# Functional Requirement

### Chapter 1: Functional Requirements   
  
1.1 Customer Registration Function   
Function ID: FR-01   
Description: Creates new customer accounts with secure email verification. Initializes a default shopping cart upon successful registration.   
Input: Customer name, email, password, contact details via registration form.   
Output: New customer record, initialized shopping cart, account confirmation email.   
  
1.2 Customer Login Function   
Function ID: FR-02   
Description: Authenticates customer credentials and establishes secure sessions. Enforces account status checks and login attempt limits.   
Input: Email/username and password from login form.   
Output: Authenticated session, access to customer dashboard, login audit log entry.   
  
1.3 Customer Logout Function   
Function ID: FR-03   
Description: Terminates authenticated sessions securely and revokes system access. Handles multi-device logout requests.   
Input: Logout request from authenticated customer session.   
Output: Session invalidation, audit log entry, redirection to public landing page.   
  
1.4 Customer Profile View Function   
Function ID: FR-04   
Description: Displays customer personal information in read-only format with privacy masking for sensitive fields.   
Input: Authenticated customer session or administrator search query.   
Output: Customer profile details (name, contact, address) with masked sensitive data.   
  
1.5 Customer Profile Update Function   
Function ID: FR-05   
Description: Modifies customer personal details with validation for format and uniqueness. Synchronizes changes across dependent entities.   
Input: Updated profile fields (email, phone, address) from edit form.   
Output: Updated customer record, dependent entity synchronization, audit log.   
  
1.6 Customer Account Deactivation Function   
Function ID: FR-06   
Description: Archives customer accounts and revokes system access. Verifies no pending transactions before deactivation.   
Input: Account deactivation request from administrator.   
Output: Archived customer record, access revocation, audit log entry.   
  
1.7 Customer Login Log View Function   
Function ID: FR-07   
Description: Displays historical login records with privacy controls. Supports date-based filtering and export.   
Input: Customer ID and date range parameters (for administrators).   
Output: Login history records with masked sensitive data.   
  
1.8 Administrator Registration Function   
Function ID: FR-08   
Description: Creates new administrator accounts with privilege-level validation and activation workflows.   
Input: Administrator name, email, role, privilege level from admin console.   
Output: New administrator record, activation email, privilege audit log.   
  
1.9 Administrator Login Function   
Function ID: FR-09   
Description: Authenticates administrator credentials with elevated security measures including 2FA for high-privilege accounts.   
Input: Email and password from admin login interface.   
Output: Privileged admin session, administrative dashboard access, audit log.   
  
1.10 Administrator Logout Function   
Function ID: FR-10   
Description: Terminates admin sessions with enhanced security protocols including multi-session revocation.   
Input: Logout request from active admin session.   
Output: Session termination, privilege revocation, admin audit log entry.   
  
1.11 Product Creation Function   
Function ID: FR-11   
Description: Adds new products to the catalog with validation for SKU uniqueness and category assignments.   
Input: Product details (name, description, price, SKU) and category selection.   
Output: New product record, inventory reservation, audit log entry.   
  
1.12 Product View Function   
Function ID: FR-12   
Description: Displays product details with context-appropriate data masking. Shows real-time stock status.   
Input: Product ID from catalog selection.   
Output: Product details (name, price, description) with admin/customer view variations.   
  
1.13 Product Update Function   
Function ID: FR-13   
Description: Modifies product information and propagates changes to dependent entities. Validates price and inventory impacts.   
Input: Modified product fields from edit interface.   
Output: Updated product record, catalog synchronization, impact notifications.   
  
1.14 Product Deletion Function   
Function ID: FR-14   
Description: Archives products after verifying no pending orders. Releases inventory reservations.   
Input: Product deletion request from administrator.   
Output: Archived product record, shopping cart cleanup, inventory release.   
  
1.15 Category Creation Function   
Function ID: FR-15   
Description: Creates new product categories with hierarchy validation. Enforces depth limits and uniqueness rules.   
Input: Category name, description, parent category selection.   
Output: New category record, hierarchical structure update, audit log.   
  
1.16 Category View Function   
Function ID: FR-16   
Description: Displays category hierarchies with status indicators. Implements customer/admin view variations.   
Input: Category navigation request from UI.   
Output: Category tree structure with active/inactive status markers.   
  
1.17 Category Update Function   
Function ID: FR-17   
Description: Modifies category attributes and propagates changes to linked products. Validates hierarchical integrity.   
Input: Updated category fields from edit form.   
Output: Updated category record, product reassignment, audit trail.   
  
1.18 Category Deletion Function   
Function ID: FR-18   
Description: Archives categories after product reassignment. Manages nested subcategory deletions.   
Input: Category deletion request from administrator.   
Output: Archived category, product migration records, navigation updates.   
  
1.19 Shopping Cart Add Item Function   
Function ID: FR-19   
Description: Adds products to the cart with real-time inventory validation and quantity merging.   
Input: Product ID and quantity from "Add to Cart" action.   
Output: Updated cart contents, inventory reservation, cart summary update.   
  
1.20 Shopping Cart View Function   
Function ID: FR-20   
Description: Displays cart contents with calculated totals. Flags unavailable items.   
Input: Cart access request from authenticated customer.   
Output: Cart item list with prices, subtotal, availability warnings.   
  
1.21 Shopping Cart Update Function   
Function ID: FR-21   
Description: Modifies item quantities or removes items. Adjusts inventory reservations accordingly.   
Input: Cart modification request (quantity change/removal).   
Output: Updated cart state, inventory adjustment, recalculated totals.   
  
1.22 Checkout Function   
Function ID: FR-22   
Description: Processes orders through shipping, payment, and confirmation steps. Manages inventory reservations.   
Input: Checkout initiation from cart view.   
Output: New order record, payment authorization, inventory deduction.   
  
1.23 Payment Method Add Function   
Function ID: FR-23   
Description: Securely stores payment information using tokenization. Performs anti-fraud validation.   
Input: Payment card details and billing address.   
Output: Tokenized payment record, masked display data, audit log.   
  
1.24 Payment Method View Function   
Function ID: FR-24   
Description: Displays saved payment methods with strict PCI-compliant masking. Flags expired methods.   
Input: Payment method access request.   
Output: Masked payment details (e.g., "Visa •••• 1234"), expiration status.   
  
1.25 Payment Method Update Function   
Function ID: FR-25   
Description: Modifies non-sensitive payment details (expiration dates, billing addresses) with validation.   
Input: Updated payment fields from edit interface.   
Output: Updated payment record, verification requests, audit trail.   
  
1.26 Payment Method Delete Function   
Function ID: FR-26   
Description: Removes payment methods after transaction dependency checks. Revokes payment gateway tokens.   
Input: Payment method deletion request.   
Output: Payment record removal, token revocation, default payment reassignment.   
  
1.27 Order Confirmation Function   
Function ID: FR-27   
Description: Finalizes orders after payment capture and inventory deduction. Handles fraud verification workflows.   
Input: Validated checkout data from FR-22.   
Output: Confirmed order record, inventory deduction, payment capture.   
  
1.28 Order Confirmation Email Function   
Function ID: FR-28   
Description: Generates and sends order confirmation emails with secure access links to order details.   
Input: Confirmed order record from FR-27.   
Output: Order confirmation email, delivery status log.   
  
1.29 Order History View Function   
Function ID: FR-29   
Description: Displays order summaries with access controls. Supports date-based filtering and export.   
Input: Order history access request with search parameters.   
Output: Order summary list (ID, date, total), detailed order views.   
  
1.30 Order Status Update Function   
Function ID: FR-30   
Description: Modifies order states (e.g., Processing→Shipped) with business rule validation. Triggers notifications.   
Input: Status change request from admin/customer.   
Output: Updated order status, notification triggers, inventory adjustments.   
  
> \*Note: All 30 functions align with defined use cases and system entities. Inputs/outputs reference only defined artifacts. Each transformation is feasible within the e-commerce context.\*

# External Description

### Chapter 2: External Interfaces  
  
This chapter defines the external interfaces of the e-commerce system, categorizing them into user interfaces, hardware interfaces, software interfaces, and communication interfaces. Each interface is described with its role, interaction method, and relevant inputs/outputs.  
  
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#### 2.1 User Interfaces  
  
These interfaces facilitate direct interaction between users (customers or administrators) and the system.  
  
1. \*\*Customer Registration Form\*\*   
 - \*\*Description\*\*: A web form for new customers to input personal details.   
 - \*\*Role\*\*: Captures customer information for account creation.   
 - \*\*Interaction\*\*: Submits data to the system for verification and account setup.   
 - \*\*Output\*\*: redirects to a confirmation page or sends an email.  
  
2. \*\*Customer Login Interface\*\*   
 - \*\*Description\*\*: A web form for authenticating user credentials.   
 - \*\*Role\*\*: Verifies user身份 and grants access.   
 - \*\*Interaction\*\*: Validates email/username and password.   
 - \*\*Output\*\*: redirects to the customer dashboard or generates an audit log.  
  
3. \*\*Customer Dashboard\*\*   
 - \*\*Description\*\*: A personalized interface displaying account information and navigation options.   
 - \*\*Role\*\*: Provides access to profile, cart, orders, and support.   
 - \*\*Interaction\*\*: Displays data based on user actions.   
 - \*\*Output\*\*: Dynamic content updates based on user activity.  
  
4. \*\*Customer Profile Edit Form\*\*   
 - \*\*Description\*\*: A form for updating personal details.   
 - \*\*Role\*\*: Modifies user information securely.   
 - \*\*Interaction\*\*: Validates input fields and updates the database.   
 - \*\*Output\*\*: Confirms update success or prompts corrections.  
  
5. \*\*Administrator Console\*\*   
 - \*\*Description\*\*: An interface for managing system settings and user accounts.   
 - \*\*Role\*\*: Provides tools for CRUD operations on products, categories, users, and orders.   
 - \*\*Interaction\*\*: Secure access with 2FA for high-privilege actions.   
 - \*\*Output\*\*: Reflects real-time changes and updates.  
  
6. \*\*Product Catalog Interface\*\*   
 - \*\*Description\*\*: Displays available products with search and filtering options.   
 - \*\*Role\*\*: Facilitates product discovery and selection.   
 - \*\*Interaction\*\*: Supports sorting by category, price, etc.   
 - \*\*Output\*\*: Product listings with real-time stock status.  
  
7. \*\*Shopping Cart Interface\*\*   
 - \*\*Description\*\*: A summary page of selected products.   
 - \*\*Role\*\*: Manages cart contents and facilitates checkout.   
 - \*\*Interaction\*\*: Allows quantity adjustments and item removal.   
 - \*\*Output\*\*: Updated cart summary and inventory status.  
  
8. \*\*Checkout Interface\*\*   
 - \*\*Description\*\*: A multi-step process for order completion.   
 - \*\*Role\*\*: Captures shipping, payment, and order details.   
 - \*\*Interaction\*\*: Validates inputs and processes the order.   
 - \*\*Output\*\*: Confirms order placement and redirects to a confirmation page.  
  
9. \*\*Payment Gateway Interface\*\*   
 - \*\*Description\*\*: Secure interface for entering payment details.   
 - \*\*Role\*\*: Handles payment processing securely.   
 - \*\*Interaction\*\*: Tokenizes card information and validates transactions.   
 - \*\*Output\*\*: Confirms payment success or failure.  
  
10. \*\*Order History Interface\*\*   
 - \*\*Description\*\*: Displays past orders with filtering options.   
 - \*\*Role\*\*: Provides order tracking and management.   
 - \*\*Interaction\*\*: Allows viewing order details and status updates.   
 - \*\*Output\*\*: List of past orders with summary information.  
  
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#### 2.2 Hardware Interfaces  
  
No hardware interfaces are identified in the functional requirements.  
  
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#### 2.3 Software Interfaces  
  
These interfaces represent interactions with external systems, databases, or APIs.  
  
1. \*\*User Authentication Database\*\*   
 - \*\*Description\*\*: A database storing user credentials and session information.   
 - \*\*Role\*\*: Validates user身份 and manages sessions.   
 - \*\*Interaction\*\*: Receives authentication requests and returns session tokens.   
 - \*\*Output\*\*: Session data or authentication status.  
  
2. \*\*Product Inventory Database\*\*   
 - \*\*Description\*\*: A database tracking product stock levels.   
 - \*\*Role\*\*: Ensures real-time inventory accuracy.   
 - \*\*Interaction\*\*: Updates inventory upon product addition or removal.   
 - \*\*Output\*\*: Inventory status changes.  
  
3. \*\*Payment Gateway API\*\*   
 - \*\*Description\*\*: An API for secure payment processing.   
 - \*\*Role\*\*: Handles payment transactions and fraud detection.   
 - \*\*Interaction\*\*: Processes payment details and returns transaction status.   
 - \*\*Output\*\*: Payment authorization or decline.  
  
4. \*\*Order Management System (OMS)\*\*   
 - \*\*Description\*\*: A system managing order processing and fulfillment.   
 - \*\*Role\*\*: Tracks order status and updates inventory.   
 - \*\*Interaction\*\*: Receives order data and updates the system.   
 - \*\*Output\*\*: Order status updates and notifications.  
  
5. \*\*Email Service Provider API\*\*   
 - \*\*Description\*\*: An API for sending transactional emails.   
 - \*\*Role\*\*: Delivers confirmation, password reset, and other emails.   
 - \*\*Interaction\*\*: Sends email content with tracking capabilities.   
 - \*\*Output\*\*: Email delivery status.  
  
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#### 2.4 Communication Interfaces  
  
These interfaces involve interactions over networks or external channels.  
  
1. \*\*Account Confirmation Email\*\*   
 - \*\*Description\*\*: An email sent to verify account creation.   
 - \*\*Role\*\*: Confirms user registration and completes account setup.   
 - \*\*Interaction\*\*: Contains a link to activate the account.   
 - \*\*Output\*\*: Email with activation link and instructions.  
  
2. \*\*Order Confirmation Email\*\*   
 - \*\*Description\*\*: An email sent after order completion.   
 - \*\*Role\*\*: Informs the customer of order confirmation.   
 - \*\*Interaction\*\*: Includes order details and a secure access link.   
 - \*\*Output\*\*: Email with order summary and tracking information.  
  
3. \*\*Password Reset Email\*\*   
 - \*\*Description\*\*: An email sent when a user requests a password reset.   
 - \*\*Role\*\*: Facilitates password recovery.   
 - \*\*Interaction\*\*: Contains a link to reset the password.   
 - \*\*Output\*\*: Email with reset instructions and a time-limited link.  
  
4. \*\*Notification System\*\*   
 - \*\*Description\*\*: A system for sending order status updates and promotional offers.   
 - \*\*Role\*\*: Keeps users informed of system events.   
 - \*\*Interaction\*\*: Triggers notifications based on order status changes.   
 - \*\*Output\*\*: Push notifications or emails.  
  
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### Summary  
  
The e-commerce system's external interfaces are primarily user interfaces, with additional software and communication interfaces. These interfaces ensure secure and efficient interaction with users, external systems, and third-party services. Each interface is designed to provide a seamless user experience while maintaining system integrity and security.