CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Autumn Examinations 2018

Module Title: Object Oriented Analysis and Design.

Module Code: SOFT7005

School : Computing & Mathematics

Programme Title: **HC Software Dev Y2 ACCS**
BSc Software Development Y2
BSc Hons Computer Systems Y2
BSc (Hons) Software Devel Y2
BSc (Hons) Web Development Y2

Programme Code: **KDSEV_8_YR2**
KDNET_8_YR2
KDWEB_8_YR2
KCOMP_7_ YR2
KCOME_6_YR1&YR2

External Examiner(s): **Professor John Murphy**

Internal Examiner(s): **Ms. M Davin**
Ms. D Dunlea

Instructions: **Answer any 4 questions.**

Duration: 2 Hours

Sitting: Autumn 2018

Requirements for this examination: **No Special requirements**

Note to Candidates: Please check the Programme Title and the Module Title to ensure that you have received the correct examination paper.
If in doubt please contact an Invigilator.

Q1

(a) What is the purpose of creating a domain model? [2]

(b) Identify the three strategies that can be used for discovering classes? [3]

(c) Why do we create software models at different levels of abstraction? [2]

(d) Explain the Object oriented perspective when developing an application using an OO programming language. [3]

(e) The Irish forestry service is under the control of the department of Agriculture. The department would like you to develop a computerised system to maintain details on all forests under its jurisdiction. The following specification gives an overview of the type of data that needs to be recorded.

Draw a class diagram to capture the following information

i. Entity Classes and their attributes
ii. Relationships between these entity classes
iii. Multiplicity values of association relationships [15]

Each forest, which is identified by its name, has many trees of various species. Data about the forest's size, owning company, and location is to be maintained by the forestry department. A forest is maintained by foresters, who are uniquely identified by their SSN. A forester only maintains one forest. Also, the foresters' name, age, and address are to be captured. The forest contains data about each species. A species is uniquely identified by its name. In addition, the wood-type and maximum height for the species is maintained. Trees in the forest are identified by their tree number. Also, the tree's location and date planted is maintained. The tree's species is also captured. The trees in the forest will be measured several times during the tree's life span, and each measurement will have a unique number. The measurement result and date needs to be maintained. Trees can propagate more trees, and the same data must be captured for the child trees. The felling of trees takes place annually. If a tree is felled then the date that this happens needs to be recorded. Under the afforestation grant scheme only certain species of trees are granted licenses. A species that was licensed may have its license withdrawn because of disease.

Q2

(a) On a **single diagram**, illustrate the following using the UML notation for objects, links and messages. [7]

i. An object of class Manufacturer with attributes for name and email address.

ii. An object of class product with name. Assume that the Product class supports an operation to get the cost of a product.

iii. Two objects of class part with attributes product code and cost. Assume that the part class supports an operation to return the cost of a part object.

iv. A link between the manufacturer and product objects, modelling the fact that the product is manufactured by the manufacturer.

v. *A link between the product object and both part objects.*

vi. Messages between objects illustrating getting the cost of product.

(b) Draw a class diagram to support the diagram created in part (a) above. [6]

(c) Create a domain model for each of the following specifications: [12]

i. An Airline flight takes place between two airports. It is necessary to differentiate between the two airports as one is the airport from which the flight takes off from and the other is the destination airport.

ii. *A student can register in any number of courses and a course can have many students. A student undertakes continuous assessment work and a final exam for each course taken. It is a requirement that the results for each student in each course are recorded.*

iii. A student can change from being an undergraduate to a postgraduate student during their time in a university.

Q3

(a) A country has many cities. A country has a name. Each city has a name and a population, while a country has a name and a capital city. Develop a design class diagram that would allow for *the capital city, the names of the cities and the average city population of a country with a specific name to be determined. Include 1 controller class and 1 derived attribute.* [8]

(b) Draw a class diagram which would correctly model the situation where a student can take the same module more than once. This would be necessary if the student failed the final exam in the module. [6]

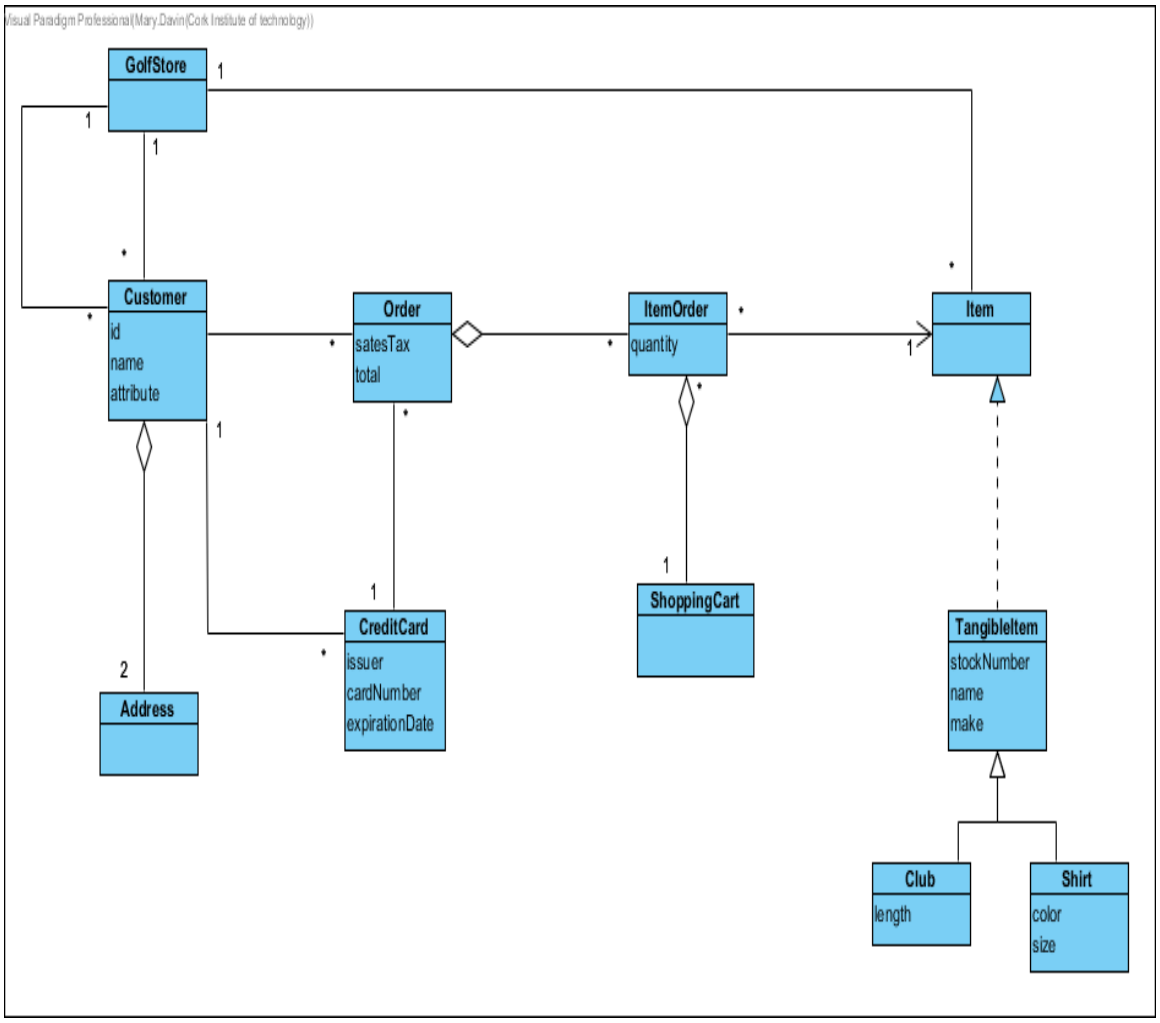
(c) Using the diagram below do the following:

i. ***Identify*** *the 4 different types of relationships used.* [2]

ii. ***Explain*** *the meaning of each of the 4 identified relationships.* [4]

iii. ***Explain*** *the meaning of the* ***navigability*** *property of an association.* [2]

iv. ***Explain*** *the meaning of a* ***mandatory*** *association.* [2]

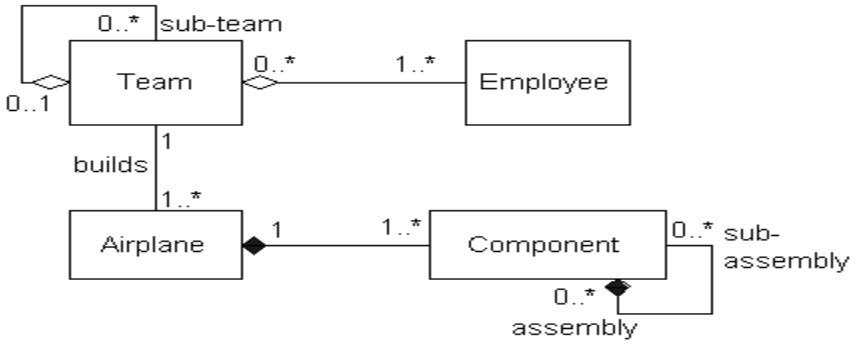


Q4

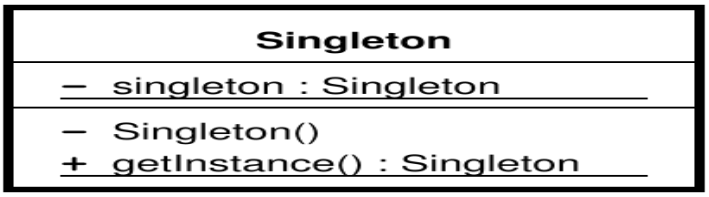
(a) Use the diagram provided below to answer the following questions

i. *What is a self-association?* [2]

ii. *Differentiate between aggregation and Composition relationships* [2]

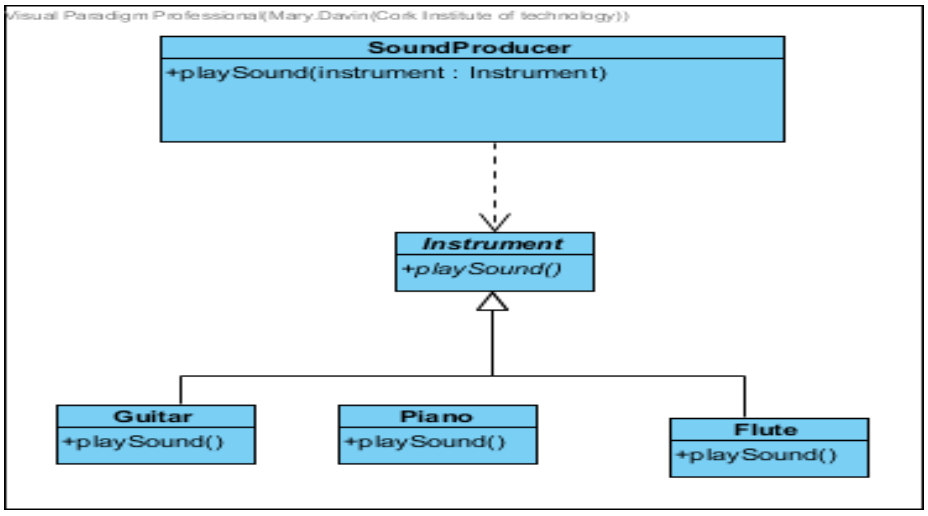


(b) Use the diagram provided to explain how a class is implemented as a singleton [3]



(c) Explain the meaning of GRASP patterns. In your answer give an overview of any **two** GRASP patterns. [6]

(d) Explain the meaning of the OCP principle using the following diagram [6]



(e) Reverse engineer the following java code into a class diagram. [6]

```
// InventoryDemo.java
class Vehicle implements Product
{
  private String name;
  private double cost;
  Vehicle (String name, double cost)
  {
    this.name = name;
    this.cost = cost;
  }
  public String getName ()
  {
    return name;
  }
  public double getCost ()
  {
    return cost;
  }
}
```

```
// InventoryDemo.java
class Vehicle implements Product
{
  private String name;
  private double cost;
  Vehicle (String name, double cost)
  {
    this.name = name;
    this.cost = cost;
  }
  public String getName ()
  {
    return name;
  }
  public double getCost ()
  {
    return cost;
  }
}
```

```
interface Product
{
  String getName ();
  double getCost ();
}

class Car extends Vehicle
{
  Car (String name, double unitCost)
  {
    super (name, unitCost);
  }
}


class Truck extends Vehicle
{
  Truck (String name, double unitCost)
  {
    super (name, unitCost);
  }
}
```

```
class Tool implements Product
{
  private String name;
  private double cost;
  Tool (String name, double cost)
  {
    this.name = name;
    this.cost = cost;
  }
  public String getName ()
  {
    return name;
  }
  public double getCost ()
  {
    return cost;
  }
}
```

Q5

You are hired to design an object-oriented application to manage the ferry services for Direct Ferry Services Company. The company offers a number of ferry services on different routes. All routes are direct that is just between two ports. For each ferry service there can be many trips. The company uses different ships on different services. The same ship will be used on all trips of a particular service. Each ship can carry a maximum number of cars. The number will vary depending on length and height of cars. Each car is driven by a licensed driver and has zero or more additional passengers. The crew of a ship includes a captain and first officer. The crew can change for a ferry trip. For every trip a ship travels, the company needs to print out a manifest for the port authority of the destination port. A manifest is a document listing vehicles, passengers and crew of ship. The manifest must include the following:

- *The ship's license number*
- *The name of the departing port.*
- *The Captain's name*
- *The names of the people on board including all the passengers and crew.*
- *Each vehicle's make, model license plate, length height its' driver and the Driver's license number.*

(a) Draw a class diagram showing the major classes and their relationships. [8]

(b) For each class show:

*Its relevant **attributes*** [2]

*Its **key methods** to **create** the manifest of a specific trip.* [4]

*Its **key methods** to **find** the date, and route of the busiest trip. [The trip that had the most passengers*] [4]

(c) Draw a sequence diagram illustrating how to find the date and route of the busiest trip for the Direct Ferry Services company within a date period. [7]