A5: Relational Schema, validation and schema refinement

Our project features an information system capable of supporting an online store, which would allow users to buy products from a wide range of categories. In this artefact we present its Relational Schema which was obtained by mapping its UML Conceptual Data Model.

1 Relational Schema

R01	user(id, username **UK NN**, firstName **NN**, lastName **NN**, email **UK NN**, password **NN**, imageURL **NN**, dateCreated **NN DF** Today, dateModified **NN**, active **NN**)
R02	client(id → user, NIF **NN**, celphoneNumber, id_cart → cart, id_chat → chat)
R03	brandManager(id → user)
R04	chatSupport(id → user)
R05	admin(id → brandManager)
R06	product(id, name **UK NN**, quantityInStock **NN DF** 0, dateCreated **NN DF** Today, modelNumber **NN**, weight **NN**, dimensions **NN**, price **NN**, imageURL **UK NN**, bigDescription **NN**, shortDescription **NN**, id_brand → brand **NN**, id_category → productCategory **NN**)
R07	cart(id)
R08	cartProduct(id_product → product, id_cart → cart, quantity **NN CK** quantity > 0)
R09	productReview(id , textReview **NN**, rating **NN CK** rating ≤ 5 & rating ≥ 0, reviewDate **NN DF** Today, idClient → client,id_product → product, id_purchase → purchase)
R10	productCategory(id , categoryName **NN UK**)
R11	wishlist(id, id_client → client **UK NN**)
R12	productWishlist(id_product → product, id_wishlist → wishlist)
R13	address(id , addressName **NN**, country **NN**, city **NN**, state **NN**, zipCode **NN**)
R14	clientAddress(id_client → client, id_address → address)
R15	purchase(id , purchaseDate **NN**, purchaseState **NN**, cost **NN CK** cost >= 0, paymentType **NN**, cardNumber **NN**, cardName **NN**, cardExpirationDate **NN CK** cardExpirationDate > purchaseDate, id_address → address **NN**, id_client → client **NN**)
R16	purchaseProduct(id_purchase → purchase, id_product → product, cost **NN CK** cost > 0, quantity **NN CK** quantity > 0)
R17	brand(id, name **NN UK**, storeContact)
R18	brandBrandManager(id_brand → brand, id_brandManager → brandManager)
R19	ban(id_client → bannedUser, id_admin → admin, banDate **NN DF** Today)
R20	chat(id, id_chatSupport → chatSupport)
R21	message(id, message **NN**, dateSent **NN DF** Today, sender **NN CK** sender **IN** Senders, id_chat → chat **NN**)

Table 1: Relational Schema

2 Domain

Today	DATE DEFAULT CURRENT DATE
Senders	ENUM('Client', 'ChatSupport')

Table 2: Domains

3 Functional Dependencies and Schema Validation

Table R01 (user)	
Keys: {id, username, email}	
Functional Dependencies	
FD0101	{id} → {username, email, firstName, lastName, password, imageURL, dateCreated, dateModified, active}
FD0102	{username} → {id, email, firstName, lastName, password, imageURL, dateCreated, dateModified, active}
FD0103	{email} → {id, username, firstName, lastName, password, imageURL, dateCreated, dateModified, active}
Normal Form	BCNF

Table 3: R01 Dependencies

Table R02 (client)	
Keys: {id}	
Functional Dependencies	
FD0201	{id} → {NIF, cellphoneNumber, id_cart, id_chat}
Normal Form	BCNF

Table 4: R02 Dependencies

Table R03 (brandManager)	
Keys: {id}	
Functional Dependencies	
none	
Normal Form	BCNF

Table 5: R03 Dependencies

Table R04 (chatSupport)	
Keys: {id}	
Functional Dependencies	
none	
Normal Form	BCNF

Table 6: R04 Dependencies

Table R05 (admin)	
Keys: {id}	
Functional Dependencies	
none	
Normal Form	BCNF

Table 7: R05 Dependencies

Table R06 (product)	
Keys: {id, name, imageURL}	
Functional Dependencies	
FD0601	{id} → {name, imageURL, quantityInStock, dateCreated, modelNumber, weight, price, bigDescription, shortDescription, id_brand, id_productCategory }
FD0602	{name} → {id, imageURL, quantityInStock, dateCreated, modelNumber, weight, price, bigDescription, shortDescription, id_brand, id_productCategory }
FD0603	{imageURL} → {id, name, quantityInStock, dateCreated, modelNumber, weight, price, bigDescription, shortDescription, id_brand, id_productCategory }
Normal Form	BCNF

Table 8: R06 Dependencies

Table R07 (cart)	
Keys: {id}	
Functional Dependencies	
none	
Normal Form	BCNF

Table 9: R07 Dependencies

Table R08 (cartProduct)	
Keys: {id_cart, id_product}	
Functional Dependencies	
FD0801	{id_cart, id_product} → {quantity}
Normal Form	BCNF

Table 10: R08 Dependencies

Table R09 (productReview)	
Keys: {id}	
Functional Dependencies	
FD0901	{id} → {textReview, rating, reviewDate, id_client, id_product, id_purchase}
Normal Form	BCNF

Table 11: R09 Dependencies

Table R10 (productCategory)	
Keys: {id, categoryName}	
Functional Dependencies	
FD1001	{id} → {categoryName}
FD1002	{categoryName} → {id}
Normal Form	BCNF

Table 12: R10 Dependencies

Table R11 (wishlist)	
Keys: {id, id_client }	
Functional Dependencies	
FD1101	{id} → {id_client}
FD1102	{id_client} → {id}
Normal Form	BCNF

Table 13: R11 Dependencies

Table R12 (productWishlist)	
Keys: {id_product, id_wishlist }	
Functional Dependencies	
none	
Normal Form	BCNF

Table 14: R12 Dependencies

Table R13 (address)	
Keys: {id}	
Functional Dependencies	
FD1301	{id} → {addressName, city, country, state, zipCode}
Normal Form	BCNF

Table 15: R13 Dependencies

Table R14 (clientAddress)	
Keys: {id_client, id_address }	
Functional Dependencies	
none	
Normal Form	BCNF

Table 16: R14 Dependencies

Table R15 (purchase)	
Keys: {id}	
Functional Dependencies	
FD1501	{id} → {purchaseDate, purchaseState, cost, paymentType, cardNumber, cardName, cardExpirationDate, id_address, id_client}
Normal Form	BCNF

Table 17: R15 Dependencies

Table R16 (purchaseProduct)	
Keys: {id_purchase, id_product}	
Functional Dependencies	
FD1601	{id_purchase, id_product} → {cost, quantity}
Normal Form	BCNF

Table 18: R16 Dependencies

Table R17 (brand)	
Keys: {id, name}	
Functional Dependencies	
FD1701	{id} → {name, storeContact}
FD1702	{name} → {id, storeContact}
Normal Form	BCNF

Table 19: R17 Dependencies

Table R18 (brandBrandManager)	
Keys: {id_brand, id_brandManager }	
Functional Dependencies	
none	
Normal Form	BCNF

Table 20: R18 Dependencies

Table R19 (ban)	
Keys: {id_client}	
Functional Dependencies	
FD1901	{id_client} → {id_admin, banDate}
Normal Form	BCNF

Table 21: R19 Dependencies

Table R20 (chat)	
Keys: {id}	
Functional Dependencies	
FD2001	{id} → {id_chatSupport}
Normal Form	BCNF

Table 22: R20 Dependencies

Table R21 (message)	
Keys: {id}	
Functional Dependencies	
FD2101	{id} → {message, dateSent, sender, id_chat}
Normal Form	BCNF

Table 23: R21 Dependencies

4 SQL Code

```
--Tables

CREATE TABLE users (
  id SERIAL PRIMARY KEY,
  firstName TEXT NOT NULL,
  lastName TEXT NOT NULL,
  username TEXT NOT NULL UNIQUE,
  email TEXT NOT NULL UNIQUE,
  password TEXT NOT NULL,
  imageURL TEXT NOT NULL,
  dateCreated TIMESTAMP DEFAULT now() NOT NULL,
  dateModified TIMESTAMP NOT NULL,
  active BOOLEAN NOT NULL
);

CREATE TABLE chatSupport (
  id INTEGER PRIMARY KEY REFERENCES users
);

CREATE TABLE chat (
  id SERIAL PRIMARY KEY,
  id_chatSupport INTEGER REFERENCES chatSupport
);

CREATE TABLE message (
  id SERIAL PRIMARY KEY,
  message TEXT NOT NULL,
  dateSent TIMESTAMP DEFAULT now() NOT NULL,
  id_chat INTEGER NOT NULL REFERENCES chat,
  sender TEXT NOT NULL CHECK (((sender = 'chatSupport') OR (sender = 'client')))
);

CREATE TABLE cart (
  id SERIAL PRIMARY KEY
);

CREATE TABLE client (
  id INTEGER PRIMARY KEY REFERENCES users,
  nif INTEGER NOT NULL,
  cellphone INTEGER,
  id_chat INTEGER REFERENCES chat,
  id_cart INTEGER REFERENCES cart
);

CREATE TABLE brand (
  id SERIAL PRIMARY KEY,
  name TEXT NOT NULL UNIQUE,
  contact INTEGER NOT NULL
);

CREATE TABLE brandManager (
  id INTEGER PRIMARY KEY REFERENCES users
);

CREATE TABLE admin (
  id INTEGER PRIMARY KEY REFERENCES brandManager
);

CREATE TABLE ban (
  id_client INTEGER PRIMARY KEY REFERENCES users,
  id_admin INTEGER REFERENCES admin NOT NULL,
  banDate TIMESTAMP DEFAULT now() NOT NULL
);

CREATE TABLE productcategory (
  id SERIAL PRIMARY KEY,
  categoryName TEXT NOT NULL UNIQUE
);

CREATE TABLE product (
  id SERIAL PRIMARY KEY,
  name TEXT UNIQUE NOT NULL,
  quantityInStock INTEGER NOT NULL DEFAULT 0,
  dateCreated TIMESTAMP DEFAULT now() NOT NULL,
  modelNumber INTEGER NOT NULL,
  weight DECIMAL NOT NULL,
  price MONEY NOT NULL,
  imageURL TEXT NOT NULL UNIQUE,
  bigDescription TEXT NOT NULL,
  shortDescription TEXT NOT NULL,
  id_brand INTEGER NOT NULL REFERENCES brand,
  id_category INTEGER NOT NULL REFERENCES productcategory
);

CREATE TABLE wishlist (
  id SERIAL PRIMARY KEY,
  id_client INTEGER REFERENCES client UNIQUE NOT NULL
);

CREATE TABLE productwishlist (
  id_product INTEGER REFERENCES product,
  id_wishlist INTEGER REFERENCES wishlist,
  PRIMARY KEY(id_product, id_wishlist)
);

CREATE TABLE cartproduct (
  id_cart INTEGER REFERENCES cart,
  id_product INTEGER REFERENCES product,
  quantity INTEGER NOT NULL CHECK (quantity > 0),
  PRIMARY KEY(id_cart, id_product)
);

CREATE TABLE address (
  id SERIAL PRIMARY KEY,
  address TEXT NOT NULL,
  city TEXT NOT NULL,
  country TEXT NOT NULL,
  state TEXT NOT NULL,
  zipcode TEXT NOT NULL
);

CREATE TABLE clientaddress (
  id_client INTEGER REFERENCES client,
  id_address INTEGER REFERENCES address,
  PRIMARY KEY(id_client, id_address)
);

CREATE TABLE purchase (
  id SERIAL PRIMARY KEY,
  id_client INTEGER REFERENCES client NOT NULL,
  id_address INTEGER REFERENCES address NOT NULL,
  purchaseDate TIMESTAMP DEFAULT now() NOT NULL,
  purchaseState TEXT NOT NULL,
  paymentType TEXT NOT NULL,
  cardNumber TEXT NOT NULL UNIQUE,
  cardName TEXT NOT NULL,
  cardExpirationDate TIMESTAMP NOT NULL,
  CHECK (cardExpirationDate > purchaseDate)
);

CREATE TABLE purchaseproduct (
  id_purchase INTEGER REFERENCES purchase,
  id_product INTEGER REFERENCES product,
  quantity INTEGER NOT NULL CHECK (quantity > 0),
  cost INTEGER NOT NULL CHECK (cost > 0),
  PRIMARY KEY(id_purchase, id_product)
);

CREATE TABLE productreview (
  id SERIAL PRIMARY KEY,
  id_product INTEGER REFERENCES product,
  id_client INTEGER REFERENCES client,
  id_purchase INTEGER REFERENCES purchase,
  reviewDate TIMESTAMP DEFAULT now() NOT NULL,
  textReview TEXT NOT NULL,
  rating INTEGER NOT NULL CHECK (((rating >= 0) AND (rating <= 5)))
);

CREATE TABLE brandBrandManager (
  idBrand INTEGER REFERENCES brand,
  idBrandManager INTEGER REFERENCES brandManager,
  PRIMARY KEY(idBrand, idBrandManager)
);
```

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