**CS 2212B Introduction to Software Engineering**

**Sample Final Exam**

**Question 1 [Process Models] [10 points equally distributed]**

1.List the advantages and disadvantages of the Waterfall process model and provide its schematic diagram

2. Discuss the Incremental process model and provide its schematic diagram

**Question 2 [UML] [30 points]**

Let us consider an e-commerce application where the users can:

1. Enter the system via a secure server by either providing a PIN or by providing a user name and a password, which in either case are verified by an authentication server
2. Browse the list of products offered through an inventory server and its corresponding database
3. Choose products and add products in a cart
4. Create orders for the products they have selected and are in the cart by using an ordering process step. Optionally Invite representatives of the company for on-line chat
5. Provide information on payment and shipping of the products it purchases. Optionally choose rush shipping option. The standard option is by surface mail without using a courier.
6. Cancel the order before payment
7. Pay by credit card via a secure payment server
8. Receive a confirmation code for the payment and the order
9. Draw the domain model for the system above [**10 points**]
10. Draw the activity diagram for the system above [**10 points**]
11. Draw the use case diagram for the login use case **U1** [**5 points**]
12. Draw the use case diagram for **U4** [5 points]

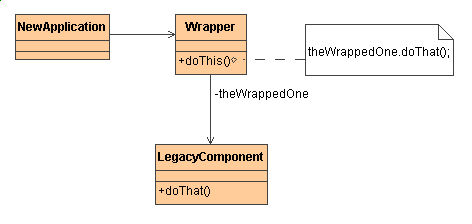
**Question 3 [Architecture] [20 points equally distributed]**

Let us consider an application that allows us to read data from a sensor, in groups of *k* data elements each time, every *n* seconds. The system sorts the data values ​​of each group of *k* dataelements in ascending order and then calculates the average values ​​of each data group. Every 50 groups the system prints the values of the group with has the highest average. Draw the system architecture using components and connectors by considering two different architectural styles:

1. Using Data Flow style
2. Using Implicit Invocation Style (event driven)

**Question 4 [Design Patterns] [20 points]**

Let us consider the following class diagram:



The purpose of this pattern is to transform the interface of a class to an interface that is expected by the application side (client application). It allows classes to work together while this would not be possible due to incompatible interfaces. The basic features of the pattern are (a) to "transform" the interface of a class with a new interface which is the one to be exposed to the client application; (b) to make possible to access an old system component (i.e. Legacy Component) by a new application.

1. Which design pattern is presented in the class diagram above? Briefly explain your answer. [**5 points**]
2. Give a short example using object oriented code and the classes above for a) defining the pattern (classes and methods that define the pattern) and b) using the pattern (client code that uses the pattern classes). Your code does not need to be syntactically perfect (i.e. compile) but has to depict the pattern and the client details. [**15 points**]

**Question 5 [Reliability] [20 points]**

International MegaSoft Machines Corp. just implemented a large system. The system size is 1.25 MLOC (million lines of code). From previous experience in similar products of the company, it is estimated that there are on average 4 bugs that produce failures, per 10 KLOC. If we consider the Musa linear model and the diagram below, calculate the minimum time that system should be tested so that the failure intensity parameter λ is less than 0.0001 failures / CPU hour of operation. Round, if need be, the value of λ0 you will find to its nearest integer.

|  |  |
| --- | --- |
| **n** | **LN(n)** |
| 0.00001 | -11.5129 |
| 0.00002 | -10.8198 |
| 0.00003 | -10.4143 |
| 0.00004 | -10.1266 |
| 0.00005 | -9.90349 |
| 0.00006 | -9.72117 |
| 0.00007 | -9.56702 |
| 0.00008 | -9.43348 |
| 0.00009 | -9.3157 |
| 0.0001 | -9.21034 |
| 0.0002 | -8.51719 |
| 0.0003 | -8.11173 |
| 0.0004 | -7.82405 |
| 0.0005 | -7.6009 |
| 0.0006 | -7.41858 |
| 0.0007 | -7.26443 |
| 0.0008 | -7.1309 |
| 0.0009 | -7.01312 |



**Useful Formulas:**

λ(μ) = λ0[1 - μ/v0]

λ(τ) = λ0exp(-λ0τ/v0)

μ(τ) = v0[1 – exp(-λ0τ/v0)]