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Midterm

Note

This is an open-book exam. You may consult any books, papers, or notes, but discussion with others is strictly forbidden.

Problems

1. (5%) What is the relationship between the factory method and the template method patterns?

2. Suppose you are in a company designing an instant messaging (IM) app for a smart phone platform. The IM protocol is implemented in the networking component developed by the network team. You are now working on the chat dialog in which the user may send and receive text messages and emoticons instantly.

(a) (10%) What design pattern will you use to receive notifications from the network component in an asynchronous manner so you don't need to use polling to check for incoming messages? Please provide a UML class diagram showing the pattern applied.

(b) (15%) The initial version is a hit and the number of users is growing rapidly. More and more users request the support for other IM services, and the product manager decides to add the support in the next release. Networking with the new IM services are provided by third-party libraries. Unsurprisingly, the libraries for different IM services have different interfaces, but you need to make the same chat dialog work with the new IM services. The existing interfaces are:

```
public abstract interface IMService {
        public abstract bool Login(String Id, String password);
        public abstract ChatSession CreateChatSession(String contactId);
}

public abstract interface ChatSession {
        public abstract String GetContactStatus();
        public abstract void SendMessage(String message);
}
```

And the new libraries has the following interfaces:

For SkyChatIM:

```
public abstract interface SkyChatIM {
        public abstract bool Login (String userID, String password);
        public abstract SkyChatChatSession StartChatSesion(String contactID);
```

};

public abstract interface SkyChatChatSession {
        public abstract String GetStatus();
        public abstract void SendTextMessage(String message);
};

For WhatsUpMessenger:

public abstract interface WhatsUpMessenger {
        public abstract bool Authenticate(String userID, String Password);
        public abstract WhatsUpChatSession NewChatSession(String contactID);
}

public abstract interface WhatsUpChatSession {
        public abstract String GetContactStatus();
        public abstract void SendText(String message);
}

What design pattern will you use to make the interfaces of the new libraries compatible with the existing one? Please provide an example using WhatsUpMessenger to show how the interfaces are made compatible with the existing one?

3. (15%) Suppose you want to provide an online application server hosting service. The application server consists of an operating system, a Web server and a database server, each of which provides its set of APIs. To simplify the management of the application servers, you provide a set of APIs to allow users to control the server instances programmatically as the following:

public abstract interface APServerControl {
        public abstract APServerId Instantiate();
        public abstract void Start(APServerID id);
        public abstract void Stop(APServerID id);
        public abstract void Remove(APServerID id);
        public abstract APServerStatus GetStatus(APServerID id);
}

What design pattern is used here? Please describe how the interface works (what is done in the individual servers) by providing an example (such as Instantiate()).
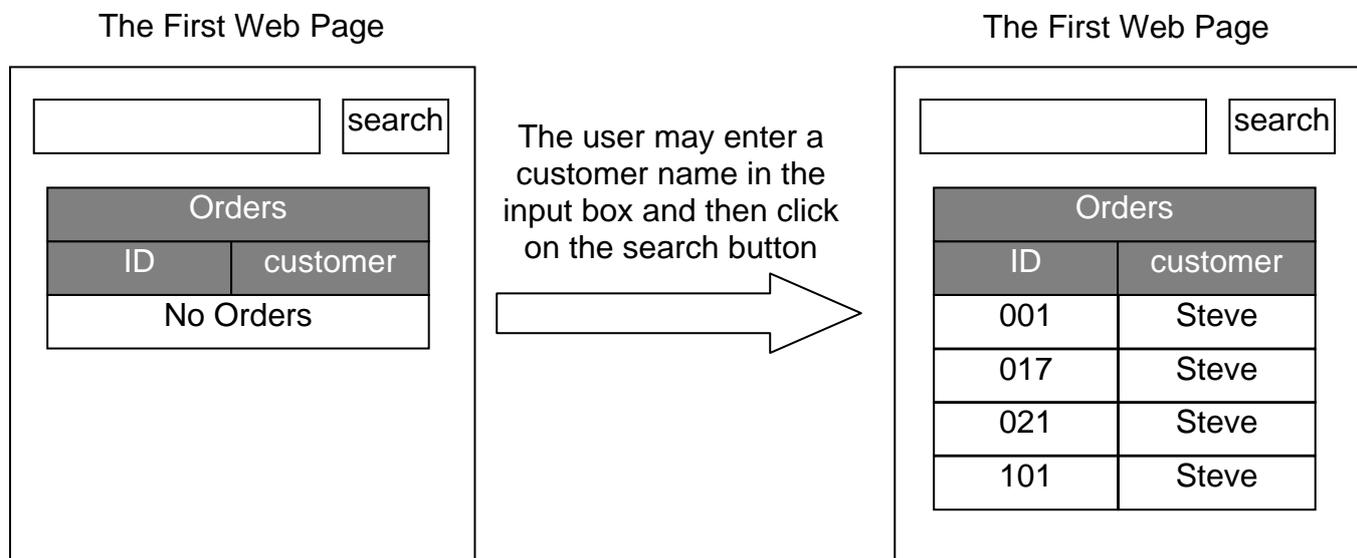

4. Consider the following Web-based search application for orders of items which consists of two Web pages. The specifications of the Web pages are as follows.

The first Web page is for the user to enter search criteria. In the beginning, there's no order in the order list of this page. The user may enter a search criterion which is the name of a customer and then click the search button. The orders the customer has are then shown in the order list immediately in the same page. After the user clicks on one of the orders in the

orders list, the search application redirects the user to the second Web page.

The second Web page shows details of the order which contains the order ID, the customer, the items. Orders and items have a many-to-many relationship. In other words, multiple items are allowed to be included in the same order while an identical item can appear in different orders.

(1) (10%) Please design a database schema that meets the requirements of the Web-based search application. You can simply draw some tables with attributes and data, or write down some "CREATE TABLE" statements in SQL. If you represent the database schema in SQL statements, you may set types of all attributes to VARCHAR(20).

(2) (30%) Please implement the Web-based search application using HTML, Javascript, and PHP. The application contains three PHP files which correspond to the first Web page, the second Web page and the page which handles requests sent from the first Web page. Among other things, you have managed to gather the following requirements:

  (a) The three PHP files are put in the same directory and named *first_page.php*, *second_page.php* and *ajax_page.php*.
  (b) You may need jQuery for shortening your code. The JS file of jQuery is put in the same directory and named *jquery.js*. Please include jQuery appropriately.
  (c) The information for connecting to the database is as follows:
     i.   Host: localhost
     ii. User Name: root
     iii. Password: secure1234
     iv. DB Name: order_application

The First Web Page

Orders	
ID	customer
No Orders	

The user may enter a customer name in the input box and then click on the search button

The First Web Page

Orders	
ID	customer
001	Steve
017	Steve
021	Steve
101	Steve

The Second Web Page

Order	
ID	017
customer	Steve
items	Apple Banana Orange

5. (15%) SQL Injection and Cross-Site Scripting are the two most common types of Web application security vulnerabilities/risks. What is the main cause of the two security vulnerabilities? How do the two compare?