Exercise 1: Inventory Management System

**1. Understand the Problem:**  
Efficient data structures and algorithms are essential for managing large inventories because they help optimize operations such as searching, adding, updating, and deleting products. With a poor choice of structure, operations can become slow as data grows.  
Suitable data structures include:  
- ArrayList: Maintains order, good for small datasets.  
- HashMap: Provides fast access, ideal for lookup by productId.  
In this case, a HashMap is ideal due to its average O(1) access time.

**2. Setup**

Create a Java project named `InventoryManagementSystem`. All code should be written inside the `com.inventory` package.

**3. Implementation:**

**Product.java:**

package com.inventory;  
  
public class Product {  
 private int productId;  
 private String productName;  
 private int quantity;  
 private double price;  
  
 public Product(int productId, String productName, int quantity, double price) {  
 this.productId = productId;  
 this.productName = productName;  
 this.quantity = quantity;  
 this.price = price;  
 }  
  
 public int getProductId() { return productId; }  
 public String getProductName() { return productName; }  
 public int getQuantity() { return quantity; }  
 public double getPrice() { return price; }  
  
 public void setProductName(String productName) { this.productName = productName; }  
 public void setQuantity(int quantity) { this.quantity = quantity; }  
 public void setPrice(double price) { this.price = price; }  
  
 @Override  
 public String toString() {  
 return "Product [ID=" + productId + ", Name=" + productName +  
 ", Quantity=" + quantity + ", Price=" + price + "]";  
 }  
}

**InventoryManager.java:**

package com.inventory;  
  
import java.util.HashMap;  
  
public class InventoryManager {  
 private HashMap<Integer, Product> inventory = new HashMap<>();  
  
 public void addProduct(Product product) {  
 inventory.put(product.getProductId(), product);  
 }  
  
 public void updateProduct(int productId, String name, int quantity, double price) {  
 Product p = inventory.get(productId);  
 if (p != null) {  
 p.setProductName(name);  
 p.setQuantity(quantity);  
 p.setPrice(price);  
 }  
 }  
  
 public void deleteProduct(int productId) {  
 inventory.remove(productId);  
 }  
  
 public void displayAllProducts() {  
 for (Product p : inventory.values()) {  
 System.out.println(p);  
 }  
 }  
}

**Main.java:**

package com.inventory;  
  
public class Main {  
 public static void main(String[] args) {  
 InventoryManager manager = new InventoryManager();  
  
 // Add products  
 manager.addProduct(new Product(1, "Laptop", 10, 75000));  
 manager.addProduct(new Product(2, "Monitor", 20, 15000));  
 manager.addProduct(new Product(3, "Mouse", 50, 500));  
  
 // Display all products  
 System.out.println("Initial Inventory:");  
 manager.displayAllProducts();  
  
 // Update a product  
 manager.updateProduct(2, "Monitor", 25, 14000);  
  
 // Delete a product  
 manager.deleteProduct(3);  
  
 // Final inventory  
 System.out.println("\nFinal Inventory:");  
 manager.displayAllProducts();  
 }  
}