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The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Electrical & Computer Engineering

Study Programme	: Bachelor of Technology Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	**: EEX4362 Object Oriented Design**
Academic Year	: 2021/2022
Date	: 06th of February 2023
Time	: 1330 – 1630hrs
Duration	: **3 hours**

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Three (3)** questions on **Four (4)** pages.
3. Answer **all** questions given.
5. Answer for each question should commence from a new page.
6. This is a Closed Book Test **(CBT).**
7. Answers should be in clear handwriting.
8. Do not use red colour pens.

Question 1[50 Marks]

Data annotation is the process of labelling data with relevant tags to make it easier for computers to understand and interpret. Annotated data is integral to various machine learning and artificial intelligence (AI) applications. However, it is also one of the most time-consuming and labour-intensive parts of AI or Machine Learning (ML) projects.

Assume that a Natural Language Programming (NLP) research group has asked you to apply the basic concepts of object-oriented design and programming to solve the problem described below.

The NLP research group needs a platform to get their data sets annotated. They have two sets of public Facebook posts in JSON format; one for text classification and the other for image classification. You can use an Application Programming Interface(API) to retrieve Facebook posts for text and image classification. Captions and comments of the Facebook posts are used for text classification, and the photo URL and video thumbnails of the Facebook posts are for image classification.

JSON structure for a Facebook post is given below;


```
{
  "postURL": "https://xxxxxxxxxxxx",
  "top_level_post_id": xxxxxxxxxxxx,
  "PostedBy": "https:// xxxxxxxxxxxx ",
  "IDofPostedBy": xxxxxxxxxxxx,
  "OriginalPostURL": null,
  "original_content_id": null,
  "original_content_owner_id": null,
  "postedDateTime": "2020-04-27 08:42",
  "OriginallyPublishedOn": "https:// xxxxxxxxxxxx ",
  "OriginallyPublishedOn_id": xxxxxxxxxxxx,
  "caption": null,
  "privacy": "Public",
  "photo_id": null,
  "photo_url": null,
  "MainImageSavedLocation": null,
  "video_thumbnail": "no",
  "video_id": null,
  "VideoThumbnailSavedLocation": null,
  "commentCount": 0,
  "comments": [],
}
```


Anyone with a valid Sri Lankan National Identity Card (NIC) older than 18 should be able to register on your platform as a worker. These workers will be given an online quiz to assess their fitness for the task, and the mark will be recorded. Those who would not get the threshold mark will not be assigned any task from the platform, and the workers will be categorized as qualified or non-qualified.

During the text classification process, the workers will be asked to tag the Facebook post as if the post contains "harmful content or not". Similarly, during the text classification process, the

workers will be prompted by the question of whether an image contains harmful content. The response of the worker should be recorded against each post id. Each post will be triggered to at least three workers for their response.

i.) Draw the following diagrams using proper UML notations.

a) Use Case diagram to illustrate the possible interactions of a worker with the system.

[08 marks]

b) Activity diagram to illustrate the stepwise activities and actions with support for choice, iteration and concurrency in validating a worker before the registration process.

[06 marks]

c) Class diagram to model the static view of the proposed platform. Illustrate the collection of classes with attributes and methods, interfaces, associations, collaborations, and constraints, if any.

[12 marks]

d) Sequence diagram to illustrate how operations are carried out in the Use Case "Assess fitness to work". State all your assumptions.

[08 marks]

ii.) Briefly explain how a collaboration diagram would differ from the Sequence diagram using the above scenario in part (d).

[06 marks]

iii.) Briefly explain two benefits of using an API to access Facebook posts in this application.

[04 marks]

iv.) Give an example of where multithreading can be used in this application. State all your assumptions.

[06 marks]

Question 2 [30Marks]

i.) State two benefits of using design patterns in Java.

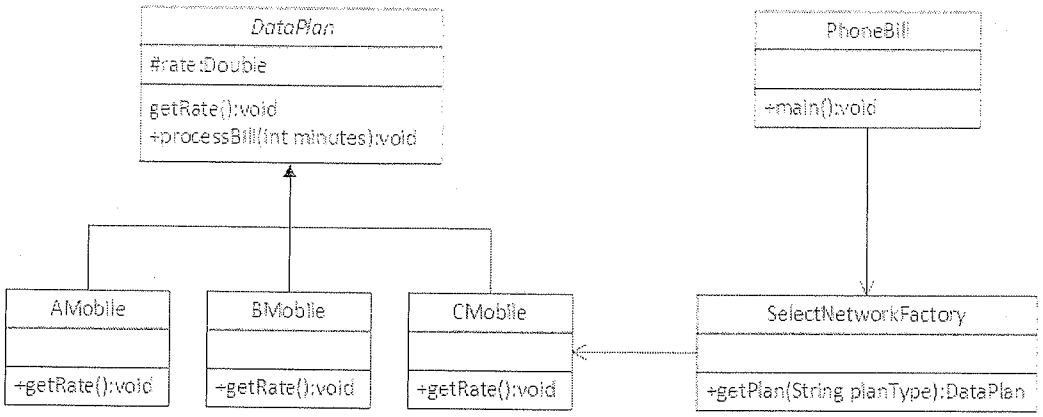
[02 marks]

ii.) Differentiate the three types of design patterns and give at least two examples for each type.

[08 marks]

iii.) Assume that we have three **Mobile Network Plans** which describe the call rate per minute. The three different networks are **AMobile, BMobile,** and **CMobile** and the *charges* or *call rate per minute* of these networks, respectively, are *Rs.1.50, Rs.1.75 and Rs.1.50.*

The following UML diagram illustrates the design of this scenario, and you have been asked to implement this design to determine the cost of a certain number of minutes on each network.



The class *SelectNetworkFactory* checks the plan type if it's AMobile, BMobile or CMobile. *processBill* method calculates and displays the cost of a certain number of minutes on each network.

The system's output should be similar to the following if "AMobile" and "2" are given as inputs.

Enter the name of the network for which the bill will be generated: AMobile
Enter the number of minutes for the bill, which will be calculated: 2
The bill amount for AMobile of 2 units is: Rs. 3.00

a) Identify the design pattern illustrated in the UML diagram and briefly explain the advantage of using this design pattern.

[04 marks]

b) Explain the use of abstraction in this example after identifying if *DataPlan* is an abstract class or an interface.

[04 marks]

c) Write the Java code to implement the given design.

[12 marks]

Question 3 [20 Marks]

i.) Briefly explain two advantages of using a multithreading program in Java.

[04 marks]

ii.) Illustrate the cycle of a thread with an appropriate diagram and briefly explain each phase.

[08 marks]

iii.) Use the output of the given code snippet on the next page to explain how multiple threads are created and work.

[08 marks]

```
class RunnableExample
{
     public static void main(String args[])
    {
           Count cnt = new Count();
           try
           {
                 while(cnt.mythread.isAlive())
                 {
                       System.out.println("Main thread will be alive
till the child thread is live");
                       Thread.sleep(1500);
                 }
           }
           catch(InterruptedException e)
           {
                 System.out.println("Main thread interrupted");
           }
                 System.out.println("Main thread run is over");
    }
}
```

```
class Count implements Runnable
{
     Thread mythread ;
     Count(){
           mythread = new Thread(this, "my runnable thread");
           System.out.println("my thread created" + mythread);
           mythread.start();
     }

     public void run(){
           try{
                 for (int i=0 ;i<5;i++){
                       System.out.println("Printing the count " + i);
                       Thread.sleep(1000);
                 }
           }
           catch(InterruptedException e){
                 System.out.println("my thread interrupted");
           }
                 System.out.println("mythread run is over" );
     }
}
```

- **End of Paper** -