Sri Lanka Institute of Information Technology

B.Sc. Special Honours Degree/Diploma
in
Information Technology

# IT2020 – Software Engineering

Duration: 3 Hours

Instructions to Candidates:

1. This paper contains five Essay Type Questions with a total of 100 marks.

2. Answer all questions in the booklet given.

3. This paper contains 9 pages with Cover Page.

4. Electronic devices capable of storing and retrieving text, including

calculators and mobile phones are not allowed.

Question 01   (15 marks)

a) Draw the Sequence Diagram for the scenario given below.

A security guard uses Alarm App (AA) on his mobile phone to activate and deactivate an alarm system of a building. Once activated, the AA can detect fire and theft in the building and if detected the sound of siren is used to give the warning. AA communicates with the Alarm Hardware System (AHS) to send/receive messages to/from the hardware components of the system. AHS consists of six classes, Control Box, Siren, Fire Sensor, FireSensorMonitor, Security Sensor and the SecuritySensorMonitor. The class diagram of the AHS is given below.
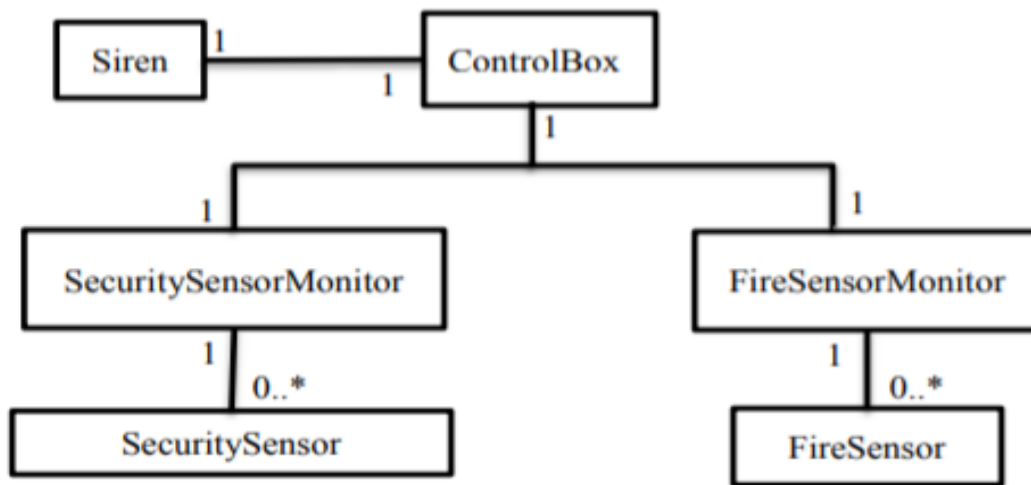
To activate the system, first the security guard presses the "Activate" button of AA on his mobile phone. This sends a message to the Control Box. In order to detect fire and thefts, Control Box should monitor messages from both FireSensorMonitor and SecuritySensorMonitor in parallel. The steps followed in detecting fire is given below.

i) Control Box sends a message to FireSensorMonitor to monitor fire.
ii) To check whether a fire has been detected, FireSensorMonitor sends a message to Fire Sensor.
iii) If a fire is detected, Fire Sensor will return "TRUE".
iv) Step ii) will be repeated until Fire Sensor returns "TRUE"
v) If a fire is detected, FireSensorMonitor informs Control Box and Control Box sends a message to Siren to sound the fire alarm.
vi) Execution of step v) should not be interrupted by other messages.
Note – Assume the sequence diagram for detecting theft is already designed for you.
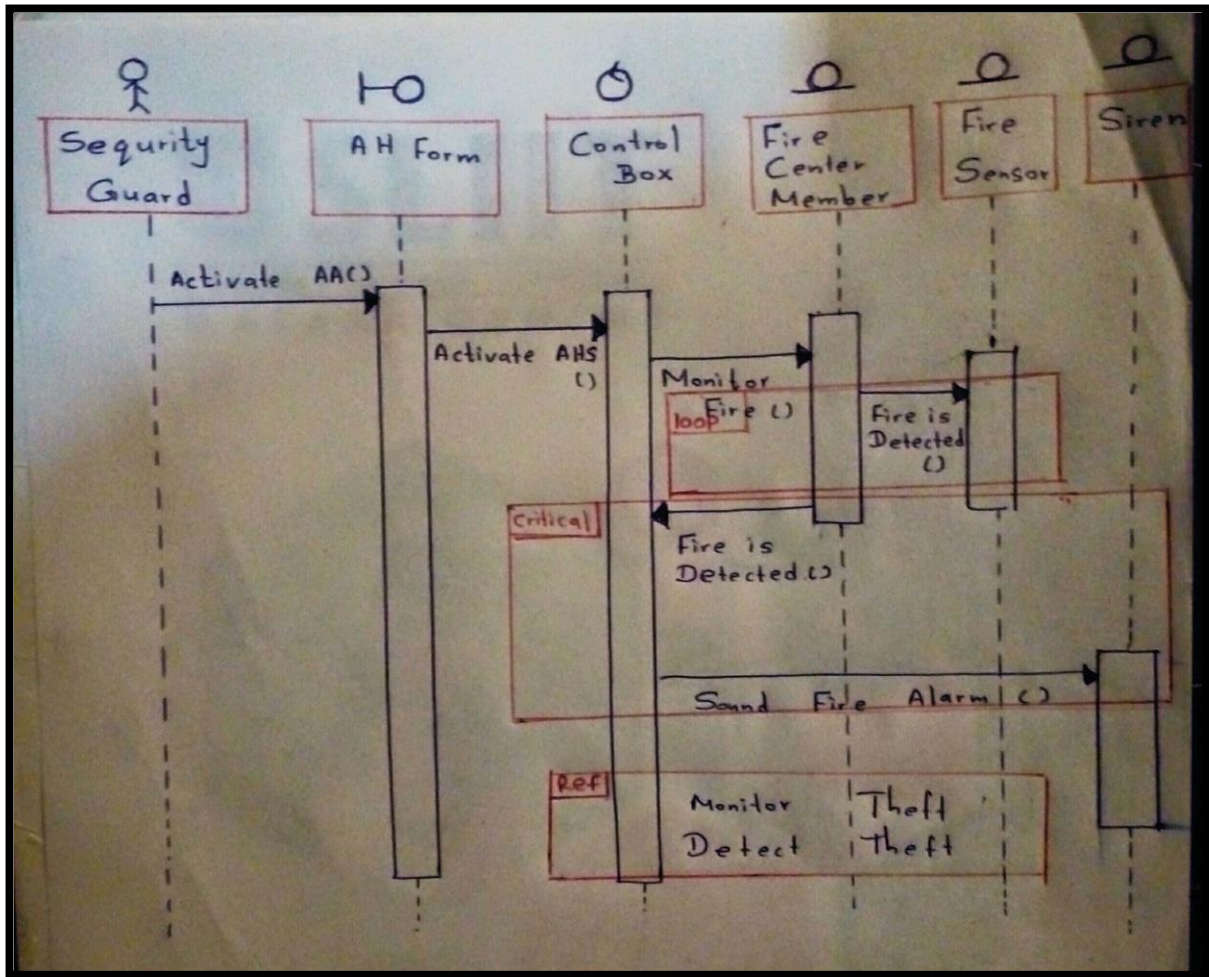
Question 02   (15 marks)

a) Model a Physical diagram for the below given scenario.
 "Neo-Safe-Health" (NSH) is a new E-Health application developed under the vision of empowering health consumers and assisting health professionals. Given below is a detailed description of the deployment of NSH application.

☐ NSH is a web application which is accessible for any user via a mobile phone or a desktop. Mobile users need to download and install the NSH_M_Client application from the respective app stores (Android or IOS), while desktop users can access the system using the browser.

☐ NSH's backend applications is named as NSH_Service, which is implemented in java and is deployed in an NGINX web server. NGINX runs in Ubuntu 16.04LTS which is installed in a Dell PowerEdge-T130 Hardware Server.

☐ This NSH_Service application consists of three core modules (components) such as UI, Patient _Services and Doctor_Services.

☐ The User Interface (UI) of NSH is developed using JSP web pages. UI component implements "I_NSH" interfaces which can be accessible by both mobile and desktop users. Other core-components (Patient_Services and Doctor_Services) implements their own interfaces such as iPatient_Services and iDoctor_Services respectively. UI component will retrieve information using these when needed.

Physical Diagram
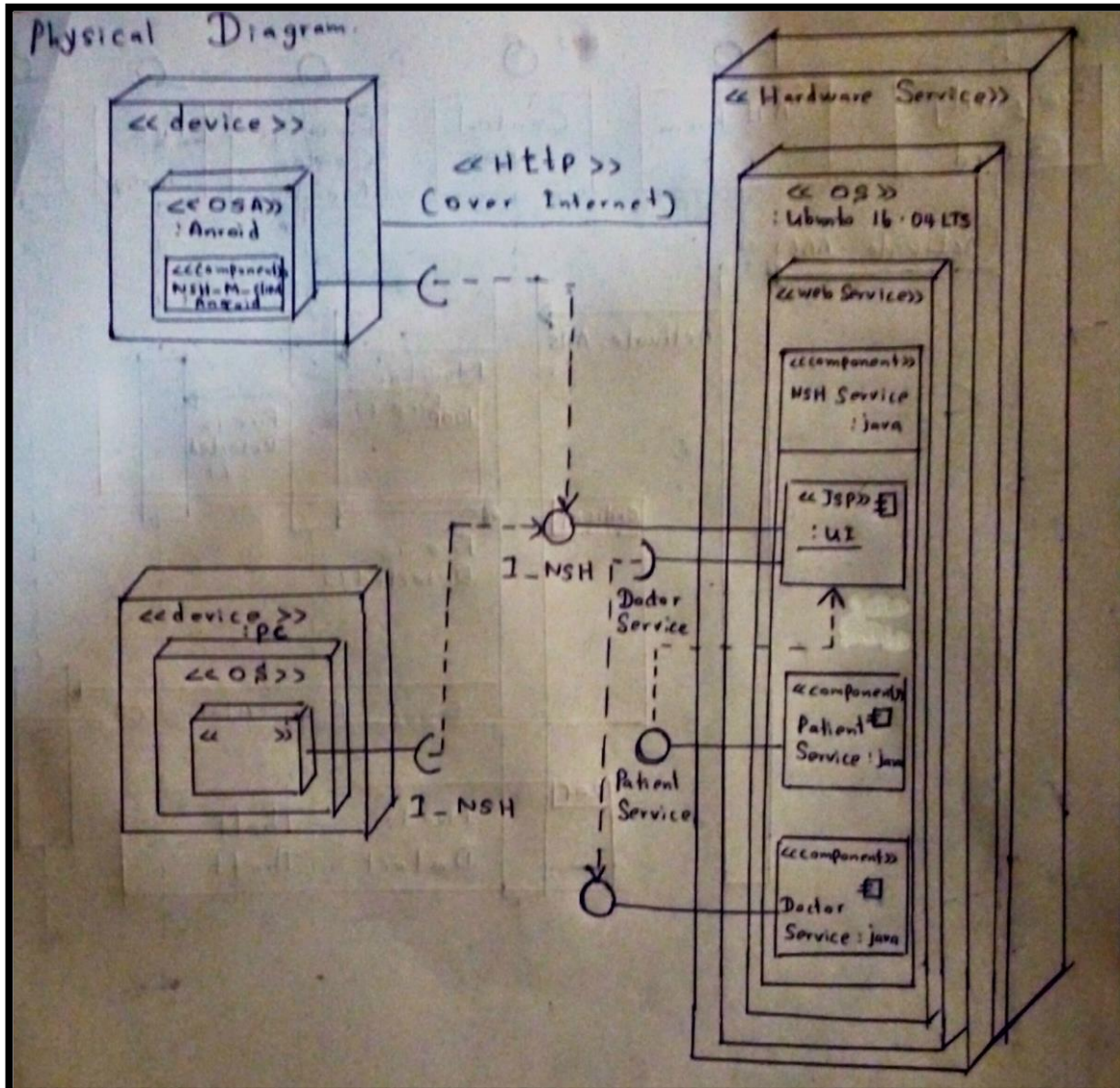
☐ Both desktop and the mobile devices connect to the web server via http over internet.

Question03 (25 marks)

a) . Based on the given code come up with a control flow graph and then calculate the minimum no of test cases required for full statement coverage.
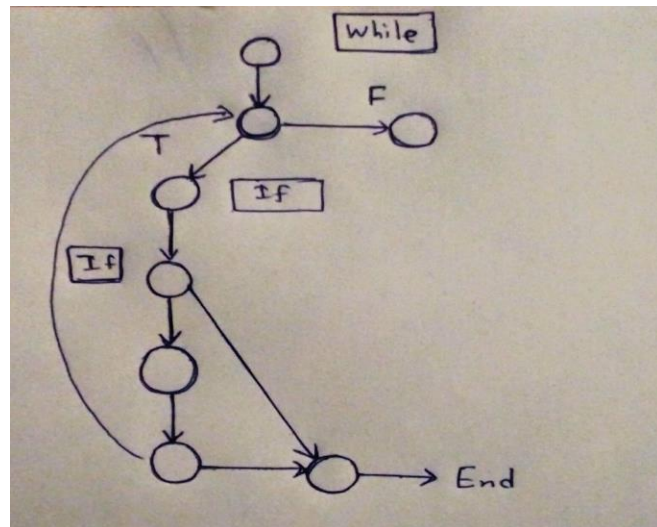Answer:
Test Case 1 : i= 1
100% code coverage

b) How many test cases are required to achieve 100% statement coverage for the given below code?

```
int evensum(int i)     {
        int sum = 0;
      while (i <= 3) {
            if ( i % 2 = = 0)   {
                    sum = sum + i;
                    }
                i++;
        }
      return sum;
      }
```
Answer:
Test Case 1 : i=1
All paths are covered

Question04   (35 marks)

a. Consider the scenario given below and answer the questions.

"TELEST" is an aero research and experiment organization. They are going to implement a new software to model data read by a telescope. A telescope can be programmed to model the orbital pattern (the rotation path) of celestial bodies such as moon, planets and stars. To track the celestial body y the telescope, one should specify the celestial body and obtain the position coordinate (RA, DEC values). With time these coordinates will be read continuously. Based on the coordinates read the angel of the telescope will also move to adjust next reading. According to the coordinates the orbital paths will be modeled as a 2d graphical representation, a virtual 3d representation and as a textual representation.

i) If you were hired as a designer for this project, what would you suggest as the most appropriate design pattern to be used in implementing the system?
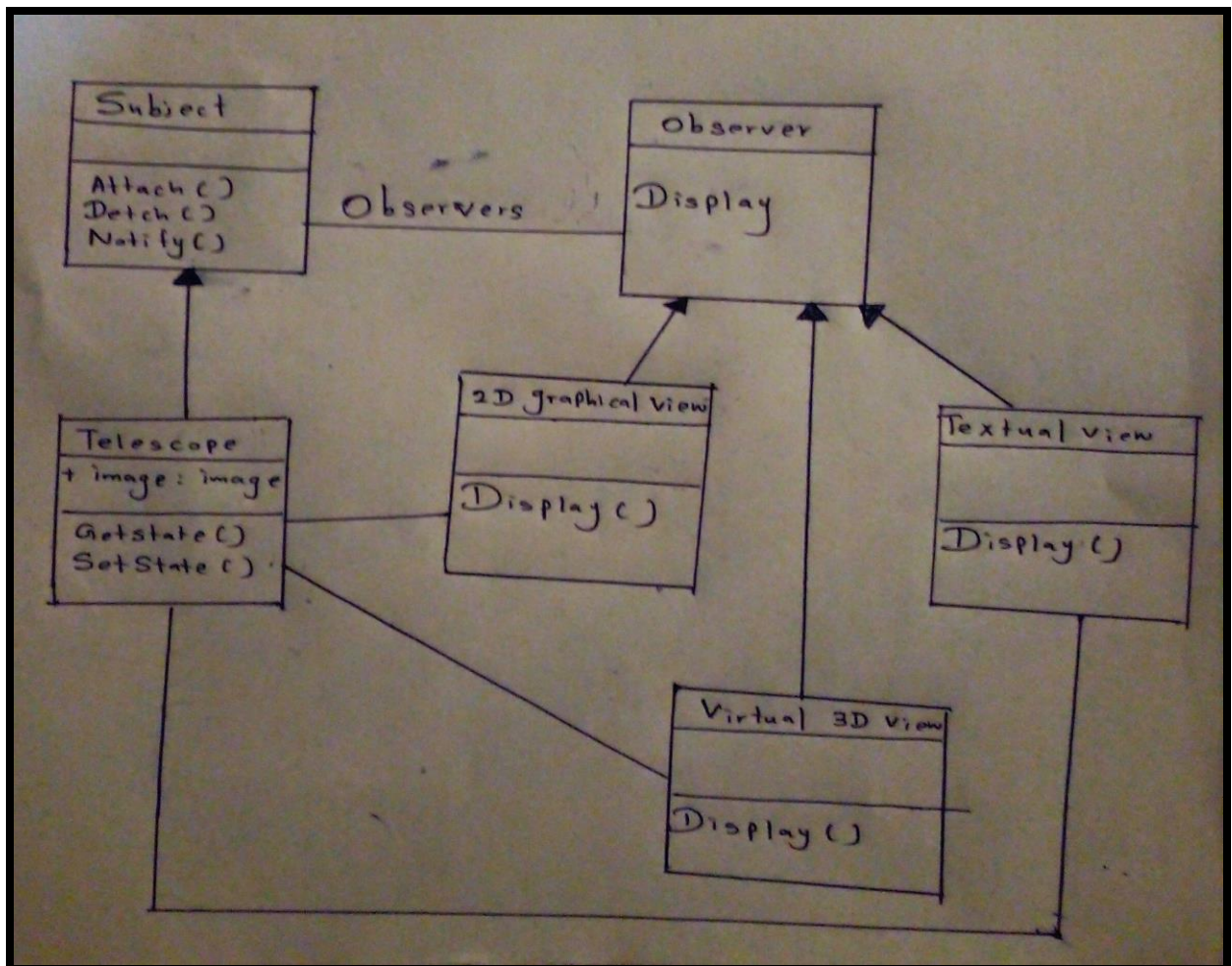Answer:

(2 marks)

ii) Justify your selection of the design pattern.

Answer:

The Subject or the data of the application is changing rapidly. (celestial body coordinates) The three representation need to be notified and update every time new coordinates are read by the telescope.   (2 marks)

iii) Using a simple class diagram and explain your solution.

c) The detailed description of the celestial object tracking is given below.
The system should first read the coordinates of a particular celestial body and store it in a, database. According to these coordinates the system should calculate the hardware settings of the telescope and compare it with the earlier position. The new position is saved in the database and the telescopes' angel is rotated to the new position. This happens in every 15 minutes. Assume you have to modify the above design to suit this requirement.

i) What is the most suitable design pattern to implement the above scenario? State the main reason we use this design pattern in designing software? (3 marks)
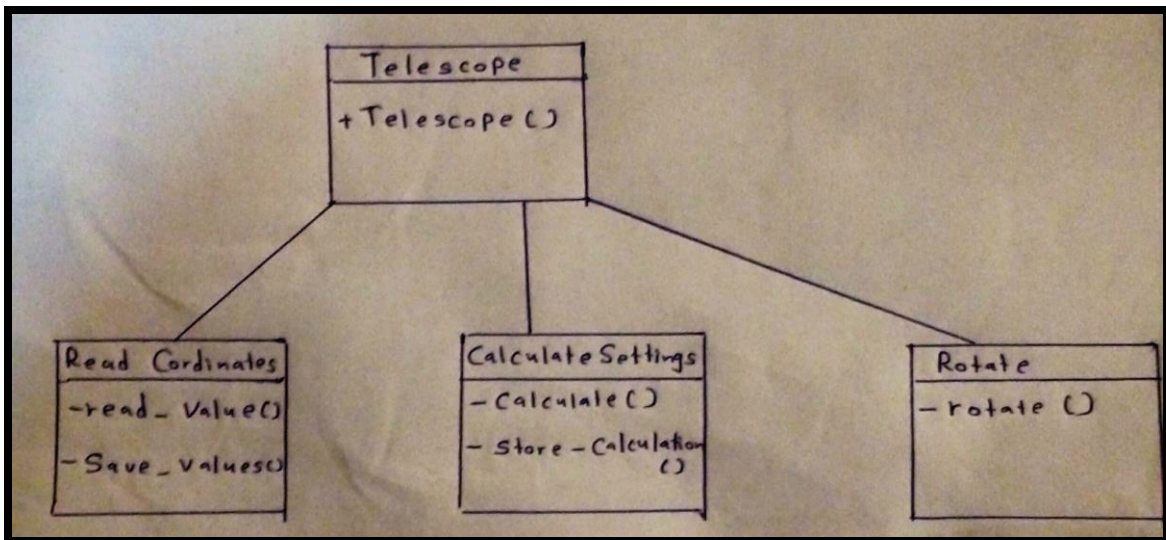
Answer:

Façade

To make the components independent to have minimum coupling

Component can be changed with minimal effect to the main program.

ii) Draw the class diagram to express this requirement. (7 marks)

Hint: You can use the classes, Telescope, ReadCordinates, Calculate ettings and Rotate. Model the diagram only for part c (You do not need to redraw the part b) iii) design again)

(4 marks)

b. Go through the code segment given below and answer the questions.

```java
public interface Room
{
  public String showRoom();
}
```

```java
public class SimpleRoom implements Room
{
 @Override
 public String showRoom()
 {
   return "Normal Room";
 }
}
```

```java
abstract class RoomView implements Room
{
  protected Room specialRoom;
  public RoomView  (Room specialRoom)
  {
   this.specialRoom= specialRoom;
  }

 public String showRoom()
 {
   return specialRoom.showRoom();
 }
}
```

```java
public class Color extends RoomView {

  public Color (Room specialRoom) {
    super(specialRoom);
  }

  public String showRoom() {
    return specialRoom.showRoom() + addColors();
  }

  private String addColors() {
    return " + Blue Color";
  }
}
```

```java
public class Curtain extends RoomView {

  public Curtainr (Room specialRoom) {
    super(specialRoom);
  }

  public String showRoom() {
    return specialRoom.showRoom() + addCurtains();
  }

  private String addCurtains() {
    return " + Red Curtains";
  }
}
```

```
public class DesignPatternMain {

  public static void main(String args[])
  {
    Room room = new Curtain (new color(new SimpleRoom()));
    System.out.println(room.showRoom());
  }
}
```
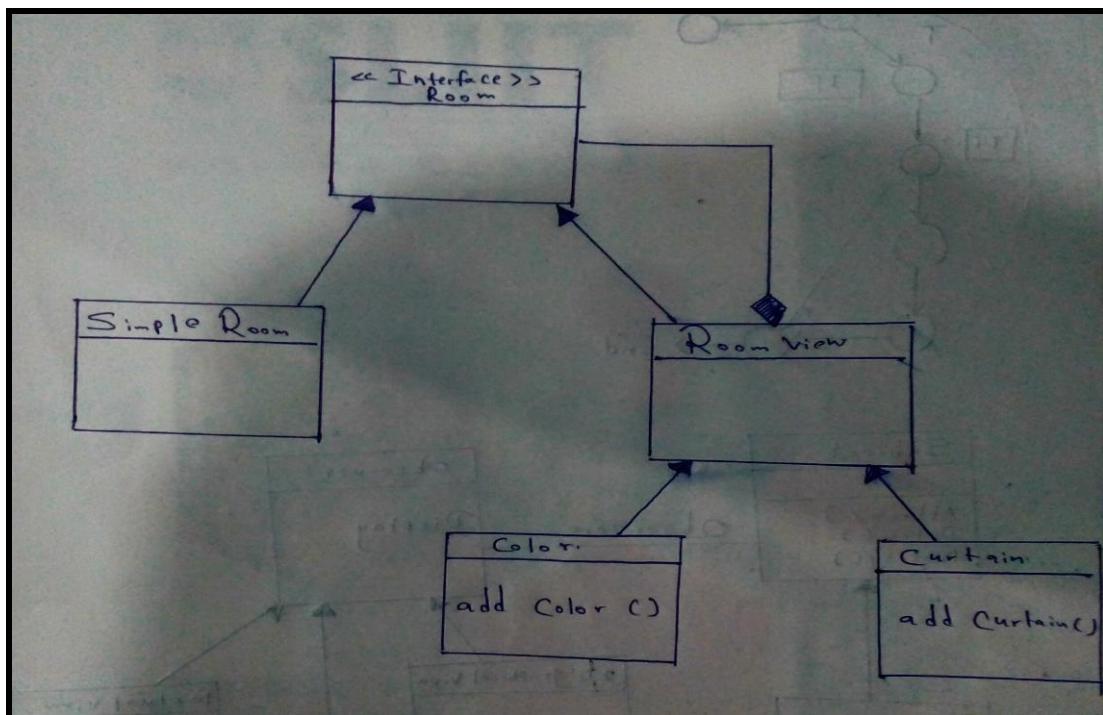
(i) What is the design pattern that has been used to implement the above code segments?
Answer:

      Decorder design pattern

(ii) Using a simple class diagram, show the structure of the design pattern you defined in part i) above. Indicate the methods given in the c de segment on your class diagram.

Question 04 (10 marks)

1. What are the four processes which includes in Configuration Management? (2marks)

Version Management
Change Management
System Building
Release Management

2. What does it mean by Codeline and Baseline in Configuration Management? (2 marks)
Answer:

1) A codeline is a sequence of versions of source code with later versions in the sequence derived from earlier versions.

2) A work product becomes a baseline only after it is reviewed and approved. A baseline is a milestone in software development that is marked by the delivery of one or more configuration items.
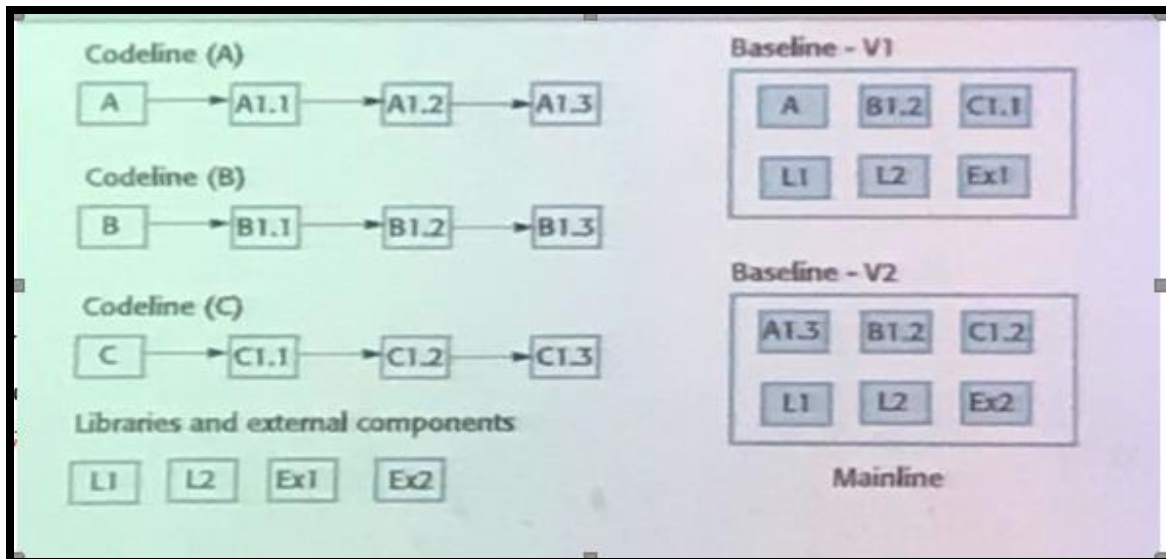
3. What is the difference between centralized version control and Distributed version control?
Answer:

1) Developers check out components or directories of components from the project repository in to their private workspace and work on these copies in their private workspace. When their changes are complete, they check-in components back to the repository.

2) A 'master' repository is created on a server that maintains the code produced by the development team. Instead of checking out the

files that they need. A developer creates a clone of the project repository that is downloaded and installed on their computer.

4. Describe "**Incident response**" in incident management process in your own words.
 (4 marks)

Answer:

Incident response has 5 main activities involved

Initial diagnosis: This occur when the user describes his or her problems and answers troubleshooting questions.

Incident escalculation: This happens when an incident requires advance support. such as sending an on-site technician or assistance from certified support staff.

Investigation and diagnosis: These processes take place during troubleshooting when the initial incident hypothesis is confirmed as being correct. Once the maident is dragnosed. Staff can apply a solution, such as changing software setting.applying software patch, or ordering new hardware.
Resolution and recovery: This is when the service desk confirms that the used has been restored to the required SLA level.