

Comprehensive Examination
(EC-3 Regular)

Course No. : SS ZG514
Course Title : OBJECT ORIENTED ANALYSIS & DESIGN
Nature of Exam : Open Book
Weightage : 50%
Duration : 3 Hours
Date of Exam : 09/11/2014 (FN)

No. of Pages = 3
No. of Questions = 4

Note:

1. Please follow all the *Instructions to Candidates* given on the cover page of the answer book.
2. All parts of a question should be answered consecutively. Each answer should start from a fresh page.
3. Assumptions made if any, should be stated clearly at the beginning of your answer.

Q.1 (a) Consider the definition of class named PurchaseOrder given below:

```
class PurchaseOrder{  
    List<Order> lstOrder = new ArrayList<Order>(); //list of orders  
    //method to get the total cost of all orders  
    double getTotalOrderCost(){  
        double total = 0;  
        //loop over the list of orders to fetch orders and find total cost  
        for(Order order : lstOrder) { total += order.getOrderCost(); }  
        return total;  
    }  
}
```

Draw the sequence diagram to capture the system response for the execution of the method `getTotalOrderCost()` in the `PurchaseOrder` class. [5]

Q.1 (b) Refer to the class diagram given in Fig. 1. Which GRASP design pattern does it violate. Suggest a better solution with proper reasoning. [5]

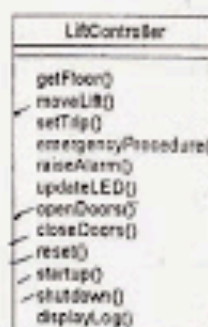


Fig. 1: class diagram corresponding to Q.1(b)

Q.1 (c) Identify the problem with the design of the class diagram given in Fig. 2. Identify classes which are badly designed. Give to the point reasons to substantiate your answer. [5]

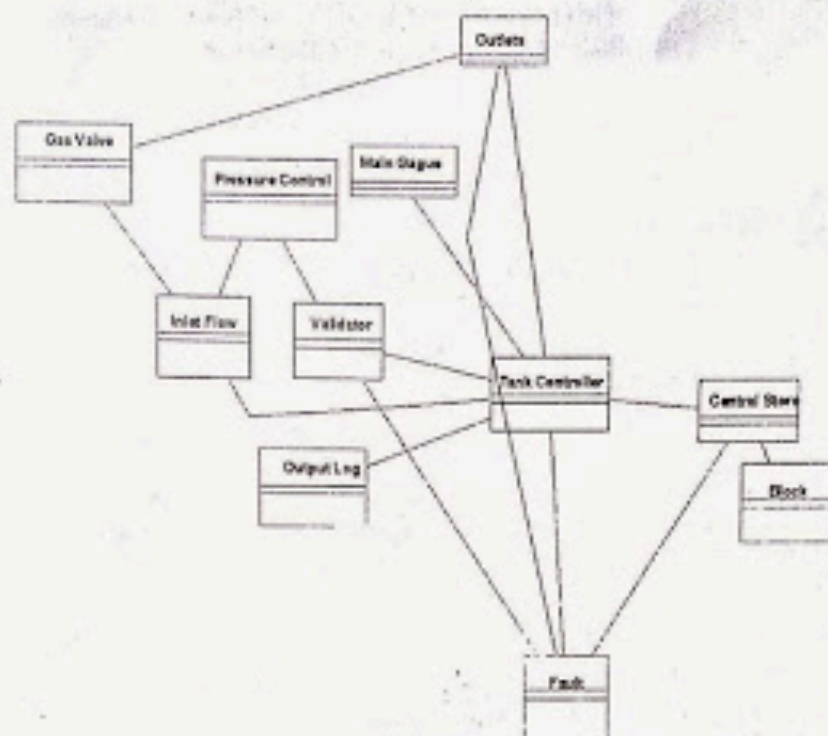


Fig. 2: class diagram corresponding to Q.1(c)

Q.1 (d) Explain briefly the way in which use of the Creator pattern acts to lower coupling. [5]

Q.2. Given below is a fully dressed use-case specification read and understand it carefully.

Use Case: Check Out Books

Primary Actor: Worker

Stakeholders and Interests:

- Worker: wants fast, and easy check out of books.
- Patron: wants fast check out, and does not want to be charged for books they did not check out.
- Library: wants fast check out of books, and wants to make sure that all books that leave the library have been checked out. Wants to allocate books fairly.
- Government: wants to protect investment in books and keep costs down. Wants to promote learning and citizen happiness.

Pre-conditions: The Worker has been authenticated.

Success Guarantee (Post-conditions): The System remembers that the Patron has checked out the books.

Main Success Scenario (or Basic Flow):

1. The Worker tells the System the identity of a patron who wishes to check out books.
2. The System confirms that the patron is allowed to check out books, and remembers the patron's identity.
3. The Worker tells the system the identity of a book this patron is checking out.
4. The System confirms that the book can circulate, calculates the due date based on whether the patron is a faculty member or a student, and records that the patron has checked out this book, which is due on the calculated due date, and makes that information available from the library catalog.
5. The System tells the Worker the due date (which also confirms that the book has been checked out).
6. The Worker repeats steps 3-5 until indicates done.

Extensions (or Alternative Flows):

- 2a. If the patron is not allowed to check out books because they have violated some library policy (for example, if the patron has not paid their university bill or library fines):

1. The System tells the Worker that the patron is not allowed to check out books and the reason for this prohibition.
2. The use case ends.
- 4a. If the book that is being checked out is non-circulating:
 1. The System tells the Worker why the book is non-circulating.
 2. The use case continues from step 3 in the main success scenario.

Special Requirements

1. There are different due dates depending on the kind of patron one is dealing with. For example, faculty can take out books for the whole academic year, whereas students can only take them out for a limited time.

Technology and Data Variations List:

- 3a. Barcode scanners are normally used to identify books.
- 3b. Books without barcodes have to be entered manually.

Draw a conceptual class diagram (domain model), which should be relatively complete for the use case description given above. It should include associations and important attributes for the classes which you have identified, no need to include operations. [5]

- Q.3. In this question you will do the design for just the checkOut system operation from the system sequence diagram shown in Fig. 3. (Don't include the startCheckOut operation) Your design should be based on the standard solution for Q.2. You should design the checkOut operation in the main success scenario, but you must check the conditions that are needed to confirm that the checkOut operation executes successfully. Represent your design using collaboration diagram notation. Only show the design patterns or principles which are used to assign responsibilities that are different than Creator or Information Expert. [5]

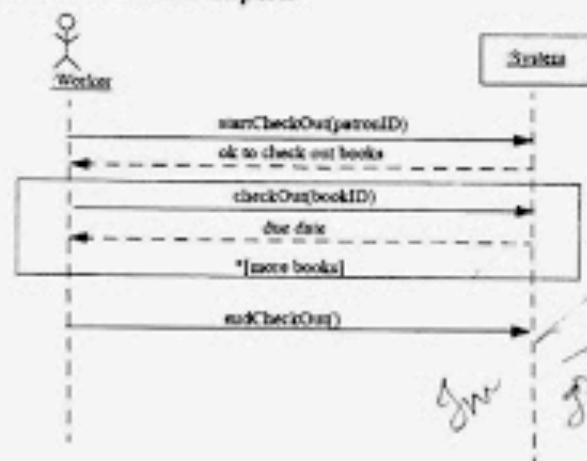


Fig. 3: SSD for the main success scenario of the above use case, corresponding to Q.3

- Q.4. Karvy Consultants is a Financial Asset Management company. They have a portfolio management system using which an investor can calculate the net asset value (NAV) of their investments in the stock market. There are two kinds of assets, stocks and mutual funds. Stock has a name, price and quantity. Mutual funds have a name and a list of stocks. Each investor of the firm has a named portfolio on which the firm charges 2 percent management fee. Investors can keep both stocks and mutual funds in these portfolios. The investor can ask the portfolio management system to get the NAV by invoking the operation on portfolios to calculate the NAV for his/her total investments that he/she made in several stocks and mutual funds.
- (a) What design pattern(s) do you think are suitable for this application. Properly Justify. [5]
 - (b) Draw the class diagram which explicitly represents the participant classes and interfaces involved in the design pattern(s) which you have selected above. [15]

Birla Institute of Technology & Science, Pilani
Work-Integrated Learning Programmes Division
First Semester 2014-2015

Comprehensive Examination
(EC-3 Makeup)

Course No. : SS ZG514
Course Title : OBJECT ORIENTED ANALYSIS & DESIGN
Nature of Exam : Open Book
Weightage : 50%
Duration : 3 Hours
Date of Exam : 23/11/2014 (FN)

No. of Pages = 2
No. of Questions = 5

Note:

1. Please follow all the *Instructions to Candidates* given on the cover page of the answer book.
2. All parts of a question should be answered consecutively. Each answer should start from a fresh page.
3. Assumptions made if any, should be stated clearly at the beginning of your answer.

- Q.1 (a) How does composition help facilitate encapsulation? Answer in 500 words. [5]
Q.1 (b) A class has a single constructor which is only visible within the class. What purpose might this class serve? Write some code to describe this situation. [5]
Q.1 (c) What are the key elements in the description of a design pattern? Answer in 500 words. [5]
Q.1 (d) What are member access specifiers, and how are they represented in a UML class diagram? Answer in 500 words. [2]
Q.1 (e) What is aggregation, composition and inheritance, and how are they represented in a UML class diagram? Answer in 500 words. [3]
- Q.2. Consider the following UML diagram given in Fig. 1 and identify the design pattern in the diagram also identify the participants in the diagram and indicate their responsibilities. [5]

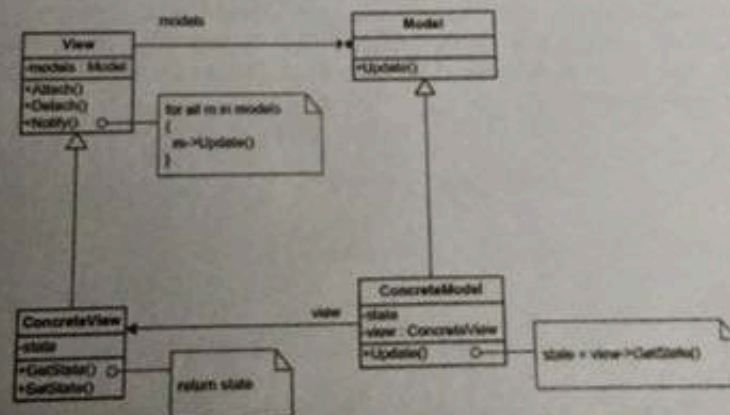


Fig. 1: Diagramming corresponding to Q.2

- Q.3. A manager is an employee who leads engineers, technicians and support personnel, all of whom are also employees. A higher level manager can also lead other lower level managers. A typical hierarchy will look similar to the one presented below in Fig. 2.

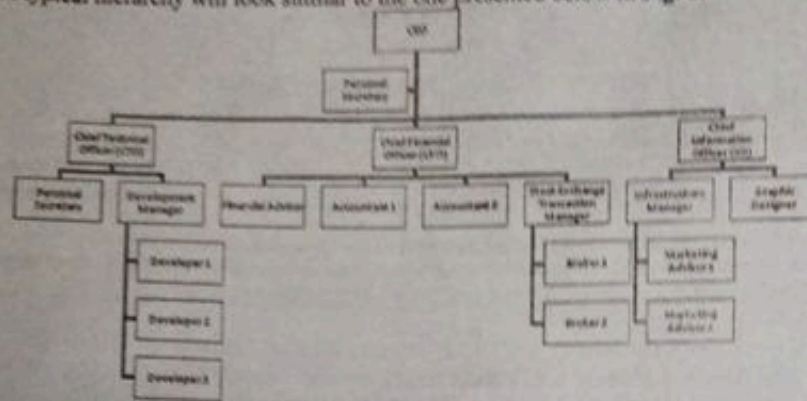


Fig. 2: Diagram corresponding to Q.3

- Which design pattern you would use to implement this corporate hierarchy? Please give a short explanation why (not more than 700 words). Show an appropriate class diagram(s). [10]
- Q.4. Give two examples of information about a problem domain that can be captured in UML Activity Diagrams, and two ways in which these diagrams can be useful for Requirements Analysis. [5]
- Q.5. Draw a state chart diagram that describes the process of passing a course as a set of concurrent activities. To pass, a student has to attend all but two lectures, present to the class a paper s/he has read, and complete a course project due on the last day of the term. To give his/her presentation, the student is given a date by the instructor, prepares his/her presentation, and gives it on the assigned day. At any time, the student can drop the course. Make sure to define events, conditions, actions for transitions in your diagram, where appropriate. [10]
