**U 1 IP**

Using your design from Phase 1 DB, apply any design changes that you feel are needed and update your UML diagrams. Implement a client/server application in which a client communicates directly with a server. The server stores product and customer information in two separate files. The client application will allow a user to request product and customer information from the server. The server will retrieve and send the requested information to the client. The information will be displayed by the client in a user friendly manner. It is suggested that your application use Swing components to support a user friendly interface.

**U 2 IP**

Modify your server to make it multithreaded. Your server should allow more than one client to connect and request product and customer data. Test your multithreaded server by connecting more than one client to the server. Take at least 4 screenshots to demonstrate that your server correctly responds to each client’s request.

**U 3 IP**

Create a desktop application that connects to the store database and allows a user to create, read, update, and delete records from the product and customer tables. Test your application for at least one create, read, update, and delete command, and take a screenshot for each test. This should be completed for both the product and customer tables resulting in 8 screenshots.

Please use the user ID and password provided by your instructor in the code that connects to the database:

Login: ctuonline  
Password: student

**U 4 IP**

**Application Requirements**

You have decided that it would be beneficial to change your application from a desktop application to a Java Web application. Investigate how you could use J2EE technologies such as JDBC, JSP, Hibernate, EJBs, Servlets, JSF, or XML to develop a Java Web application that will allow a user to create, read, update, and delete records in product and customer tables of the store database. The schema provided earlier in the course must be used.

Applying the J2EE technologies of your choice, create an application that runs in a Web page, and connect to the MySQL store database. You may reuse some of the code developed in the earlier tasks. Your application must now run in a Web page and not run as a desktop application.

Please use the user ID and password provided by your instructor in the code that connects to the database:

Login: ctuonline  
Password: student

**Design Document Requirements**

Update your design document to reflect a Java Web application that will allow a user to create, read, update, and delete records in product and customer tables of the store database for an online store. Provide a description of the system architecture, including diagrams of all components and tiers including presentation, application, business logic, data access, and data storage. Diagrams should be drawn using UML notation. Please note that your design document will also serve as  your Key Assignment Draft in the next Discussion Board assignment.

**Users Manual Requirements**

Provide a user’s manual that explains how to start and use your application. If your instructor cannot run your application, you will not receive credit for this assignment. Use the schema provided earlier in the course for the product and customer tables. Include a SQL script file to build the store database with populated tables for the product and customer. Include any MySQL username and password required to run your application. Include screenshots if necessary to convey your instructions.

**U 5 IP**

**Application Requirements**

You will implement a Java Web application that will allow a user to create, read, update, and delete records in product and customer tables of the store database for an online store. The schema provided earlier in the course must be used.

Your application must run in a Web page and connect to a MySQL database backend. You may reuse some of the code developed in the earlier tasks.

You have had opportunity to examine a variety of technologies in the previous weeks, including Web services, JSF, hibernate, networking, and multithreading. You will determine which technologies to use to build your application, but you must use Java EE technologies such as JDBC, JSP, EJBs, Servlets, JSF, or XML.

Your application must demonstrate advanced level Java programming skills and be well commented. The application should be user-friendly, and the interface should be professional in appearance.

**Design Document Requirements**

Complete your design document. You must explain which Java EE technologies you have used and the reasons for your choices. Explain how these technologies achieved data persistence. Include some of the Java EE technologies that you considered but did not incorporate. Share your reasons why they were not used.

Provide a description of the system architecture including diagrams of all components and tiers including presentation, application, business logic, data access, and data storage. Diagrams should be drawn using UML notation.

You must include a Future Development Plan section in your design document that explains how you could modify your application so that the sever side is multithreaded and can handle multiple requests from different clients running the Web application. You will also include a reflection upon the following topics:

* Explain how web services are used in the real world. Provide at least 3 real world examples.
* What are the benefits of web services?
* How would you troubleshoot and test a web service? Would you use a debugger? Why or why not?
* Do you think that your client/server application could be enhanced to consume a web service or be used as a web service? Why or why not?
* Discuss the Java EE technologies you used and the reasons for your choice. Explain how these technologies achieved data persistence.

**Test Plan Requirements**

Assemble your test plan and test cases with results.

**Users Manual Requirements**:

Provide a user's manual that explains how to start and use your application. If your instructor cannot run your application, you will not receive credit for this assignment. Do not deviate from the schema provided earlier in the course for the product and customer tables. A SQL script file must be provided to build the store database. Include any MySQL username and password required to run your application.