Designing App

CT60A4304: Basic of Database System

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1. Introduction:

a) Motivation for choosing a particular domain

- The reason we created this app is to serve two main audiences: users and distributors.
- For users: Users can use coupons to receive store incentives and save a large amount of money. Also, they have the opportunity to explore the shops in the vicinity of where they live.
- For distributors: Through the use of the app, stores will have the opportunity to promote their stores and reach out to a new customer base while retaining existing ones.

b) The general description of the domain

We're building an app that provides users with the best discounts online and in the set area. The user can set the area they live in, the categories they are interested in. The app's algorithm will then showcase the best discounts to the users. . This helps the users to save money and time while providing the opportunity for businesses to draw in more customers and leads.

c) Elicit the business rules of the domain, e.g., involved entities, certain limitations, or relationships.

Business rule:

- Customers choose their location and choose the items they are interested in to receive coupons such as: food, travel or services
- Stores will upload store coupons with information, location and time of application
- After choosing, customers will come to use coupons with the service that the store provides
- The software can calculate the options that customers will need in the future and send coupons of stores to customers near them.
- The software needs to ensure the confidentiality of the information provided by the customer and, at the same time, ensure the number of coupons that the store has given to avoid the cost damage that the store encounters.

Entities:

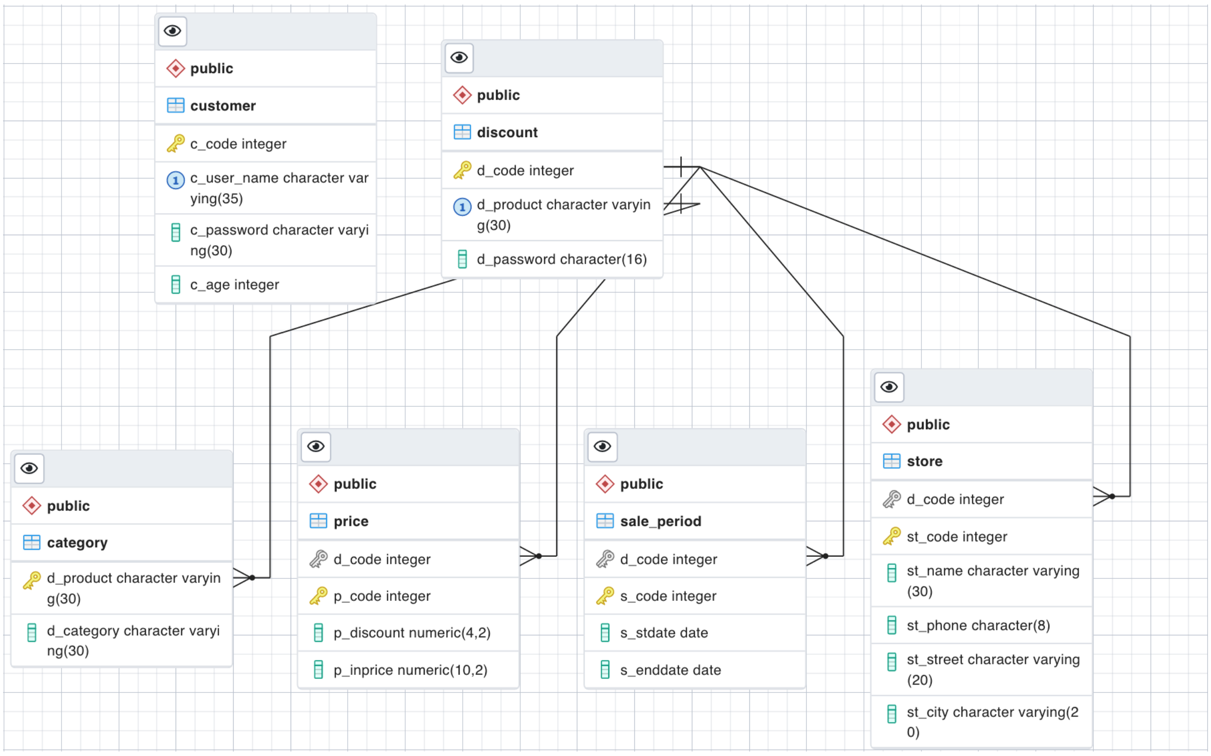
- CUSTOMER
- STORE

- PRICE
- SALE PERIOD
- DISCOUNT
- CATEGORY

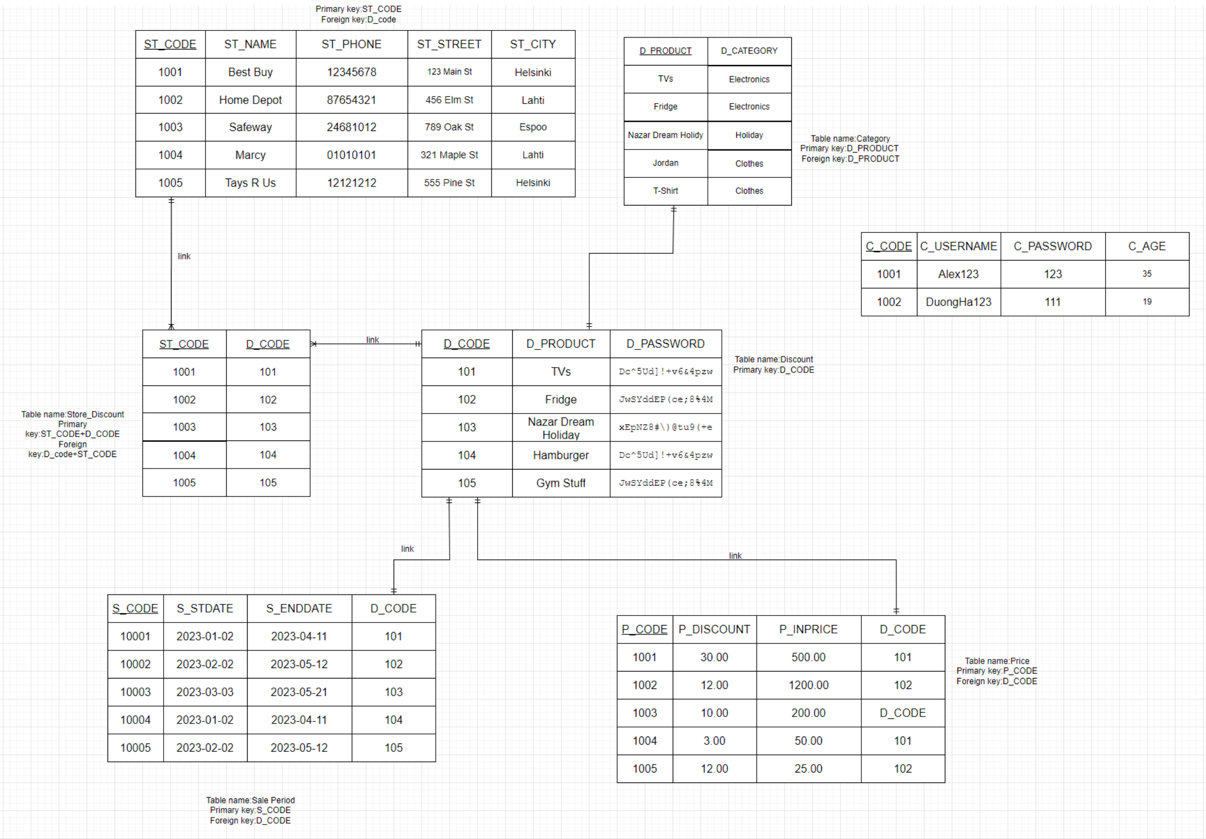
Limitations

- The software can be hacked through which customer information such as name, date of birth, email or address is exposed and used for malicious purposes.
- The software may have problems such as expired coupons not being updated leading to customer misunderstanding thereby reducing customer experience or incorrect coupon numbers leading to loss of in profit of the store.
- Because when operating the app in Finland, the number of users is limited, so the number of discounts will not be much and the number of customers that the company can reach will not be too significant.
- Small company with limited resources for marketing and expansion

2. The ERD of the real-world problem.



3. The relational model, transformed from the ERD



Primary key:ST_CODE
Foreign key:D_code

ST_CODE	ST_NAME	ST_PHONE	ST_STREET	ST_CITY
1001	Best Buy	12345678	123 Main St	Helsinki
1002	Home Depot	87654321	456 Elm St	Lahti
1003	Safeway	24681012	789 Oak St	Espoo
1004	Marcy	01010101	321 Maple St	Lahti
1005	Tays R Us	12121212	555 Pine St	Helsinki

D_PRODUCT	D_CATEGORY
TVs	Electronics
Fridge	Electronics
Nazar Dream Holidy	Holiday
Jordan	Clothes
T-Shirt	Clothes

Table name:Category
Primary key:D_PRODUCT
Foreign key:D_PRODUCT

C_CODE	C_USERNAME	C_PASSWORD	C_AGE
1001	Alex123	123	35
1002	DuongHa123	111	19

ST_CODE	D_CODE
1001	101
1002	102
1003	103
1004	104
1005	105

Table name:Store_Discount
Primary
key:ST_CODE+D_CODE
Foreign
key:D_code+ST_CODE

D_CODE	D_PRODUCT	D_PASSWORD
101	TVs	Dc^5Ud]!+v6&4pzw
102	Fridge	JwSYddEP(ce;8%4M
103	Nazar Dream Holiday	xEpNZ8#\)@tu9(+e
104	Hamburger	Dc^5Ud]!+v6&4pzw
105	Gym Stuff	JwSYddEP(ce;8%4M

Table name:Discount
Primary key:D_CODE

S_CODE	S_STDATE	S_ENDDATE	D_CODE
10001	2023-01-02	2023-04-11	101
10002	2023-02-02	2023-05-12	102
10003	2023-03-03	2023-05-21	103
10004	2023-01-02	2023-04-11	104
10005	2023-02-02	2023-05-12	105

Table name:Sale Period
Primary key:S_CODE
Foreign key:D_CODE

P_CODE	P_DISCOUNT	P_INPRICE	D_CODE
1001	30.00	500.00	101
1002	12.00	1200.00	102
1003	10.00	200.00	D_CODE
1004	3.00	50.00	101
1005	12.00	25.00	102

Table name:Price
Primary key:P_CODE
Foreign key:D_CODE

4.

These are the improvements we used to our DB structure:

- Indexing: We use the improvement because indexing may significantly enhance a database system's efficiency, scalability, and reliability, making it a crucial tool for optimizing big and complicated queries.

  In this project, when creating table by using SQL in PgAdmin4, we already added an index on STORE(ST_CITY), there are following reasons:

  - We use the query “where” clause on ST_CITY column
  - The “STORE” table has many rows and many attributes
  - In the future, ST_CITY would get more different values => high sparsity, for example more cities in Viet Nam, US, UK,....

  ```
  Code: CREATE INDEX CityIndex ON STORE(ST_CITY);
  ```

- Normalization: we use normalization to arrange the active tables smoothly in order to minimize the amount of common data, thereby helping the data in the machine to be processed optimally and customers can see the necessary information in a clear and understandable manner

  In this project, for example, to eliminate transitive dependencies, we created a new table for D_PRODUCT and D_CATEGORY, because the category depends on the product, as you can see in our relation model.

- SQL Injection: To prevent the hacker from having the information of our table, we avoid passing directly input from users as string into the query. Instead, we use “?” in place of variables so that we can validate the parameters before inserting them into the query.
  For example this line of code:
  st=con.prepareStatement("SELECT D_PASSWORD FROM DISCOUNT WHERE D_CODE = ?");
  st.setInt(1, Integer.parseInt(textField.getText()));
  rs = st.executeQuery();

5.Brief description of the application/program that you develop to interact with the database

I.Which programming language have you chosen?

- Java language:
- First, our team chose Java because it is a language that can work well with large amounts of data and interacts well with databases in PostgreSQL so that we can easily interact with this data.
- Second, Java is a language that we are learning and easy to use through which we can do a project to reinforce the learning process.
- Finally, Java is a language that can run on many different operating systems, typically Windows and MacOS. Thereby, the software we create can be designed to run on many different platforms.
- SQL language:
- Choose SQL because with this software will have to store and retrieve a large amount of data linked together provided by both customer and salesperson, so choosing SQL will be the most optimal to operate.
- Java Swing
- Using Java Swing will create an easy-to-interact user interface and optimize with Java, thereby showing all the data processed in Java.

II.A list of the SQL queries implemented in the program.

- INSERT INTO CUSTOMER (C_USER_NAME,

C_PASSWORD, C_AGE) VALUES (?, ?, ?)

- SELECT * FROM DISCOUNT JOIN STORE ON STORE.D_CODE = DISCOUNT.D_CODE JOIN PRICE ON PRICE.D_CODE = DISCOUNT.D_CODE JOIN SALE_PERIOD ON SALE_PERIOD.D_CODE = DISCOUNT.D_CODE JOIN CATEGORY ON CATEGORY.D_PRODUCT = DISCOUNT.D_PRODUCT WHERE D_CATEGORY = ? AND ST_CITY = ?
- SELECT D_PASSWORD FROM DISCOUNT WHERE D_CODE = ?
- DELETE FROM DISCOUNT WHERE D_CODE = ?
- INSERT INTO DISCOUNT (D_PRODUCT, D_PASSWORD) VALUES (?, ?) RETURNING D_CODE;
- INSERT INTO CATEGORY (D_PRODUCT, D_CATEGORY) VALUES (?, ?)
- INSERT INTO PRICE (D_CODE, P_DISCOUNT, P_INPRICE) VALUES (?, ?, ?)
- INSERT INTO STORE (D_CODE, ST_NAME, ST_PHONE, ST_STREET, ST_CITY) VALUES (?, ?, ?, ?, ?)
- INSERT INTO SALE_PERIOD (D_CODE, S_STDATE, S_ENDDATE) VALUES (?, ?, ?)
- UPDATE PRICE SET P_DISCOUNT = ?, P_INPRICE = ? WHERE D_CODE = ?
- UPDATE SALE_PERIOD SET S_STDATE = ?, S_ENDDATE = ? WHERE D_CODE = ?

III.What kind of end-user requirements are you meeting with these SQL queries? Write the imagined scenarios (per the chosen domain and its business rules) or questions from the end-user perspective, e.g., what kind of information or changes they need or want with the stored data.

- First, the user will choose whether they are a customer or a salesperson, thereby giving different processing directions.
- If the user selects a customer, the header software will display a page for them to register. Here users can register by entering their Username, Password and age. All this information will be saved in the system and remembered for the next login. Based on the information in the data, the software will compare to determine whether the account and password already exist, thereby avoiding data duplication. If they already have an account, the user can choose to log in by clicking the "click here" button just below the "You already have an account" section through which the user just needs to enter the Username and Password to be able to log in.
- After successful login the user is taken to the homepage. Here they need to select the Category they are interested in in the top left corner and the city they live in in the top right corner through which the system will calculate to give appropriate coupons based on these two information. After seeing the necessary coupons users need to remember "Discount code" or "D_CODE" and click next there they need to enter the "Discount code" to get the password and bring it to the store to be able to use the discount .
- For users who choose a salesperson, the system will give two options if they want to update i.e. edit an existing discount or they want to create a new discount. If users choose to create a new discount, they need to fill in all information including: company name, phone number, company address, city, product name, which category, discount password, discount, initial price, application start date and end date. As for the update option, users can edit the price that their discount offers or the available time for the discount.If the user chooses to edit the price that the discount offers, they will have to enter the D_CODE or DISCOUNT CODE then edit the discount and the original price of the product. If they edit the time, they also need to enter the D_CODE or DISCOUNT CODE then select the release date and end date in YYYY-MM-DD format.