Part 1. Database Design

Diagram

categories
name	varchar(255)
category_id	integer

users
email	varchar(255)
password_hash	varchar(255)
full_name	varchar(255)
address	text
balance	numeric(10,2)
user_id	integer

orders
user_id	integer
total_amount	numeric(10,2)
order_date	timestamp
status	varchar(50)
order_id	integer

products
name	varchar(255)
description	text
image_url	varchar(255)
price	numeric(10,2)
category_id	integer
created_by_user_id	integer
product_id	integer

seller_reviews
user_id	integer
seller_id	integer
rating	integer
comment	text
created_at	timestamp
updated_at	timestamp
review_id	integer

carts
user_id	integer
created_at	timestamp
updated_at	timestamp
cart_id	integer

order_items
order_id	integer
product_id	integer
seller_id	integer
quantity	integer
price_at_purchase	numeric(10,2)
fulfillment_status	varchar(50)
fulfillment_date	timestamp
order_item_id	integer

product_reviews
user_id	integer
product_id	integer
rating	integer
comment	text
created_at	timestamp
updated_at	timestamp
review_id	integer

inventories
quantity	integer
seller_id	integer
product_id	integer

cart_items
cart_id	integer
product_id	integer
seller_id	integer
quantity	integer
cart_item_id	integer

messages
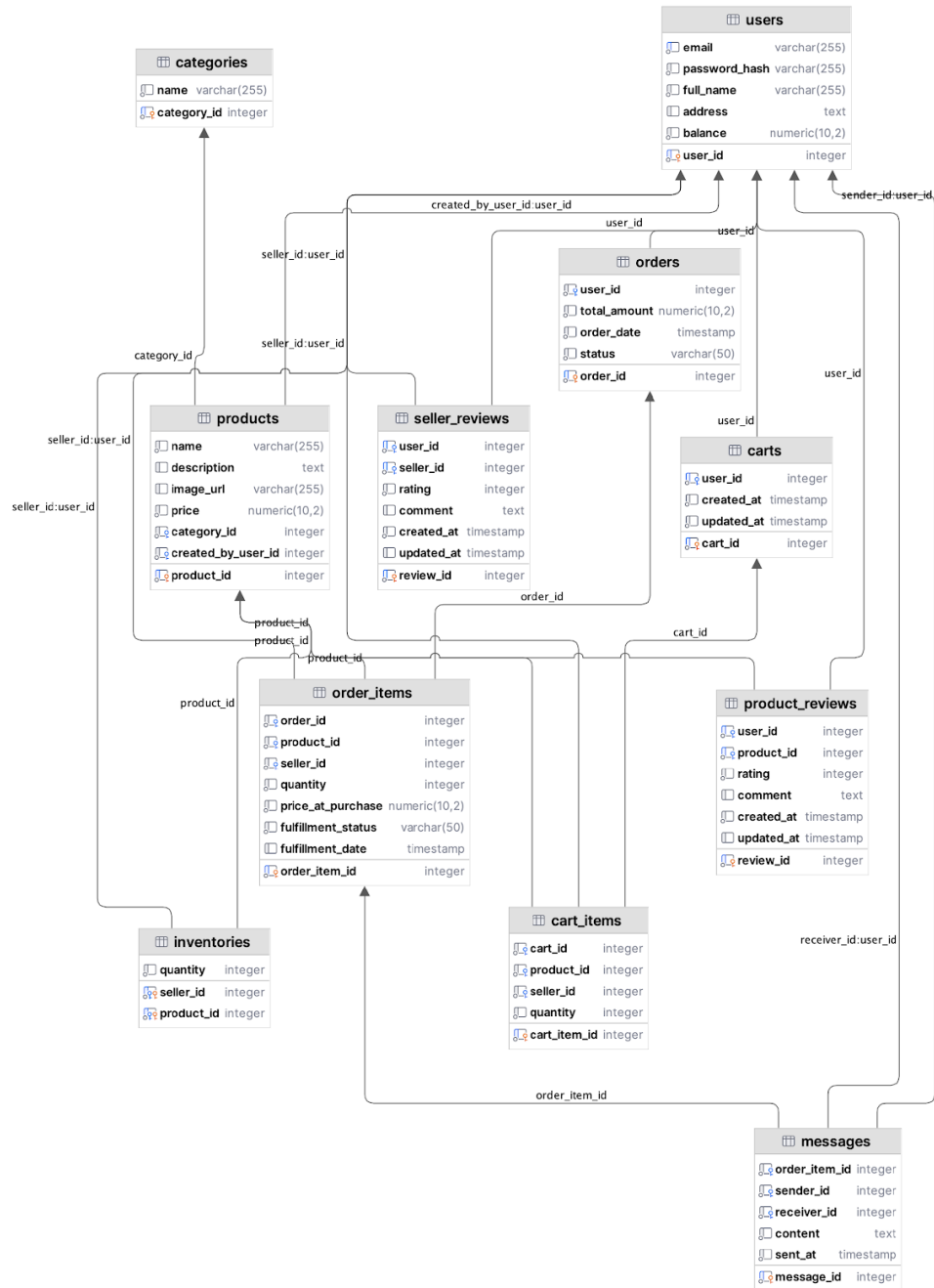|	
order_item_id	integer
sender_id	integer
receiver_id	integer
content	text
sent_at	timestamp
message_id	integer

Tables and Constraints

1. Users Table

- **Purpose:** Stores essential account information for both users and sellers.
- **Fields:**
  - `user_id` (Primary Key, SERIAL) – Unique identifier (auto-incremented).
  - `email` (VARCHAR, UNIQUE) – User's email address (serves as login credential).
  - `password_hash` (VARCHAR) – Securely hashed version of the user's password.
  - `full_name` (VARCHAR) – User's full name.
  - `address` (TEXT) – Residential or business address.
  - `balance` (DECIMAL, default=0) – Account balance.
- **Constraints:**
  - `email` must be unique.
  - Balance starts at $0.
  - A user can act as both a buyer and a seller.

2. Categories Table

- **Purpose:** Defines a structured classification for products.
- **Fields:**
  - `category_id` (Primary Key, SERIAL) – Unique identifier.
  - `name` (VARCHAR) – Category name (e.g., "Electronics", "Clothing").
- **Constraints:**
  - Categories are predefined and cannot be created by users.

3. Products Table

- **Purpose:** Stores product listings created by sellers.
- **Fields:**
  - `product_id` (Primary Key, SERIAL) – Unique identifier.
  - `name` (VARCHAR) – Product name.
  - `description` (TEXT) – Detailed product description.

- `image_url` (VARCHAR) – URL link to the product image.
- `price` (DECIMAL) – Current price.
- `category_id` (Foreign Key → `categories.category_id`) – Associated product category.
- `created_by_user_id` (Foreign Key → `users.user_id`) – Seller who created the listing.
- **Constraints:**
  - Must belong to a valid category.
  - `created_by_user_id` must reference an existing user.

4. Inventories Table

- **Purpose:** Tracks the availability of products for each seller.
- **Fields:**
  - `seller_id` (Foreign Key → `users.user_id`, Primary Key) – Identifies the seller.
  - `product_id` (Foreign Key → `products.product_id`, Primary Key) – Identifies the product.
  - `quantity` (INT) – Units available in stock.
- **Constraints:**
  - A seller can only list products that exist in the Products table.
  - Unique combination of `seller_id` and `product_id` prevents duplicate inventory records.

5. Carts Table

- **Purpose:** Stores shopping cart details for users.
- **Fields:**
  - `cart_id` (Primary Key, SERIAL) – Unique identifier.
  - `user_id` (Foreign Key → `users.user_id`, UNIQUE) – Associates the cart with a user.
  - `created_at` (TIMESTAMP) – Time the cart was created.
  - `updated_at` (TIMESTAMP) – Time the cart was last modified.
- **Constraints:**
  - Each user has exactly one cart.

6. Cart Items Table

- **Purpose:** Stores individual products added to shopping carts.
- **Fields:**
  - `cart_item_id` (Primary Key, SERIAL) – Unique identifier.
  - `cart_id` (Foreign Key → `carts.cart_id`) – Associated cart.
  - `product_id` (Foreign Key → `products.product_id`) – Product added.
  - `seller_id` (Foreign Key → `users.user_id`) – Seller offering the product.
  - `quantity` (INT) – Number of units.
- **Constraints:**
  - The `cart_id` must reference a valid cart.
  - The product must be sold by a valid seller.

7. Orders Table

- **Purpose:** Stores records of completed and pending purchases.
- **Fields:**
  - `order_id` (Primary Key, SERIAL) – Unique identifier.
  - `user_id` (Foreign Key → `users.user_id`) – Buyer who placed the order.
  - `total_amount` (DECIMAL) – Total cost at checkout.
  - `order_date` (TIMESTAMP) – Order placement time.
  - `status` (VARCHAR, e.g., "pending", "fulfilled") – Current order status.
- **Constraints:**
  - `total_amount` is computed at checkout.
  - `user_id` must reference a valid buyer.

8. Order Items Table

- **Purpose:** Stores individual products within an order.
- **Fields:**
  - `order_item_id` (Primary Key, SERIAL) – Unique identifier.
  - `order_id` (Foreign Key → `orders.order_id`) – Associated order.
  - `product_id` (Foreign Key → `products.product_id`) – Purchased product.
  - `seller_id` (Foreign Key → `users.user_id`) – Seller responsible.
  - `quantity` (INT) – Number of units purchased.

- `price_at_purchase` (DECIMAL) – Price at the time of purchase.
- `fulfillment_status` (VARCHAR, e.g., "pending", "shipped") – Fulfillment state.
- `fulfillment_date` (TIMESTAMP) – Time of fulfillment.

- **Constraints:**
  - `order_id` must be linked to a valid order.
  - `seller_id` must reference an active seller.

9. Product Reviews Table

- **Purpose:** Allows users to leave reviews and ratings for products.
- **Fields:**
  - `review_id` (Primary Key, SERIAL) – Unique identifier.
  - `user_id` (Foreign Key → `users.user_id`) – Reviewer.
  - `product_id` (Foreign Key → `products.product_id`) – Reviewed product.
  - `rating` (INT) – Numerical rating (e.g., 1-5).
  - `comment` (TEXT) – Review text.
  - `created_at` (TIMESTAMP) – Time review was posted.
  - `updated_at` (TIMESTAMP) – Time review was last modified.
- **Unique Constraint:** (`user_id`, `product_id`)
- **Constraints:**
  - A user can review a product only if they have purchased it.

10. Seller Reviews Table

- **Purpose:** Enables users to review and rate sellers.
- **Fields:**
  - `review_id` (Primary Key, SERIAL) – Unique identifier.
  - `user_id` (Foreign Key → `users.user_id`) – Reviewer.
  - `seller_id` (Foreign Key → `users.user_id`) – Reviewed seller.
  - `rating` (INT) – Numerical rating (e.g., 1-5).
  - `comment` (TEXT) – Review text.
  - `created_at` (TIMESTAMP) – Time review was posted.
  - `updated_at` (TIMESTAMP) – Time review was last modified.

- **Unique Constraint:** (`user_id`, `seller_id`)
- **Constraints:**
  - A user can review a seller only if they have purchased from them.

11. Messages Table

- **Purpose:** Facilitates private communication between buyers and sellers.
- **Fields:**
  - `message_id` (Primary Key, SERIAL) – Unique identifier.
  - `order_item_id` (Foreign Key → `order_items.order_item_id`) – Associated order item.
  - `sender_id` (Foreign Key → `users.user_id`) – Sender of the message.
  - `receiver_id` (Foreign Key → `users.user_id`) – Receiver of the message.
  - `content` (TEXT) – Message content.
  - `sent_at` (TIMESTAMP) – Time the message was sent.
- **Constraints:**
  - Messages are allowed only between buyers and sellers related to an order.

Additional Assumptions

- **Users as Buyers/Sellers:**
  A user can act as both buyer and seller. Sellers are identified by entries in the Inventories table.
- **Inventory Management:**
  Sellers update inventories to add or remove products. The quantity is decremented when an order is placed.
- **Order Flow:**
  - Buyer's balance is reduced by `total_amount`.
  - Sellers' balances are incremented based on their order items.
  - `inventories.quantity` is updated atomically (using transactions).
- **Reviews:**
  - Users can only review products they have purchased (validated via order items).
  - Seller reviews require at least one fulfilled order item.
- **Carts:**
  Each user has exactly one cart (`carts.user_id` is UNIQUE).

Part 2. Website Design

1. Login/Registration and Landing Pages

1.1 Landing (Home) Page

- **Content Description:**
  - Displays the website name, a brief introduction, and key features (e.g., shopping, seller onboarding, virtual currency management).
  - Prominent "Login" and "Register" buttons.
  - Section showcasing top-selling or trending products based on recent sales data.
- **User Interactions:**
  - Unauthenticated users click "Login" or "Register" to access the forms.
  - Logged-in users are redirected to their dashboard or personal home page.

1.2 Login Page

- **Content Description:**
  - Form with fields for email and password.
  - "Login" button and an optional "Forgot Password" link.
- **User Interactions:**
  - Upon entering valid credentials, the user is taken to their dashboard.
  - Specific error messages (e.g., "Invalid email format", "Password incorrect") are displayed for invalid entries, with a limit of 5 login attempts.

1.3 Registration Page

- **Content Description:**
  - Registration form including email, password, confirm password, full name, address, etc.
  - "Register" button.
- **User Interactions:**
  - On successful registration, a persistent shopping cart is created and the user is redirected to a welcome page or dashboard.

2. User Account and Personal Dashboard

2.1 Personal Dashboard/Home Page

- **Content Description:**
  - Displays basic user info (full name, account ID, current balance) and a mini-summary of the last 3 balance transactions.
  - Navigation links to order history, shopping cart, account settings, and deposit/withdraw functionalities.
  - If the user is also a seller, a "Seller Dashboard" link is provided.
- **User Interactions:**
  - Users click navigation links to access detailed views.
  - Information can be updated through dedicated forms.

2.2 Account Settings Page

- **Content Description:**
  - Allows users to update personal details (name, address, password).
  - Displays current balance with options for topping up (deposit) or withdrawing funds.
- **User Interactions:**
  - Users submit changes and receive confirmation or error feedback.

2.3 Order History Page

- **Content Description:**
  - Lists all past orders in reverse chronological order.
  - Each order summary includes details such as order number, date, total amount, and status.
  - Provides a "View Details" link for each order.
- **User Interactions:**
  - Clicking "View Details" shows comprehensive order information.

3. Product Browsing and Search

3.1 Product Listing Page

- **Content Description:**
  - Displays a grid or list of products with thumbnails, product names, prices, and average review ratings.
  - Supports filtering by category and availability, keyword search (in product name/description), and sorting by price or average rating.
  - Includes pagination or infinite scrolling.
- **User Interactions:**
  - Users filter, search, or sort products.
  - Clicking on a product navigates to the Product Detail Page.

3.2 Product Detail Page

- **Content Description:**
  - Displays detailed product information: large image, product name, full description, price, and category.
  - Lists sellers with stock details (e.g., "Seller A: 5 in stock") and warnings if stock is low.
  - Provides an input field to specify quantity and an "Add to Cart" option for each seller.
  - Contains a section for user reviews with an option to "Write Review."
- **User Interactions:**
  - Users select a seller, specify quantity, and click "Add to Cart."
  - Users can click "Write Review" to submit feedback if eligible.

4. Shopping Cart and Order Flow

4.1 Shopping Cart Page

- **Content Description:**
  - Lists all items in the user's persistent shopping cart, including product details, seller information, quantity, unit price, and subtotal.
  - Displays the overall total amount.
  - Provides options to update item quantities, remove items, and a "Checkout" button.

- **User Interactions:**
  - Users modify quantities or remove items with immediate updates.
  - Clicking "Checkout" transitions to the Order Confirmation Page.

4.2 Order Confirmation Page

- **Content Description:**
  - Summarizes the placed order (order ID, total amount, order date, initial status such as "pending").
  - Lists order items with details (product, seller, quantity, price).
  - Provides a link to the Order Details Page.
- **User Interactions:**
  - Users review the order details and proceed to the Order Details Page.

4.3 Order Details Page

- **Content Description:**
  - Provides comprehensive details of the order: order ID, buyer information, total amount, order date, and status.
  - Lists order items with details (product, seller, quantity, price, fulfillment status, fulfillment date).
  - If applicable, displays options to message the seller or write a review.
- **User Interactions:**
  - Users can view order status, message sellers, or submit reviews.

5. Seller-Related Pages (For Users Who Are Sellers)

5.1 Seller Dashboard

- **Content Description:**
  - Displays inventory status, pending orders, recent orders, average rating, and a chart of orders over the past week.
  - Navigation links to modules for inventory management, order fulfillment, product management, seller reviews, and messaging.
- **User Interactions:**

- Sellers navigate through detailed modules to manage sales and view analytics.

5.2 Inventory/Product Management Page

- **Content Description:**
  - Lists all products offered by the seller, along with current inventory levels and pricing.
  - Provides a button to "Add New Product" that leads to a product creation form.
  - Allows editing or deleting of existing product listings.
- **User Interactions:**
  - Sellers update product details or inventory quantities, with immediate updates.

5.3 Order Fulfillment Page

- **Content Description:**
  - Displays a list of order items for the seller, including buyer information, product details, order dates, and fulfillment statuses.
  - Provides buttons to mark each order item as "Shipped" or "Fulfilled."
- **User Interactions:**
  - Sellers mark items as fulfilled, and the system updates the order status accordingly.

5.4 Seller Reviews Page

- **Content Description:**
  - Shows all reviews and ratings for the seller, including the average rating and number of reviews.
- **User Interactions:**
  - Sellers view detailed feedback and, if supported, can respond to reviews.

5.5 Messaging/Communication Page

- **Content Description:**
  - Contains message threads between sellers and buyers related to specific order items.

- Displays messages in chronological order, showing both buyer and seller communications.
- **User Interactions:**
  - Sellers reply to buyer messages to address issues or confirm order details.

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6. Reviews and Feedback

6.1 Product Review Page

- **Content Description:**
  - Displays reviews with reviewer names, ratings, comments, and dates.
  - Offers options to "Write Review" or "Edit Review" for eligible users.
- **User Interactions:**
  - Users can submit or update reviews; updates are immediately reflected.

6.2 Seller Review Page (Public View)

- **Content Description:**
  - Lists all reviews and ratings for a seller, showing an average score and total review count.
- **User Interactions:**
  - Buyers who have purchased from the seller can add their review via a provided link.

Overall Navigation and Logical Flow

- **Global Navigation Bar:**
  Includes links to "Home," "Products," "Cart," "My Orders," "Account," and "Seller Dashboard" (if applicable).
- **Feedback and Prompts:**
  Each page provides clear action feedback (e.g., "Added to Cart Successfully," "Order Placed Successfully"), and critical actions include confirmation dialogs.
- **Access Control:**
  - Pages requiring authentication (e.g., account settings, cart, order history) verify login status and redirect unauthenticated users to the Login Page.
  - Seller-specific pages are accessible only to users with seller privileges.

Example User Flow

1. A user visits the homepage and browses the product list.

2. The user clicks a product to view detailed information and chooses a seller to add the product to the cart.

3. The user reviews the shopping cart, adjusts quantities if needed, and clicks "Checkout."

4. On the Order Confirmation Page, the user verifies all details and submits the order.

5. The user is directed to the Order Details Page to monitor fulfillment and later review the purchased items and seller.

6. If the user is also a seller, they access the Seller Dashboard to manage inventory, fulfill orders, and communicate with buyers.