

**School of Computing and Information Technology**

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CSCI334

Software Design

Hong Kong Campus

Supplementary Assignment Paper–Answer Sheet

2022 Semester B

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| --- | --- |
| Exam duration  Weighting | 3 hours  55 % |
| Items permitted by examiner | *None* |
| Aids supplied | None |
| Directions to students | **6 questions** to be answered. |

**Question 1 (10 marks)**

The following is an extraction of the “Project Needs” document from customer:

**Introduction:** A group of system administrators must keep track of which computers are assigned to computer users in the community they support. Currently this is done by hand, but this is tedious, error prone, and inconvenient. System administrators want to automate this task to ease their workload.

**Product Vision:** The Computer Assignment System (CAS) will keep track of computers, computer users, and assignments of computers to users; answer queries; and produce reports about users, computers, and assignments.

**Introduction:** A group of system administrators must keep track of which computers are assigned to computer users in the community they support. Currently this is done by hand, but this is tedious, error prone, and inconvenient. System administrators want to automate this task to ease their workload.

**Project Scope:** Developers in the same enterprise will implement CAS. CAS will be the simplest system meeting basic system administrator needs, developed by a small team in a short time.

**Assumptions and Constraints:**

* CAS will be accessible over the Internet to authorized users.
* Three people must develop CAS in three months or less.
* CAS must require no more than one person-week per year for maintenance.

***Business Requirements*:**

* CAS must maintain the location, components, operational status, purchase date, and assignment of every computer in the organization.
* CAS must maintain the name, location, and title of every computer user in the organization.
* CAS users must take no more than one minute per transaction, on average, to maintain this information.
* CAS must answer queries about computers, users, and assignments.
* CAS must provide data for quarterly reports sufficient for accountants to compute equipment depreciation in preparing tax returns.

Write about ten (10) key application domain questions needed to be answered by customer in order to understand the CAS problem domain better?

**(10 marks)**

**Answer**

1) What is the purpose to implement the CAS.

2) What queries are supported by the CAS.

3) Who will administer the CAS.

4) What is the information managed by the CAS.

5) What type of environment is needed by CAS i.e. client-server, distributed or centralized.

6) What are the disadvantages of using the existing system and advantages of using CAS instead of the existing system.

7) What are the benefits of the newly designed CAS to the system administrators and organization.

8) What type of reports will be generated by CAS and what information and data will be processed.

9) What type of information managed by the CAS.

10) How the maintenance of the CAS is performed.

**Question 2 (10 marks)**

1. The following are extraction of requirement statements which is considered to be written with poor quality.
2. Students will be able to enroll to undergraduate and post graduate courses
3. A professor user will log into the system by providing his username, password, and other relevant information
4. A student will have either undergraduate courses or post-graduate courses but not both. Some courses will be open to both under-graduate and post-graduate
5. Each page of the system will load in an acceptable time-frame
6. Maintain student information-mapped to “BRD req.ID?”

For the above requirement statements,

1. identify the problems of poor quality.
2. re-write the statements to enhance the quality.

**(5 marks)**

**Answer**

1. Students will be able to enroll to undergraduate and post graduate courses

The poor quality is that it does not identify whether students are able to enroll in 1 or more courses and whether a student can only enroll in 1 or both courses

Rewrite: students will be able to enroll in either an undergraduate or post graduate courses

1. A professor user will log into the system by providing his username, password, and other relevant information

This does not specify what other relevant information is because we usually only need username and password to login to a system

Rewrite: a professor will login to the system by using his provided username and password.

1. A student will have either undergraduate courses or post-graduate courses but not both. Some courses will be open to both under-graduate and post-graduate

The problem is that the students who have not yet completed the undergraduate will not be able to enroll in postgraduate courses and so there is a need to specify

Rewrite: Each student will have either undergraduate or post graduate courses but not both however some courses will be open to both. Students that are enrolled in undergraduate will not be able to enroll only in undergraduate courses except for some of the other courses.

1. Each page of the system will load in an acceptable time-frame

This statement does not specifies the time frame which should be specified as then we would know the acceptable time frame.

Rewrite: each page of the system will load in an acceptable time frame e.g(00:05s).

1. Maintain student information-mapped to “BRD req.ID?”
2. Each of the following heuristics helps make a good module according to some modularity principles. Identify the principle
3. Make all attributes of a class protected or private.
4. A class should capture exactly one key abstraction.
5. Make sure an operation needs all its parameters.
6. Spin off unrelated data into another class.
7. Most of the operations in a class should use most of the attributes most of the time.

**(5 marks)**

**Answer**

1.Principle of information hiding

2. Principle of least privilege

3.Principle of cohesion

4.Priciple of least privilege

5.Principle of cohesion

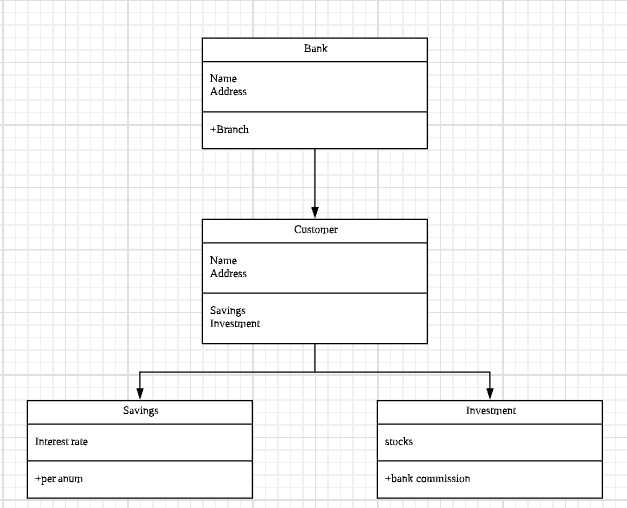
**Question 3 (10 marks)**

1. Design the class diagram for a “bank” system with the following specifications.

The bank system contains data on customers (identified by name and address) and their accounts. Each account has a balance and there are 2 type of accounts: one for savings which offers an interest rate, the other for investments, used to buy stocks. Stocks are bought at a certain quantity for a certain price (ticker) and the bank applies commission on stock orders.

**(4 marks)**

**Answer**

****

1. A class **PlayerDatabase** which is performing **many different tasks** like connecting to a database, printing the information of all the players, printing information of a single player, printing all the players, printing all the rankings and finally closing all opened database connections.

class PlayerDatabase

{

public void connectDatabase();

public void printAllPlayersInfo();

public void printSinglePlayerInfo();

public void printRankings()

public void closeDatabase();

}

1. Discuss the problem of this design.
2. Suggest the enhancement of the code based on proper design principle of coding.

**(3 marks)**

**Answer**

1. this is a bad programming design as this design contains 1 class that is designed to do many different tasks rather than focusing on a single specialized task which is why this is a bad design

2. class PlayerDatabase

{

ConnectDatabase connectDB= new connectDatabase();

PrintAllPlayersInfo allPlayer= new PrintAllPlayersInfo();

PrintRankings rankings = new PrintRankings();

CloseDatabase closeDB= new CloseDatabase();

PrintSinglePlayerInfo singlePlayer = PrintSinglePlayerInfo();

}

1. Analyze the following pieces of code for “class A” and “class B”.

These pieces of code violate the design principles.

class A

{

public String name;

public A()

{

name="John";

}

public void printname()

{

**if** (name!=**null**){

System.***out***.println(name);

}

}

class B

{

public static void main()

{

A ob= new A();

ob.name=”Mary”;

System.out.println(ob.name);

}

}

1. Identity and describe the violation.
2. Make suggestions to resolve the violation.
3. Write the code for better design.

**(3 marks)**

**Answer**

1. the given code is not following the proper object-oriented architecture and there are some flaws that violate the design principle. I have seen two flaws that are in this code which is data hiding and encapsulation. The given code does not follow the data hiding concept as the name variable can be changed in class A is public and it can be accessed from outside the class.and it also does not follow the encapsulation concept as there is no variables that can bind the data and also no setter method to set the value of the name

2.

Create string variable name as private to provide the data hiding and also create an object of class A and call the setter method to set the value of the name and call the print name method to print the name

3. class A

{

public String name;

public A()

{

name="John";

}

public void printname()

{

if (name!=null){

System.out.println(name);

}

}

}

public class B

{

public static void main(String[] args)

{

A ob = new A();

ob.name="Mary";

System.out.println(ob.name);

}

}

**Question 4 (10 marks)**

1. Customer wants a system with higher level of reliability, availability and performance. Using the architectural style/pattern, discuss the approach to design the system.

(2 marks)

**Answer**

I will design a system in a way that I use the perceived reliability and measure the availability of the system. I will see that how reliable the system is when the system is being used the most at the peak times, and I will also check if the system is available at the peak times. I will also use the performance to see if the system has the right power and hardware to power the to see if the power is enough for the availability and reliability of the system

1. When designing an architecture, design conflicts will sometimes occur for the implementation of multiple non-functional requirements of equal importance.
2. provide a scenario that will cause this conflict.
3. explain the cause of the conflict.

(3 marks)

**Answer**

1. Draft an architectural decomposition of the Fingerprint Access System described below by determining functional components. Document your design using a box-and-line diagram and brief component responsibility descriptions.

A Fingerprint Access System (FAS) is designed to provide control access to secure facilities using fingerprints. FAS reads fingerprint scanners and controls entry and exit gates. Personnel wishing to enter or leave a facility must place their fingers on the fingerprint reader at a gate, and the gate will be unlocked to let them through.

* FAS has the following functional and data requirements:
* FAS must match scanned fingerprints against a fingerprint database and unlock gates when it identifies legitimate commuters.
* Authorized personnel must be able to unlock individual gates.
* Authorized personnel must be able to record that individuals unknown to FAS (visitors) have entered or left the building.
* FAS must log all entries, exits, and failed or aborted attempts at entry or exit.
* FAS must support queries by authorized personnel about particular individuals’ activities.
* FAS must provide authorized personnel with reports about all current facility occupants.

Draft an architectural decomposition of the Fingerprint Access System by determining functional components. Document your design using a box-and-line diagram and brief component responsibility descriptions.

(5 marks)

**Answer**

**Question 5 (10 marks)**

1. Analyze the following piece of code for the “Transportation” class. This design can be considered as “smelly code”, and does not follow the best practice of design principle.

**package** transportationApplication;

**public** **class** Transportation {

**public** **static** **void** main(String[] args) {

String transportationtype = args[0];

Transportation trans=**new** Transportation(transportationtype);

**switch** (transportationtype) {

**case** "ship":

//operations of ship transportation

System.***out***.println("operations by sea transportation details");

rest of code. .;

. .;

break;

**case** "truck":

//operations of truck transportation

System.***out***.println("operations by sea transportation details");

rest of code. .;

. .;

**break**;

}

System.***out***.println("end");

}

}

* 1. Describe the reason that the above segment of code smells.
  2. Describe how to use an Object Oriented Design pattern, to enhance the design of the class to avoid the smelly code.
  3. Draw the class diagram of the design pattern used.
  4. Write sample code in java for the implementation of this design pattern.

(5 marks)

**Answer**

1. The reason it smells because it contains comments and unnecessary code which is similar to each other and its usually considered as bad practice, the switch statements also include similar coding and should not be used and written in a clear and precise way

2.using object oriented pattern we can just create a constructor inside the transportation class but outside the main method. As in the main method we can call the class and can also implement a switch condition inside the constructor instead of in the main method

3.

4. public class Transportation{

Public transportation(String transportationType){

int choice=0;

switch(transportationType){

case “ship”:

choice=0;

break;

case “truck”:

choice=1;

break;

}

System.out.println(“operation by sea transportation details”)

Rest of the code;

}

System.out.println(“end”)

Public static void main(String args[]){

String transportationtype=args[0];

Transportation trans=new Transportation(transportationtype);

}

}

1. Mary decides to get a new dress for her birthday party. She goes online to her favourite website fashionworld.com and selects a red dress. But unfortunately the red dress is out of stock. She tries to find another dress but there is nothing that can replace it. So, she goes back to the dress page, registers her email id and click on the "Inform Me" button.

The "Inform Me" application will inform Mary when the shop has replenished the dress again.

Design how this “Inform Me” application can use a design pattern in the core module.

1. Describe how to use an Object Oriented Design pattern to design this core module.
2. Draw the class diagram of the design pattern used.
3. Write sample code in java for implementation of this design pattern.

(5 marks)

**Answer**

**Question 6**

(5 marks)

1. The following segment of code can be enhanced by code refactoring. Describe the problem of the coding style in this segment.

void printuser() {

printBanner();

// Print details.

System.out.println("name: " + username);

System.out.println("firstname: " + firstname);

System.out.println("lastname: " + lastname);

System.out.println("amount: " +getOutstandingBalance());

System.out.println("amount: " +getCredit());

}

(2 mark)

**Answer**

1. Suggest a refactoring method with suggested code modification to enhance the above piece of code.

(2 marks)

**Answer**

1. Describe the scenarios in which refactoring code very difficult and not appropriate

(1 marks)

**Answer**

**End of Examination**