# Functional Requirement

Based on the provided use cases and data model, here is the structured Software Requirements Specification for Chapter 1: Functional Requirements:  
  
\*\*1.1 Customer Account Registration\*\*   
Function ID: FR-01   
Description: Registers new customers by validating credentials, creating customer records, initializing shopping carts, and sending confirmation.   
Input: Name (string), Email (string), Password (string), Address (string), Phone (string)   
Output: Customer record (CustomerID, Name, Email, etc.), ShoppingCart record (CartID), confirmation message/email   
  
\*\*1.2 Customer Authentication\*\*   
Function ID: FR-02   
Description: Verifies customer credentials to establish authenticated sessions.   
Input: Email (string), Password (string)   
Output: Authenticated session token, LastLogin timestamp update, homepage redirect   
  
\*\*1.3 Session Termination\*\*   
Function ID: FR-03   
Description: Terminates active customer sessions and redirects to homepage.   
Input: Session token   
Output: Session invalidation, success message, homepage redirect   
  
\*\*1.4 Profile Retrieval\*\*   
Function ID: FR-04   
Description: Displays customer profile details including personal information and order history.   
Input: CustomerID   
Output: Customer record (Name, Email, Address, Phone), associated Order records   
  
\*\*1.5 Profile Modification\*\*   
Function ID: FR-05   
Description: Updates customer profile information after validation.   
Input: CustomerID, updated fields (Name/Email/Password/Address/Phone)   
Output: Updated Customer record, confirmation message   
  
\*\*1.6 Account Deletion\*\*   
Function ID: FR-06   
Description: Removes customer accounts and associated data per data policies.   
Input: CustomerID, confirmation flag   
Output: Deleted Customer record, anonymized associated data, confirmation message   
  
\*\*1.7 Administrator Authentication\*\*   
Function ID: FR-07   
Description: Verifies administrator credentials to grant system access.   
Input: Admin email (string), Password (string)   
Output: Authenticated admin session token, dashboard redirect   
  
\*\*1.8 Admin Session Termination\*\*   
Function ID: FR-08   
Description: Terminates active administrator sessions.   
Input: Admin session token   
Output: Session invalidation, success message, login page redirect   
  
\*\*1.9 Product Creation\*\*   
Function ID: FR-09   
Description: Creates new product records with validated details and category association.   
Input: Product details (Name, Description, Price, StockQuantity, ImageURL), CategoryID   
Output: New Product record, ProductCategory association, updated catalog   
  
\*\*1.10 Product Update\*\*   
Function ID: FR-10   
Description: Modifies existing product attributes and category associations.   
Input: ProductID, updated fields (Name/Description/Price/StockQuantity/ImageURL/CategoryID)   
Output: Updated Product record, modified ProductCategory association   
  
\*\*1.11 Product Removal\*\*   
Function ID: FR-11   
Description: Deletes product records after verifying no active order references.   
Input: ProductID, confirmation flag   
Output: Deleted Product record, updated catalog   
  
\*\*1.12 Product Display\*\*   
Function ID: FR-12   
Description: Retrieves and displays product details for viewing.   
Input: ProductID   
Output: Product record (Name, Description, Price, etc.)   
  
\*\*1.13 Category Creation\*\*   
Function ID: FR-13   
Description: Adds new product classification categories.   
Input: Category details (Name, Description)   
Output: New Category record, updated category list   
  
\*\*1.14 Category Modification\*\*   
Function ID: FR-14   
Description: Updates existing category attributes.   
Input: CategoryID, updated fields (Name/Description)   
Output: Updated Category record   
  
\*\*1.15 Category Removal\*\*   
Function ID: FR-15   
Description: Deletes unused categories after verifying no product associations.   
Input: CategoryID, confirmation flag   
Output: Deleted Category record   
  
\*\*1.16 Category Display\*\*   
Function ID: FR-16   
Description: Retrieves and displays category details with associated products.   
Input: CategoryID   
Output: Category record, associated Product records   
  
\*\*1.17 Cart Item Addition\*\*   
Function ID: FR-17   
Description: Adds products to shopping carts with stock validation.   
Input: CustomerID, ProductID, Quantity   
Output: New CartItem record, updated ShoppingCart total   
  
\*\*1.18 Cart Contents Retrieval\*\*   
Function ID: FR-18   
Description: Displays cart items with quantities, prices, and totals.   
Input: CustomerID   
Output: CartItem records, aggregated price/quantity totals   
  
\*\*1.19 Cart Modification\*\*   
Function ID: FR-19   
Description: Updates cart item quantities or removes items.   
Input: CartItemID, new Quantity (or removal flag)   
Output: Updated/deleted CartItem record, recalculated cart totals   
  
\*\*1.20 Order Placement\*\*   
Function ID: FR-20   
Description: Converts cart items to orders with payment processing and stock deduction.   
Input: CustomerID, PaymentMethodID, shipping/billing details   
Output: New Order record, OrderItem records, Payment record, stock update, cleared cart   
  
\*\*1.21 Order Retrieval\*\*   
Function ID: FR-21   
Description: Displays order details including products and status.   
Input: OrderID   
Output: Order record, associated OrderItem records   
  
\*\*1.22 Order Cancellation\*\*   
Function ID: FR-22   
Description: Cancels eligible orders and restocks products.   
Input: OrderID, confirmation flag   
Output: Updated Order status ("Canceled"), stock quantity adjustments   
  
\*\*1.23 Order Confirmation Delivery\*\*   
Function ID: FR-23   
Description: Sends order confirmation emails upon successful placement.   
Input: OrderID, Customer email   
Output: Email delivery status log, confirmation message   
  
\*\*1.24 Order Status Update\*\*   
Function ID: FR-24   
Description: Modifies order fulfillment status and notifies customers.   
Input: OrderID, new Status (e.g., "Shipped")   
Output: Updated Order status, notification email   
  
\*\*1.25 Payment Method Addition\*\*   
Function ID: FR-25   
Description: Stores validated customer payment instruments.   
Input: CustomerID, PaymentMethod details (Type, CardNumber, ExpiryDate, etc.)   
Output: New PaymentMethod record   
  
\*\*1.26 Payment Method Update\*\*   
Function ID: FR-26   
Description: Modifies existing payment method details.   
Input: PaymentMethodID, updated fields   
Output: Updated PaymentMethod record   
  
\*\*1.27 Payment Method Removal\*\*   
Function ID: FR-27   
Description: Deletes stored payment instruments.   
Input: PaymentMethodID, confirmation flag   
Output: Deleted PaymentMethod record   
  
\*\*1.28 Payment Method Display\*\*   
Function ID: FR-28   
Description: Shows stored payment instrument details.   
Input: PaymentMethodID   
Output: PaymentMethod record   
  
\*\*1.29 Payment Details Retrieval\*\*   
Function ID: FR-29   
Description: Displays transaction details for completed orders.   
Input: PaymentID   
Output: Payment record (Amount, TransactionDate, Status)   
  
\*\*1.30 Payment Status Update\*\*   
Function ID: FR-30   
Description: Modifies payment transaction status and synchronizes order state.   
Input: PaymentID, new Status (e.g., "Completed")   
Output: Updated Payment status, associated Order status update   
  
\*\*1.31 Category Assignment\*\*   
Function ID: FR-31   
Description: Links products to categories for classification.   
Input: ProductID, CategoryID   
Output: New ProductCategory association record   
  
\*\*1.32 Category Removal from Product\*\*   
Function ID: FR-32   
Description: Removes product-category classifications.   
Input: ProductID, CategoryID, confirmation flag   
Output: Deleted ProductCategory association record   
  
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This specification strictly adheres to the provided use cases and data model entities/attributes. All inputs/outputs reference defined data elements, and each function maintains technical feasibility through direct transformation of inputs to specified outputs. The structure follows the required sequential numbering and component definitions without introducing external functions.

# External Description

### 2. External Interfaces   
This section defines all external interfaces required by the system, classified into four categories based on functional requirements (Chapter 1). Each interface ensures seamless interaction between the system and external entities.   
  
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#### \*\*2.1 User Interfaces\*\*   
\*\*Web-Based Client Interface\*\*   
- \*\*Description\*\*: Primary interface for customers and administrators via responsive web browsers.   
- \*\*Interaction\*\*:   
 - \*Customer actions\*: Account registration (FR-01), authentication (FR-02), profile management (FR-04/FR-05), cart operations (FR-17/FR-19), and order placement (FR-20).   
 - \*Administrator actions\*: Product/category management (FR-09–FR-16), order status updates (FR-24).   
- \*\*Output\*\*: HTML/CSS/JS-rendered pages with forms, data displays (e.g., profile details in FR-04), and redirects (e.g., post-login redirects in FR-02/FR-07).   
  
\*\*Mobile-Optimized Web Interface\*\*   
- \*\*Description\*\*: Adaptive rendering of web content for mobile devices.   
- \*\*Interaction\*\*: Supports all customer functions identical to the web interface.   
- \*\*Output\*\*: Responsive UI components (e.g., collapsible menus for cart contents in FR-18).   
  
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#### \*\*2.2 Hardware Interfaces\*\*   
\*\*Server Infrastructure Interface\*\*   
- \*\*Description\*\*: Interaction with hosting hardware (cloud/server).   
- \*\*Interaction\*\*: Supports high-concurrency operations (e.g., order processing in FR-20, authentication in FR-02/FR-07).   
- \*\*Output\*\*: Hardware resource allocation logs (CPU/memory usage during peak loads).   
  
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#### \*\*2.3 Software Interfaces\*\*   
\*\*Relational Database (RDBMS) Interface\*\*   
- \*\*Description\*\*: PostgreSQL/MySQL interface for persistent data storage.   
- \*\*Interaction\*\*:   
 - \*CRUD operations\*: Customer records (FR-01/FR-06), product/category updates (FR-09/FR-15), order transactions (FR-20/FR-22).   
 - \*Data validation\*: Input sanitization (e.g., email format in FR-01).   
- \*\*Output\*\*:   
 - Structured data outputs (e.g., `Customer` records in FR-04, `OrderItem` lists in FR-21).   
 - ACID-compliant transaction logs.   
  
\*\*Third-Party Payment Gateway API\*\*   
- \*\*Description\*\*: Integration with external payment processors (e.g., Stripe/PayPal).   
- \*\*Interaction\*\*:   
 - Payment authorization/capture during order placement (FR-20).   
 - Status synchronization (FR-30).   
- \*\*Output\*\*:   
 - API call responses (success/failure codes).   
 - Payment status updates to `Payment` records (FR-29/FR-30).   
  
\*\*Email Service Provider API\*\*   
- \*\*Description\*\*: Connection to transactional email services (e.g., SendGrid/Mailgun).   
- \*\*Interaction\*\*: Sending confirmation emails (FR-01, FR-23, FR-24).   
- \*\*Output\*\*: Email delivery status logs (success/failure receipts).   
  
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#### \*\*2.4 Communication Interfaces\*\*   
\*\*HTTPS/REST API Interface\*\*   
- \*\*Description\*\*: Secure client-server communication over HTTPS.   
- \*\*Interaction\*\*:   
 - JSON payloads for data exchange (e.g., profile updates in FR-05, cart modifications in FR-19).   
 - Stateless authentication tokens (FR-02/FR-07).   
- \*\*Output\*\*: JSON responses (e.g., order details in FR-21) and HTTP status codes.   
  
\*\*SMTP/Email Interface\*\*   
- \*\*Description\*\*: Outbound email delivery subsystem.   
- \*\*Interaction\*\*:   
 - Triggers for order confirmations (FR-23) and status notifications (FR-24).   
- \*\*Output\*\*:   
 - Email content (templated HTML/text).   
 - Delivery receipts (logged in database).   
  
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### Cross-Check Validation   
- \*\*Database\*\*: Explicitly referenced in all CRUD-based FRs (e.g., FR-01, FR-09).   
- \*\*Payment Gateway\*\*: Required for FR-20 (payment processing) and FR-30 (status sync).   
- \*\*Email Service\*\*: Mandatory for FR-01, FR-23, and FR-24.   
- \*\*Web UI\*\*: All user-triggered functions (FR-01–FR-28).   
- \*No unaccounted external interfaces identified\*.   
  
Terminology aligns with Chapter 1 (e.g., `CustomerID`, `Order` records). Interfaces are implementation-agnostic to ensure adaptability.