# 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(<u>id</u>, username **UK NN**, firstName **NN**, lastName **NN**, email **UK NN**, password **NN**, imageURL **NN**, dateCreated **NN DF** Today, dateModified **NN**, active **NN**) |
| R02 | client(<u>id</u> → user, NIF **NN**, celphoneNumber, id_cart → cart, id_chat → chat) |
| R03 | brandManager(<u>id</u> → user) |
| R04 | chatSupport(<u>id</u> → user) |
| R05 | admin(<u>id</u> → brandManager) |
| R06 | product(<u>id</u>, 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(<u>id</u>) |
| R08 | cartProduct(<u>id_product</u> → product, <u>id_cart</u> → cart, quantity **NN CK** quantity > 0) |
| R09 | productReview(<u>id</u>, textReview **NN**, rating **NN CK** rating ≤ 5 & rating ≥ 0, reviewDate **NN DF** Today, idClient → client, id_product → product, id_purchase → purchase) |
| R10 | productCategory(<u>id</u>, categoryName **NN UK**) |
| R11 | wishlist(<u>id</u>, id_client → client **UK NN**) |
| R12 | productWishlist(<u>id_product</u> → product, <u>id_wishlist</u> → wishlist) |
| R13 | address(<u>id</u>, addressName **NN**, country **NN**, city **NN**, state **NN**, zipCode **NN**) |
| R14 | clientAddress(<u>id_client</u> → client, <u>id_address</u> → address) |
| R15 | purchase(<u>id</u>, 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(<u>id_purchase</u> → purchase, <u>id_product</u> → product, cost **NN CK** cost > 0, quantity **NN CK** quantity > 0) |
| R17 | brand(<u>id</u>, name **NN UK**, storeContact) |
| R18 | brandBrandManager(<u>id_brand</u> → brand, <u>id_brandManager</u> → brandManager) |
| R19 | ban(<u>id_client</u> → bannedUser, id_admin → admin, banDate **NN DF** Today) |
| R20 | chat(<u>id</u>, id_chatSupport → chatSupport) |
| R21 | message(<u>id</u>, 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} → {firstName, lastName, password, imageURL, dateCreated, dateModified, active} |
| FD0102 | {username} → {firstName, lastName, password, imageURL, dateCreated, dateModified, active} |
| FD0103 | {email} → {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} → {quantityInStock, dateCreated, modelNumber, weight, price, bigDescription, shortDescription, id_brand, id_productCategory } |
| FD0602 | {name} → {quantityInStock, dateCreated, modelNumber, weight, price, bigDescription, shortDescription, id_brand, id_productCategory } |
| FD0603 | {imageURL} → {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} | |
| **Functional Dependencies** | |
| FD1001 | {id} → {categoryName} |
| **Normal Form** | BCNF |

Table 12: R10 Dependencies

| **Table R11** (wishlist) | |
|---|---|
| **Keys**: {id} | |
| **Functional Dependencies** | |
| FD1101 | {id} → {id_client} |
| **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** (wishlist) | |
|---|---|
| **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} → {storeContact} |
| FD1702 | {name} → {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

```sql
--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,
```

```sql
  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)
);
```