Mid-Term Exam (AY2022) of “Introduction to OOA OOD and UML”

-- The Question Sheet (40p)

**ID: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Q1:** What is the Unified Modeling Language? (2p)

**Q2:** What are the differences between a real-world object and a software object? (5p)

Please answer based on the following two aspects: 1. The definitions of a real word object and a software object; 2. When a software object models a real-world object, does it model every existing attribute and operation? Why?

**Q3:** Please choose all correct type(s) based on the following options (“(a)”, “(b)”, “(c)”, “(d)”) for “Q3-1”, “Q3-2”, “Q3-3”, and “Q3-4”. (If your choice includes “(d)”, please point out which object is the “source”, and which one is the “target”). (4p)

1. Association, (b) Aggregation, (c) Composition, (d) Navigable

Example answer:

Shape, rectangle

Description automatically generated“An example, (a) and (d): Object 1 is the source and Object 2 is the target.”

**An example**



**Q3-2**

**Q3-1**

****

**Q3-4**

**Q3-3**

**Q4:** Please consider the class diagram shown in Fig. Q4 and answer the questions “Q4-1”, “Q4-2”, and “Q4-3”. (10p)

**Text

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**Fig.Q4**

**Q4-1:** Please list the names of the fields included in the class “Circle” and please choose **one** of the fields (except the example answer) to describe with the following information: the field name, the visibility of the field, the type of the field, the initial value of the field.

Example answer: “radius” is one of the fields. Its visibility is “private”, which means it can only directly be accessed or changed by its own objects/instances. Its type is ‘String’. Its initial value is “1.0”.

**Q4-2:** Please list the names of the methods included in the class “Circle” and please choose **two** of themethods (except the example answer) to describe with the following information:themethod name, the visibility of the method, the return value type of the method, the parameters of the method (only in the case that the method has parameters), the type of the parameters.

Example answer: “toString()” is one of the methods. Its visibility is “public”, which means it can be accessed or redefined by objects/instances of any classes. Its return value type is “String”. It doesn’t have any parameters.

**Q4-3:** Explain the reasons that “getter” and “setter” methods (or messages) are needed in the class “Circle”.

**Q5:** What do we call a specific object built from a specific class? (2p)

**Q6:** Which of the following statements are true? Choose all options that apply. (2p)

(a) Most super classes are abstract.

(b) Inheritance is preferable to composition.

(c) Most super classes are concrete.

(d) Composition is preferable to inheritance.

Table

Description automatically generated**Q7:** What are the problems of the diagram shown in Fig. Q7? (4p) Please find at least two problems.

**Fig.Q7**

**Diagram

Description automatically generatedQ8:** Based on the diagram shown in Fig. Q8. Please list the names of the methods that an instance/object of the class “Point3D” can access and redefined and explain the reason. (5p)

Fig. Q8

Please answer Q9-1 or Q9-2 based on your ID number. If the last four digits of your ID number is even, please answer Q9-1. If your ID number is odd, please answer Q9-2. (Be careful, if you choose the wrong problem, your answer will not be evaluated)

Diagram

Description automatically generated**Q9-1:** Please implement the method “attack()” of the classes “WaterMonster” and “StoneMonster” shown in the class diagram Fig. Q9-1. (6p)

**Fig. Q9-1**

Example answer: For the class “FireMonster”, the implementation of the method “attack” is shown as follows:

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

public class FireMonster extends Monster{

…

@override

public String attack(){

return “Attack with fire !”;

}

…

}

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

**Q9-2:** Read the following Java code and answer the following questions: (6p)

* Q9-2-1: What will be the output for “person.teach ();”
* Q9-2-2: What will be the output for “anther\_person.teach();”
* Q9-2-3: What will be the output for “teacher.teach();”

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

class Person {

public void teach () {

System.out.println (“Person can teach”); // print the message “Person can teach”

}

}

class Teacher extends Person {

public void teach () {

System.out.println (“Teacher can teach in a school”); // print the message “teacher can teach in a school”

}

}

public class TestTeacher {

public static void main (String args[]){

Person person = new Person;

Person another\_person = new Teacher ();

Teacher teacher = new Teacher ();

person.teach ();

another\_person.teach();

teacher.teach ();

}

}

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*/

**Q10 (Additional):** Please chose one of the following lists (List #01, List #02) and draw a UML object diagram that models the relationships among the objects in the list that you chose. Please also write a document to explain the logic for the diagram that you draw. (15p)

**List #01**: “sink”, “freezer”, “refrigerator”, “dining table”, “kitchen light”, “light switch”, “window”, “smoke alarm”, “burglar alarm”, “cabinet”, “bread”, “cheese”, “ice”, “door”, “kitchen”

**List #02:** “person”, “patient”, “operations staff”, “administrative staff”, “technical staff”, “doctor”, “nurse”, “front desk staff”, “technician”, “technologist”, “surgeon”, “receptionist”, “surgical technologist”

1. The relationship types between two objects may include one or more of the followings:

“Association”, “Aggregation”, “Composition”.

1. The relationship types among the objects may include one or more of the followings:

“Tree”, “Graph”, “Inheritance”

1. Please use “Astah” to draw the diagram, export the diagram as a jpg/png file and paste the file to the answer sheet.