

Read the following scenario CAREFULLY then answer ALL SIX questions:

A leading manufacturing company XYZ commissions a long list of shippers (freight forwarders) to transport the spare parts from the suppliers to their storehouses. Billing is done according to the distance, the weight, the charging and discharging time.

Billing can be done either through an *invoice* which is issued by the shipper to XYZ, or through a *credit note* issued by XYZ for the shipper. The structure of the invoice and the credit note are similar.

It is required to create a web site to be hosted by XYZ to track the invoices and the credit notes. The employees of XYZ can upload the credit notes to this site so that the employees of the shippers can revise them, accept them or eventually place a complaint about one or more items of the credit notes. A credit note consists of several items with a price and a short description for each item, and a date, a total amount, and the name and address of the shipper. The complaints are registered by the system are associated to the credit note and the employees of XYZ respond by either rejecting the complaint or updating the credit note.

Basically, the same happens for the invoices which are uploaded by the shippers. The invoice consists of several items with a price and a short description for each item, and a date, a total amount, and the name and address of company XYZ. The employees of XYZ revise the invoices, accept them or place an objection about one or more items of the invoice. The shipper can then update the invoice and upload a new version.

The employees of a shipping company can see their invoices and credit notes only, which means a login with username and password is required. An administration section of the system must be created to enable company XYZ to define and manage shippers, their corresponding registered users, and other configuration parameters represented as key and value pairs (such as "UploadDirectory", "c:\invoices", "CreditNotePrefix", "CN_", etc.).

Question 1 (10%):

Construct a simple use case diagram involving the employee of XYZ and the employee of shipping company S1.

Question 2 (20%):

Draw the UML state diagram for an *invoice*.

Transform it to a JAVA class skeleton using the *state* design pattern.

Question 3 (20%):

Draw the UML class diagram for the system. All attributes mentioned in the scenario must be present in the diagram. All operations needed in Questions 1 and 2 as well as any obvious methods in the problem description must be included in the diagram. Make all necessary assumptions.

Question 4 (20%):

Map the UML class Diagram of Question 3 into a code **skeleton** written in JAVA. All associations between classes must be present in the code. Make all necessary assumptions.

Question 5 (20%):

Using one (or a combination) of the design patterns studied in the course, suggest a flexible solution that enables the employees of XYZ to be notified upon the change in the state for specific credit notes. An example would be that employee *emp1* configures the system to receive an email if a complaint is placed on CN_0815, and employee *emp2* configures the system to receive an email if CN_4711 is downloaded.

Identify the design pattern(s) used, draw the UML class diagram and write a JAVA code skeleton.

Question 6 (10%):

- a. Draw the UML class diagram of the *object pool* design pattern
- b. Draw the UML class diagram of the *pull filter* design pattern.

GOOD LUCK