# Functional Requirement

### 1.1 Customer Registration   
\*\*Function ID\*\*: FR-01   
\*\*Description\*\*: Allows new customers to create accounts by providing personal information. Validates email uniqueness and password complexity. Creates a customer record and sends confirmation email.   
\*\*Input\*\*: Name (string), email (string), password (string)   
\*\*Output\*\*: New customer record stored in Customer entity (CustomerID, Name, Email, Password)   
  
### 1.2 User Login   
\*\*Function ID\*\*: FR-02   
\*\*Description\*\*: Authenticates customers/administrators using email and password. Grants access to respective dashboards upon successful verification.   
\*\*Input\*\*: Email (string), password (string)   
\*\*Output\*\*: Active user session, redirect to customer/admin dashboard   
  
### 1.3 User Logout   
\*\*Function ID\*\*: FR-03   
\*\*Description\*\*: Terminates active user sessions, clears session data, and redirects to the login page.   
\*\*Input\*\*: Session token   
\*\*Output\*\*: Session termination, redirect to login page   
  
### 1.4 Update Customer Information   
\*\*Function ID\*\*: FR-04   
\*\*Description\*\*: Enables customers to modify profile details (e.g., address, phone). Validates field integrity and email uniqueness.   
\*\*Input\*\*: CustomerID (int), updated fields (e.g., Address, Phone)   
\*\*Output\*\*: Modified attributes in Customer entity   
  
### 1.5 View Customer Information   
\*\*Function ID\*\*: FR-05   
\*\*Description\*\*: Displays customer details (e.g., order history, contact info) for administrators or the customer themselves.   
\*\*Input\*\*: CustomerID (int)   
\*\*Output\*\*: Customer entity data (Name, Email, Address, Phone)   
  
### 1.6 Add Product   
\*\*Function ID\*\*: FR-06   
\*\*Description\*\*: Allows administrators to create new product entries with details (name, price, category) and associate them with categories.   
\*\*Input\*\*: Name (string), Description (text), Price (float), StockQuantity (int), CategoryID (int)   
\*\*Output\*\*: New record in Product entity; association in ProductCategory entity   
  
### 1.7 Update Product   
\*\*Function ID\*\*: FR-07   
\*\*Description\*\*: Enables administrators to edit product attributes (e.g., price, description) and update category associations.   
\*\*Input\*\*: ProductID (int), modified fields (e.g., Price, Description, CategoryID)   
\*\*Output\*\*: Updated attributes in Product entity; modified ProductCategory linkage   
  
### 1.8 Delete Product   
\*\*Function ID\*\*: FR-08   
\*\*Description\*\*: Removes a product from the system if no active orders reference it. Prevents deletion for data integrity.   
\*\*Input\*\*: ProductID (int)   
\*\*Output\*\*: Removal of Product entity record   
  
### 1.9 Browse Products   
\*\*Function ID\*\*: FR-09   
\*\*Description\*\*: Lists available products with core details (name, price) for customers/admins.   
\*\*Input\*\*: None (catalog request)   
\*\*Output\*\*: List of Product entities (ProductID, Name, Price)   
  
### 1.10 View Product Details   
\*\*Function ID\*\*: FR-10   
\*\*Description\*\*: Displays comprehensive product information (description, stock, category) when selected.   
\*\*Input\*\*: ProductID (int)   
\*\*Output\*\*: Full Product entity data + linked Category details   
  
### 1.11 Add Category   
\*\*Function ID\*\*: FR-11   
\*\*Description\*\*: Creates new product categories with unique names for product classification.   
\*\*Input\*\*: Name (string), Description (text)   
\*\*Output\*\*: New record in Category entity   
  
### 1.12 Update Category   
\*\*Function ID\*\*: FR-12   
\*\*Description\*\*: Modifies category attributes (name, description) while ensuring name uniqueness.   
\*\*Input\*\*: CategoryID (int), updated fields (Name/Description)   
\*\*Output\*\*: Modified attributes in Category entity   
  
### 1.13 Delete Category   
\*\*Function ID\*\*: FR-13   
\*\*Description\*\*: Removes a category if no products are associated with it.   
\*\*Input\*\*: CategoryID (int)   
\*\*Output\*\*: Removal of Category entity record   
  
### 1.14 View Category Details   
\*\*Function ID\*\*: FR-14   
\*\*Description\*\*: Shows category information and linked products.   
\*\*Input\*\*: CategoryID (int)   
\*\*Output\*\*: Category entity data + list of associated Products   
  
### 1.15 Add to Shopping Cart   
\*\*Function ID\*\*: FR-15   
\*\*Description\*\*: Adds a product to the customer’s cart after stock verification. Updates cart totals.   
\*\*Input\*\*: CustomerID (int), ProductID (int), Quantity (int)   
\*\*Output\*\*: New CartItem record; updated ShoppingCart total   
  
### 1.16 Update Shopping Cart   
\*\*Function ID\*\*: FR-16   
\*\*Description\*\*: Modifies product quantities or removes items from the cart. Recalculates cart totals.   
\*\*Input\*\*: CartItemID (int), new Quantity (int; 0 for removal)   
\*\*Output\*\*: Updated CartItem.Quantity or record deletion; revised ShoppingCart total   
  
### 1.17 View Shopping Cart   
\*\*Function ID\*\*: FR-17   
\*\*Description\*\*: Displays all items in the cart, quantities, prices, and total cost.   
\*\*Input\*\*: CustomerID (int)   
\*\*Output\*\*: List of CartItems + Product details; ShoppingCart total amount   
  
### 1.18 Place Order   
\*\*Function ID\*\*: FR-18   
\*\*Description\*\*: Converts cart items into an order, processes payment, reduces inventory, and sends confirmation.   
\*\*Input\*\*: CustomerID (int), PaymentMethodID (int), shipping/billing details   
\*\*Output\*\*: New Order and OrderItem records; reduced Product.StockQuantity; email confirmation   
  
### 1.19 Browse Orders   
\*\*Function ID\*\*: FR-19   
\*\*Description\*\*: Lists orders (for customers: their own; for admins: all orders).   
\*\*Input\*\*: CustomerID (int, for customers) or none (for admins)   
\*\*Output\*\*: Order summaries (OrderID, OrderDate, TotalAmount)   
  
### 1.20 View Order Details   
\*\*Function ID\*\*: FR-20   
\*\*Description\*\*: Shows comprehensive order information, including items and status.   
\*\*Input\*\*: OrderID (int)   
\*\*Output\*\*: Order entity data + OrderItem list + PaymentMethod details   
  
### 1.21 Cancel Order   
\*\*Function ID\*\*: FR-21   
\*\*Description\*\*: Cancels eligible orders (e.g., not shipped), restocks inventory, and notifies the customer.   
\*\*Input\*\*: OrderID (int)   
\*\*Output\*\*: Order.Status set to "Canceled"; increased Product.StockQuantity   
  
### 1.22 Update Order Status   
\*\*Function ID\*\*: FR-22   
\*\*Description\*\*: Allows admins to change order status (e.g., "Shipped") and notify customers.   
\*\*Input\*\*: OrderID (int), new Status (string)   
\*\*Output\*\*: Updated Order.Status; notification email   
  
### 1.23 Manage Inventory   
\*\*Function ID\*\*: FR-23   
\*\*Description\*\*: Adjusts product stock levels (e.g., after shipments/returns).   
\*\*Input\*\*: ProductID (int), new StockQuantity (int)   
\*\*Output\*\*: Updated Product.StockQuantity   
  
### 1.24 Manage Customer Payment Methods   
\*\*Function ID\*\*: FR-24   
\*\*Description\*\*: Adds/edits/removes customer payment methods (e.g., credit cards).   
\*\*Input\*\*: PaymentMethodID (int, for edit/remove), Type (string), TokenizedCard (string), ExpiryDate (date)   
\*\*Output\*\*: New/updated/deleted PaymentMethod record   
  
### 1.25 Assign Product to Category   
\*\*Function ID\*\*: FR-25   
\*\*Description\*\*: Links a product to a category via the ProductCategory entity.   
\*\*Input\*\*: ProductID (int), CategoryID (int)   
\*\*Output\*\*: New ProductCategory association record   
  
### 1.26 Manage Administrator Accounts   
\*\*Function ID\*\*: FR-26   
\*\*Description\*\*: Adds/edits/deletes administrator accounts with role permissions.   
\*\*Input\*\*: AdminID (int, for edit/delete), Name (string), Email (string), Role (string)   
\*\*Output\*\*: New/updated/deleted Administrator record   
  
### 1.27 Delete Customer   
\*\*Function ID\*\*: FR-27   
\*\*Description\*\*: Removes customer accounts if no active orders exist.   
\*\*Input\*\*: CustomerID (int)   
\*\*Output\*\*: Deleted Customer record + dependent PaymentMethods   
  
### 1.28 Delete Order   
\*\*Function ID\*\*: FR-28   
\*\*Description\*\*: Permanently deletes orders in cancellable states (e.g., "Canceled").   
\*\*Input\*\*: OrderID (int)   
\*\*Output\*\*: Removal of Order and OrderItem records   
  
### 1.29 Update Order Items   
\*\*Function ID\*\*: FR-29   
\*\*Description\*\*: Modifies items in pending orders (e.g., quantity changes), adjusts inventory and order totals.   
\*\*Input\*\*: OrderID (int), OrderItemID (int), new Quantity (int)   
\*\*Output\*\*: Updated OrderItem.Quantity; revised Order.TotalAmount; adjusted Product.StockQuantity

# External Description

### Chapter 2: External Interfaces   
This chapter defines all external interfaces required by the system, classified into four categories based on interaction type. All interfaces referenced in functional requirements (Section 1) are comprehensively defined below.   
  
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#### \*\*2.1 User Interface Output\*\*   
Defines human-system interaction mechanisms via graphical interfaces.   
  
| \*\*Interface Component\*\* | \*\*Description\*\* | \*\*Interaction Method\*\* |   
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|   
| \*\*Web Application Interface\*\* | Primary interface for customers and administrators. Renders dashboards, forms, and data displays. | - Input: User actions (clicks/form submissions) via browser<br>- Output: HTML/CSS/JS rendering (e.g., dashboards in FR-02, product catalog in FR-09) |   
| \*\*Registration Module\*\* | Captures new customer data with real-time validation (FR-01). | - Input: Name/email/password fields<br>- Output: Success confirmation or error prompts for duplicate email/complexity rules |   
| \*\*Shopping Cart UI\*\* | Displays cart items, prices, and totals (FR-17). Supports quantity updates/removals (FR-16). | - Input: Quantity adjustments via +/- buttons<br>- Output: Dynamically updated cart totals and item list |   
| \*\*Order Management Portal\*\* | Shows order summaries (FR-19) and detailed views (FR-20). Enables status updates (FR-22) and cancellations (FR-21) for admins. | - Input: OrderID selection<br>- Output: Order details (items, status, payment) or batch lists |   
  
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#### \*\*2.2 Hardware Interface Output\*\*   
Describes interactions with physical devices.   
  
| \*\*Interface Component\*\* | \*\*Description\*\* | \*\*Interaction Method\*\* |   
|-------------------------|---------------------------------------------------|------------------------|   
| \*None required\* | The system operates purely as a web application and does not interface with specialized hardware devices. | N/A |   
  
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#### \*\*2.3 Software Interface Output\*\*   
Defines integrations with external software systems and data stores.   
  
| \*\*Interface Component\*\* | \*\*Description\*\* | \*\*Interaction Method\*\* |   
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|   
| \*\*Relational Database (RDBMS)\*\* | Central data store for all entities (Customer, Product, Order, etc.). Referenced in 22/29 FRs (e.g., FR-01, FR-06, FR-18). | - \*\*Input\*\*: SQL queries (e.g., `INSERT INTO Customer` for FR-01)<br>- \*\*Output\*\*: Persistent records (e.g., new CustomerID) and query results (e.g., order history in FR-05) |   
| \*\*Payment Gateway API\*\* | Third-party service for processing payments during order placement (FR-18). | - \*\*Input\*\*: Tokenized payment data (via PaymentMethodID), amount<br>- \*\*Output\*\*: Transaction status (success/failure) and authorization codes |   
| \*\*Inventory Management Hook\*\* | External warehouse system integration for real-time stock synchronization (implied by FR-23). | - \*\*Input\*\*: ProductID and new StockQuantity<br>- \*\*Output\*\*: Stock adjustment confirmation |   
  
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#### \*\*2.4 Communication Interface Output\*\*   
Specifies network-based communication protocols.   
  
| \*\*Interface Component\*\* | \*\*Description\*\* | \*\*Interaction Method\*\* |   
|--------------------------|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|   
| \*\*Email Service (SMTP)\*\* | Sends transactional emails for key events (referenced in FR-01, FR-18, FR-21, FR-22). | - \*\*Input\*\*: Recipient email, template (e.g., order confirmation)<br>- \*\*Output\*\*: Email delivery status logs |   
| \*\*Session Token System\*\* | Manages user authentication states via HTTP cookies (used in FR-02, FR-03). | - \*\*Input\*\*: Session token<br>- \*\*Output\*\*: Session creation/deletion (e.g., redirects post-logout in FR-03) |   
  
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### Cross-Verification Summary   
- \*\*Database\*\*: Covered under \*2.3 Software Interface Output\* (supports 22 FRs including core entities).   
- \*\*Email Service\*\*: Explicitly defined in \*2.4 Communication Interface Output\* (links to FR-01/18/21/22).   
- \*\*Payment Gateway\*\*: Documented in \*2.3 Software Interface Output\* (critical for FR-18).   
- \*\*User Interfaces\*\*: Mapped to web components in \*2.1 User Interface Output\* (all GUI-dependent FRs).   
- \*No omissions identified\*; all external references in Section 1 are addressed.   
  
> Terminology alignment: Consistent use of \*CustomerID\*, \*ProductID\*, \*OrderID\*, and entity names (e.g., \*ShoppingCart\*) from functional requirements.