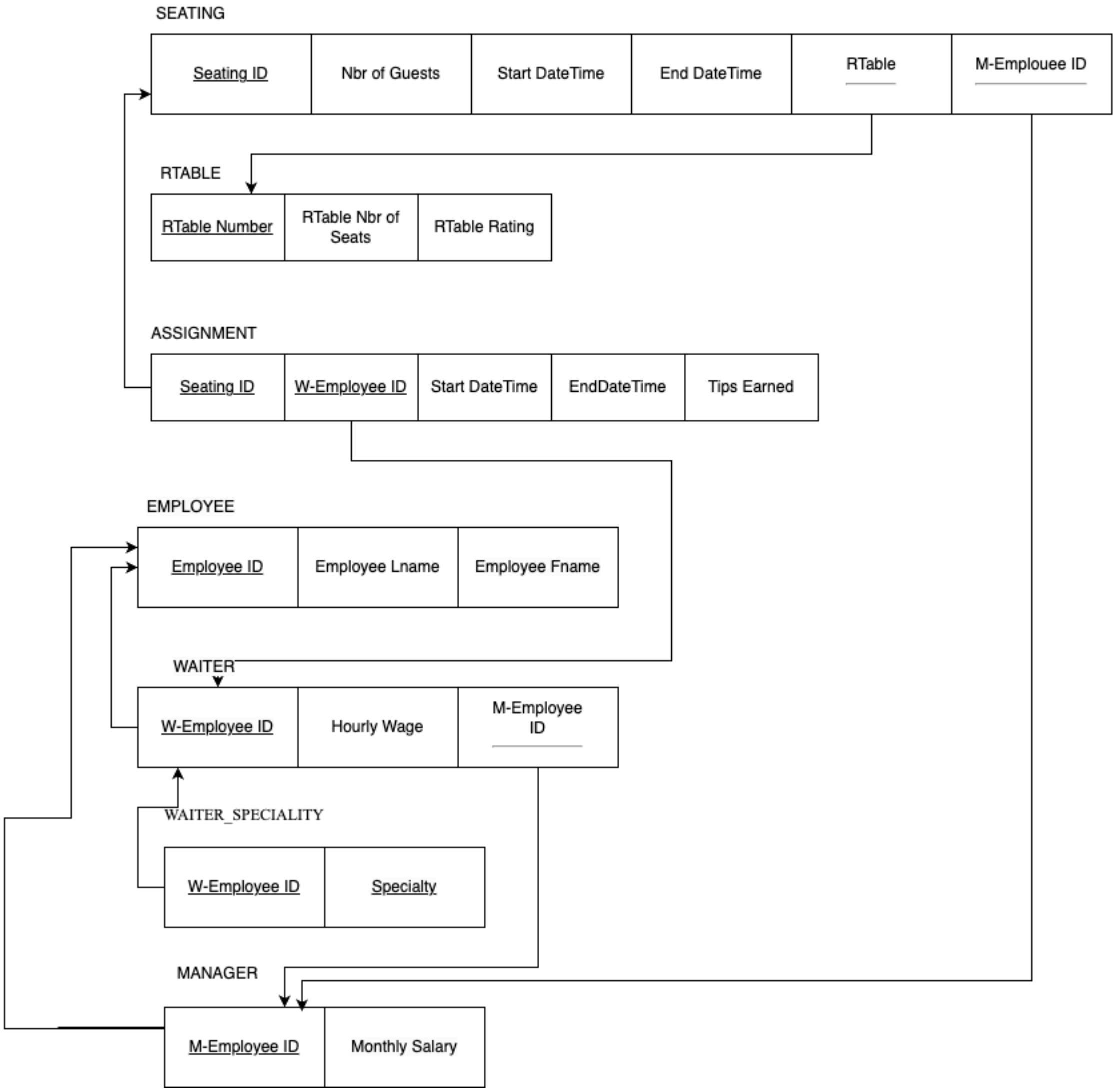
MANAGER

M-Employee ID	**Monthly Salary**

b.


SEATING
Seating ID
Nbr of Guests
Start DateTime
End DateTime
RTable
M-Emplouee ID
RTABLE
RTable Number
RTable Nbr of Seats
RTable Rating
ASSIGNMENT
Seating ID
W-Employee ID
Start DateTime
EndDateTime
Tips Earned
EMPLOYEE
Employee ID
Employee Lname
Employee Fname
WAITER
W-Employee ID
Hourly Wage
M-Employee ID
WAITER_SPECIALITY
W-Employee ID
Specialty
MANAGER
M-Employee ID
Monthly Salary

c.



4-37.

a.

MANIFEST

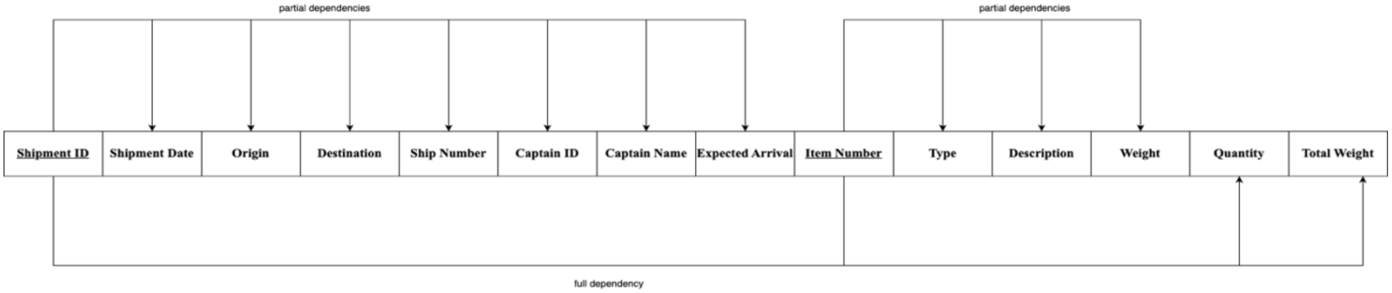
Shipment ID	Shipment Date	Origin	Destination	Ship Number	Captain ID	Captain Name
00-0001	01/10/2018	Boston	Brazil	39	002-15	Henry Moore
00-0001	01/10/2018	Boston	Brazil	39	002-15	Henry Moore

Expected Arrival	Item Number	Type	Description	Weight	Quantity	Total Weight
01/14/2018	3223	BM	Concrete Form	500	100	50000
01/14/2018	3297	BM	Steel Beam	87	2000	174000

b. The relation is in 1NF (First Normal Form) because:

- All attributes are atomic
- There are no repeating groups

c.



Shipment ID	Shipment Date	Origin	Destination	Ship Number	Captain ID	Captain Name	Expected Arrival

SHIPMENT (2NF)

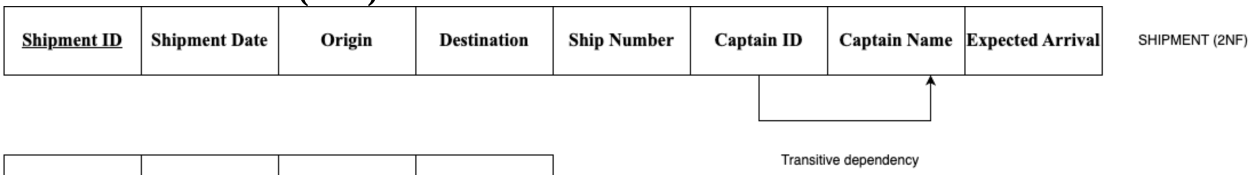
Item Number	Type	Description	Weight

ITEM (2NF)

Shipment ID	Item Number	Quantity	Total Weight

SHIPMENT_ITEM (2NF)

Second Normal Form(2NF)



Shipment ID	Shipment Date	Origin	Destination	Ship Number	Captain ID	Captain Name	Expected Arrival

SHIPMENT (2NF)

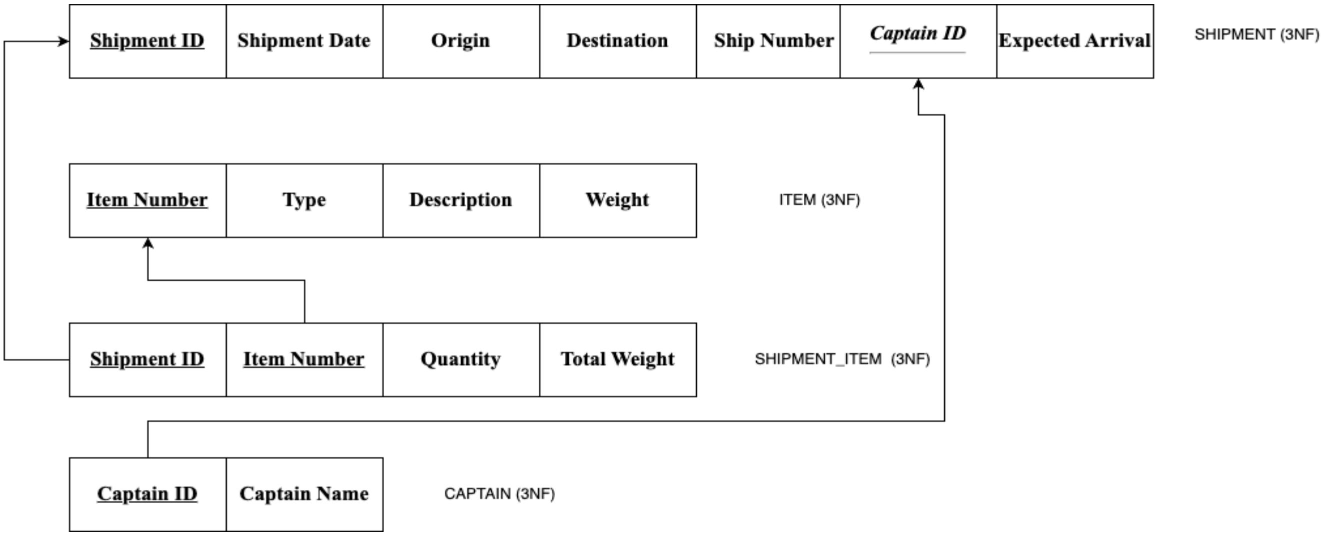
Transitive dependency

Item Number	Type	Description	Weight

ITEM (2NF)

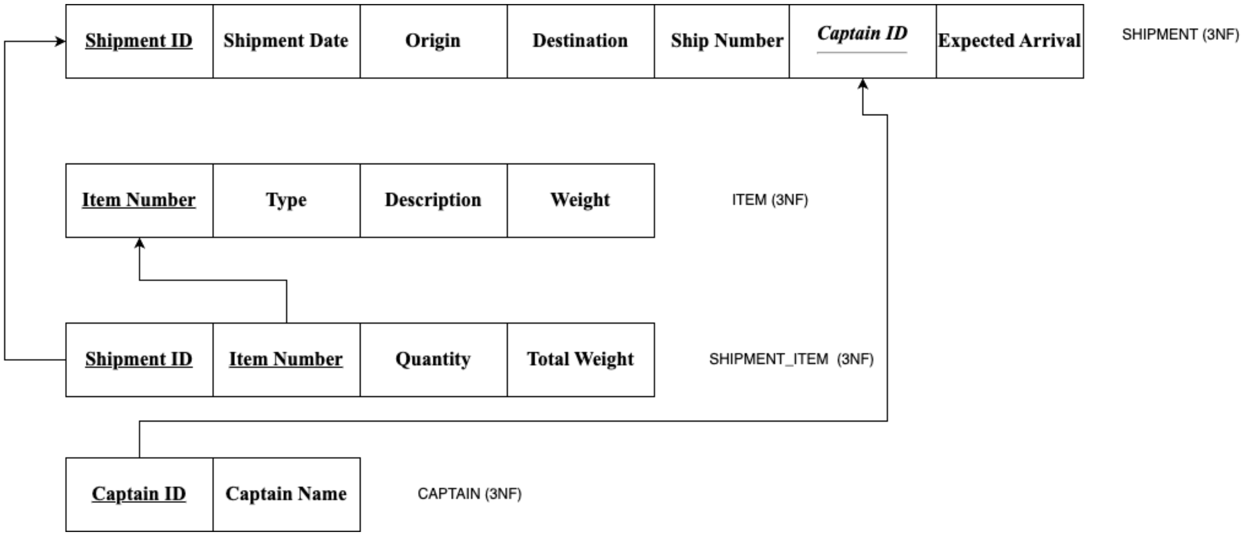
Shipment ID	Item Number	Quantity	Total Weight

SHIPMENT_ITEM (2NF)



Third Normal Form(3NF)

d.

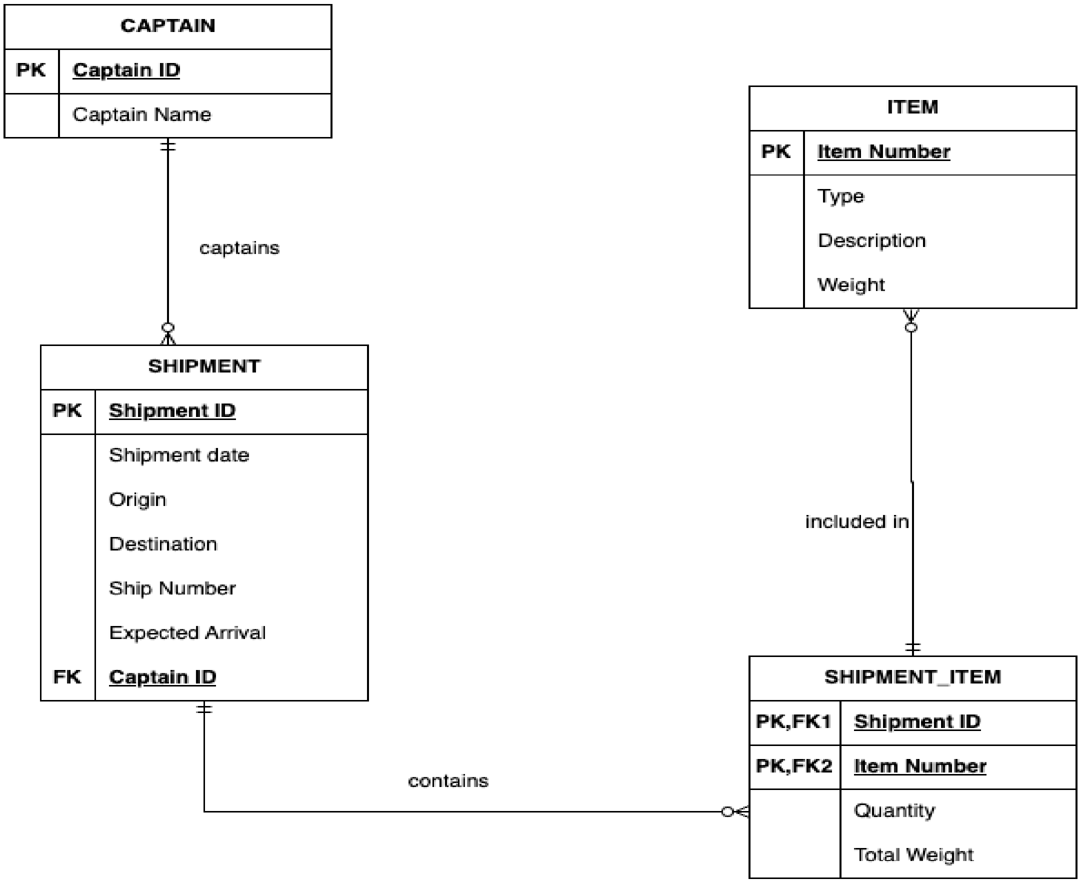


1. SHIPMENT (3NF) Attributes: Shipment_ID (PK), Shipment_Date, Origin, Destination, Ship_Number, Captain_ID (FK), Expected_Arrival
   Primary Key: Shipment_ID, Foreign Key: Captain_ID references CAPTAIN(Captain_ID)
2. ITEM (3NF) Attributes: Item_Number (PK), Type, Description, Weight
   Primary Key: Item_Number
3. SHIPMENT_ITEM (3NF) Attributes: Shipment_ID (PK, FK), Item_Number (PK, FK), Quantity, Total_Weight
   Primary Key: (Shipment_ID, Item_Number) Foreign Keys: Shipment_ID references SHIPMENT(Shipment_ID), Item_Number references ITEM(Item_Number)
4. CAPTAIN (3NF) Attributes: Captain_ID (PK), Captain_Name
   Primary Key: Captain_ID

Referential Integrity Constraints:

1. SHIPMENT.Captain_ID references CAPTAIN.Captain_ID
2. SHIPMENT_ITEM.Shipment_ID references SHIPMENT.Shipment_ID
3. SHIPMENT_ITEM.Item_Number references ITEM.Item_Number

e.



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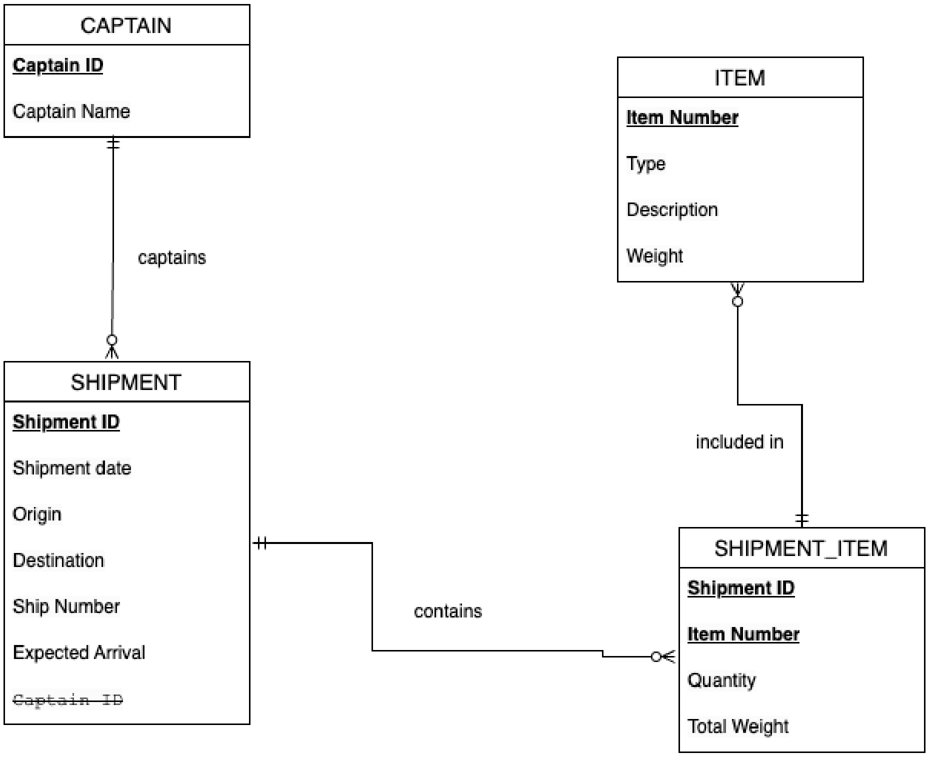

- Each SHIPMENT is captained by one CAPTAIN, indicated by the "captains" relationship between CAPTAIN and SHIPMENT.
- A CAPTAIN can captain multiple SHIPMENTS (one-to-many relationship).
- Each SHIPMENT contains multiple ITEMS, shown by the "contains" relationship between SHIPMENT and SHIPMENT_ITEM.
- An ITEM can be included in multiple SHIPMENTS (many-to-many relationship resolved through the SHIPMENT_ITEM junction table).
- The SHIPMENT_ITEM table serves as a junction table to resolve the many-to-many relationship between SHIPMENT and ITEM.
- SHIPMENT_ITEM includes additional attributes like Quantity and Total Weight specific to each item in a shipment.

References

Hoffer, J. A., Ramesh, V., & Topi, H. (2016). *Modern database management* (13th ed.). Pearson.