UNIVERSITÀ DEGLI STUDI DI PADOVA

DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

Foundations of Databases A.Y. 2021-2022

Homework 2 – Conceptual and Logical Design

Master Degree in Computer Engineering
Master Degree in Cybersecurity
Master Degree in ICT for Internet and Multimedia

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Team acronym	TAGMS	
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Conceptual Design

Variations to the Requirement Analysis

There are no relevant variations to Requirements Analysis.

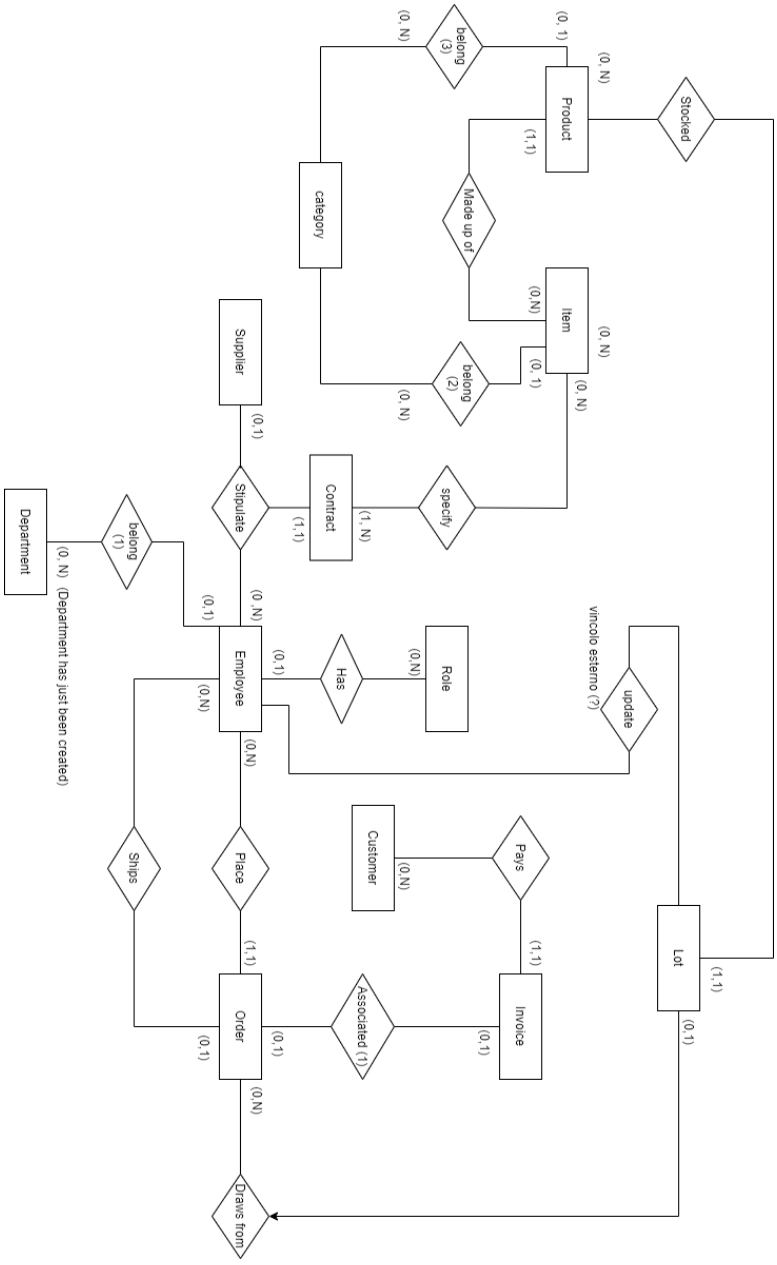

Figure 1: Entity-Relationship schema.

Entity-Relationship Schema

Data Dictionary

Entities Table

Entity	Description	Attributes	Identifier
Employee	Represents data of an employee who works in the company and needs access to the system	• Badge_number • First_name • Last_name • Phone_number • Email_address • Password • Gender • Birth_date • Hiring_date • Role_ID • Department_ID	Badge_number
Role	Represents data on the role of employees who work in the company	• ID • Name • Description	ID
Department	Represents data on the departments in which employees work	• ID • Name • Description	ID

Customer	Represents data about a customer of the company	• ID • Customer_name • Phone_number • Email_address • Address • Registration_date	ID
Contract	Represents data about a contract stipulated between a supplier and a manager for the supply of items	• ID • Name • Description • Agreement_date • Supplier_ID • Employee_ID	ID
Order	Represents the order placed by a salesman for a customer	• ID • Order_date • Customer_ID • Sub_total • Product_name • Product_type • Product_quantity	ID

Payment	Represents the payment made by the customer	• ID • Payment_method • Payment_status • Invoice_ID • Order_ID	ID
Inventory	Represents the inventory of the company, containing products and items	• ID • Element_type • Element_ID • Element_quantity • Storage_ID • Expiration_date • Price	ID
Storage	Represents the physical storages that contain the elements present in the inventory	• ID • Name • Location	ID
Product	Represents the final product that is marketed	• ID • Serial_number • Name • Description • Item_list • Product_category_ID	ID

Product_category	Represents the category of product ready to be sold	• ID • Name • Description	ID
Item	Represents materials provided by suppliers from which the final products will be produced	• ID • Description • Item_category_ID • Supplier_ID • Nutritional_values	ID
Item_category	Represents the category of material provided by suppliers	• ID • Name • Description	ID
Invoice	Represents the invoice associated with the order of a customer	• ID • Total_amount • Product • Quantity	ID

Relationships Table

Relationship	**Description**	**Component Entities**	**Attributes**
Has	Relates each employee to a role	• Employee (0,1) • Role (0,N)	None
Belongs to (1)	Assigns each employee to a department	• Employee (0,1) • Department (0,N)	None

Stocked into	Specifies the items and product stocked in the inventory	• Item (1,1) • Product (0,N)	None
Belongs to (3)	Links product to the category	• Product (0,1) • Category (0,N)	None
Belongs to (2)	Links item to the category	• Item (0,1) • Category (0,N)	None
Made up of	Describes which items are involved into creation to the product	• Item (0,N) • Product (1,1)	None
Stipulate	Links the supplier with the company and the contract stipulated	• Supplier (0,1) • Employee (0,N) • Contract (1,1)	None
Specifies	Describes which items are provided by a contract	• Contract (0,N) • Item (0,N)	None
Ships	Relates the employee shipping the order with the order itself and the shipment details	• Employee (0,N) • Order (0,1)	Tracking number
Place	Links the order made by the employee	• Employee (0,N) • Order (1,1)	None
Associated	Associated the payement to the order	• Invoice (1,1) • Order (1,N)	None

Draws from	Associates the order and the lot	• Order (1,N) • Lot (0,N)	None

External Constraints

- Employees can only insert and modify transactions in their particular department and role (i.e workers assigned in raw materials cannot add finished products transactions)
- Customers coordinate with Salesmen thus, only Salesmen can create Customers' profile, orders and payment and track status
- Employees can only ship orders once payment of Customer has been confirmed
- Products and Items belong in a specific category and must be added correctly by the Employees

Functional Requirements Satisfaction Check

The DBMS has to be able to:

- **store all the details of the employees, customers and suppliers in the organization:** Entities Employee and Role store data related to the employees. Entity Customer has details about the customers and entity Supplier has data related to the Supplier.
- **allow the employees to update their personal information:** Entity Employee has some attributes as Email, Password or Phone Number which can be changed. Employees can access the system using their credentials which are Email and Password and change their personal data.
- **store details of all on-hand products in the warehouse such as item code, item description, quantity and expiration date:** Attributes ID_Product, Description, Expiration_Date from entity Product and ID_Item, Description from entity Item show this data. Secondly the amount of each product is shown in attribute Quantity of entity Inventory.
- **allow the employees to log into the system and enter the inbound items they received with information item code, item description, quantity, expiration date and supplier:** With attributes Email and Password employees log in the application and insert this data in Entities Product,Item and Inventory.
- **show and generate the list of inbound and outbound transactions:** the inbound transactions can be derived from instances of the Contract entity, the outbound transactions can be derived from instances of the Order entity.
- **allow the employees to log into the system and enter the outbound transaction needed for the issuance of the products in the production and shipment to the customers:** Salesman are responsible of entering outbound transactions as instances of the Order entity with proper attributes values, specifically Product_List, Quantities_List (has at index *i* the quantity of purchased items for product at index *i* of Product_List), Address and ID_Order which identifies the instance.

- **inventory stocks will be automatically updated whenever there are inbound and outbound transactions:** the update is executed automatically when an inbound transaction happens by inspecting each ID_Product **x** and associated Quantity Q_x in the relative Contract, then for each said **x** its Quantity attribute in the entity Inventory is increased by Q_x **(if x is not in the inventory?)**. Similarly for outbound transactions, ID_Product and its Quantity attribute value are extracted from the relative Order and the correspondent value is decreased in Inventory.
- **show and generate the current inventory balance or stock inquiries:**
- **receive and process the Customers order, specifying which products they want and respective quantity:** Salesmen who are responsible of making orders check if there is enough quantity of the product. If there is enough, they insert in Entity Order a new row with attributes mentioned in the Entities Table. The attribute Id_order identifies each order.
- **modification and cancellation of orders:** The Costomers can change or cancel the orders given by the employee.
- **allow users to view order and shipment status of finished products:** With the unique tracking number given to the Costomers by the system, the Costomers can get information about the order and shipment.
- **generate invoice whenever payment has been made:** When a customer pays an order, there is an insertion in Entity Invoice. Each invoice is identified by the attribute Id_invoice.
- **permit transfer of items and products:**
- **grant Cycle Counting in order to validate the accuracy of inventory:**
- **re-ordering the previous orders is allowed:** The system allows customers to reorder their orders. that means, the inventory system allows customers to save their orders and access them again.
- **create tracking code for orders:** Attribute ID_Order of Entity Order store an unique identifier of each order. It is shown too in the relationship Ships between Order, Employee and Shipment.

The system must store

- Customer data:
- Employee data with its activity:
- Any action of the employee on the order will be stored on the Order entity.

The system must allow Customers to:

- View orders and shipping specifications
- Customer will be able to check where the order is with the tracking number.

The system must allow Employee to:

- Login to system using the email address and password
- Modify/delete the order
- modify their personal information

Logical Design

Transformation of the Entity-Relationship Schema

Redundancy Analysis

Choice of Principal Identifiers

Analysis of Database Load

Relational Schema

Data Dictionary

Relation	Attribute	Description	Domain	Constraints
Relation 1				
Relation 1				

External Constraints

Group Members Contributions