

**CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ**

Semester 2 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: Summer 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

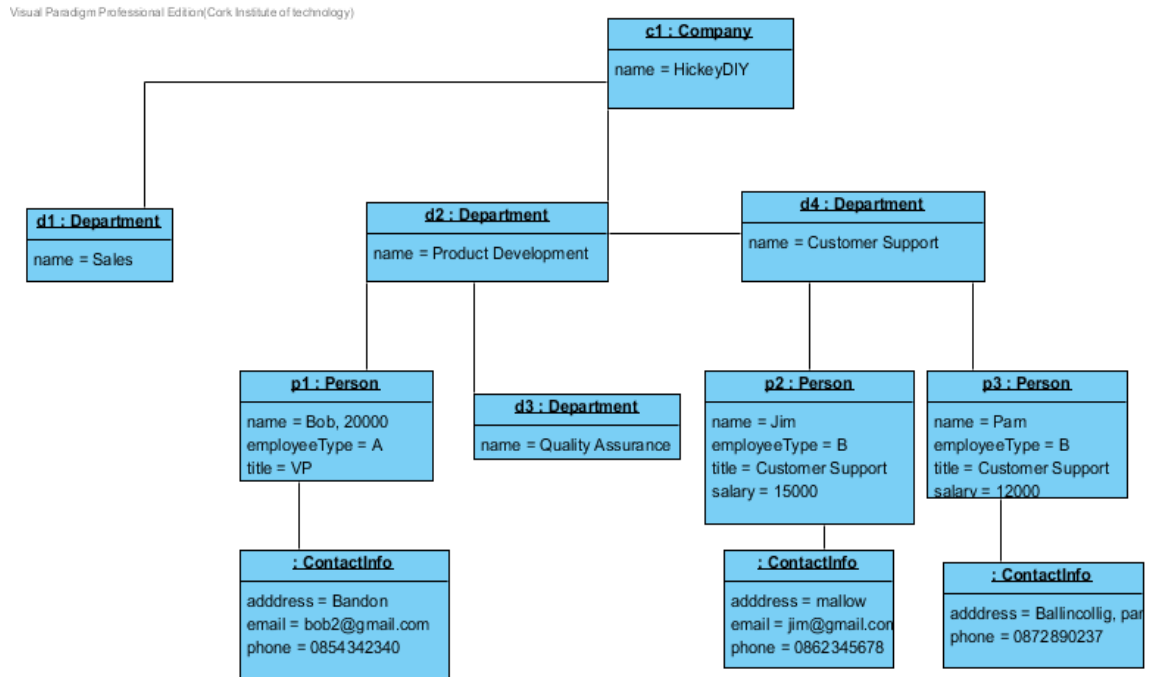
- (a) Through software modelling we achieve 4 aims. What are these aims? [2]
- (b) In software there are several ways to approach a model. The two most common ways are the **algorithmic perspective** and the **object oriented perspective**. Differentiate between these two perspectives [4]
- (c) What is the purpose of creating a domain model? [2]
- (d) What is the advantage of creating a domain model prior to designing an object oriented system? [2]
- (e) Create a domain model for the following specification.

Each county council in Ireland maintains a network of roads. For each county the name and population size are recorded. A road can be in more than one county. A road has a name and number. Roads in the Republic are classified as either motorways (shown by the letter M followed by a route number, e.g. M7), national roads (shown by the letter N followed by a route number, e.g. N25), regional roads (shown by the letter R followed by a route number, e.g. R611) and local roads (shown by the letter L followed by a route number, e.g. L4202). A road is divided into road sections. Each section of road has a vehicle speed limit, starting coordinates and end coordinates. Each section of road is under the control of only one council. Each council has a number of depots that are used for storing trucks. When the weather is predicted to be icy a schedule for de-icing roads needs to be created. A truck can be used to treat a number of road sections that are under the control of the depot. A road section can be treated by a number of different trucks. Each truck depot has one foreman (council employee) who wants to keep track of the treatment of road sections. When a section of a road is treated, the truck used, truck driver, date and time need to be recorded. All truck drivers are employed by a council to work from a specific depot. A road section has a number of weather stations that are used to send weather stations readings that can be used for the work of scheduling and de-icing roads. A weather reading has a reading time and temperature measurement. [15]

Q2

(a) Differentiate between an object diagram and a design class diagram. [2]

(b) Draw a class diagram that would support the following object diagram. [6]

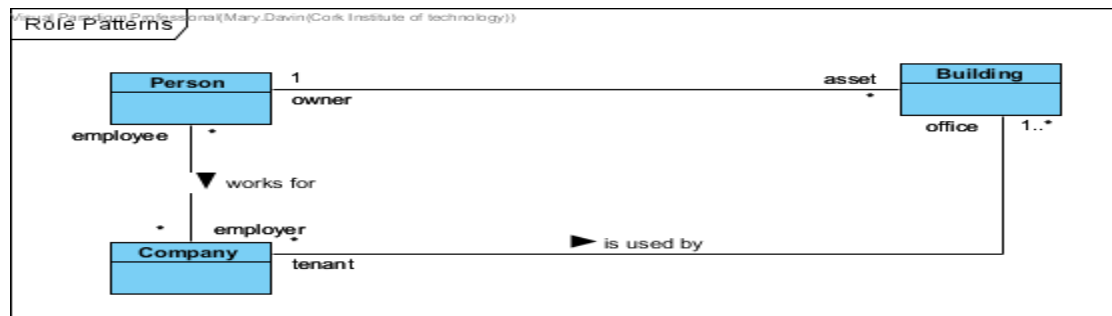


(c) Modify the diagram you created in part (b) to allow for the date a person started to work in a department. You can assume that over time a person can be transferred from one department to another. [6]

(d) All role problems can easily be solved by selecting one of 5 role patterns. [3]

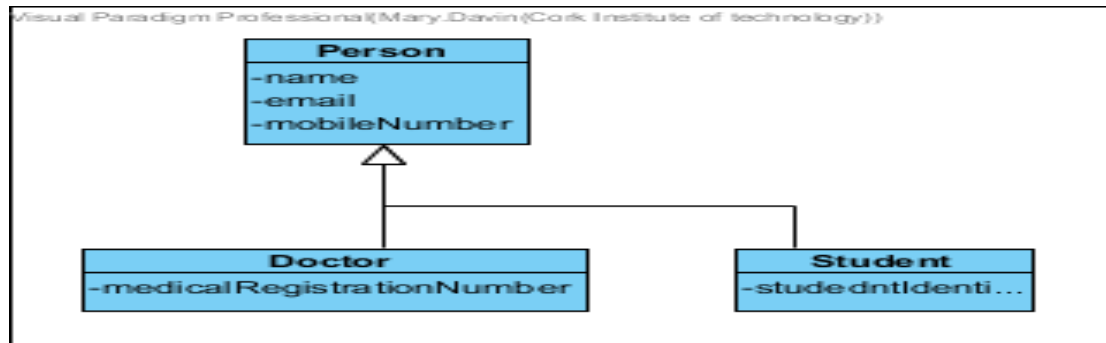
i. What pattern is used in the following diagram? [3]

ii. Identify any problem with using this pattern? [3]



(e) Consider a situation where a doctor wants to continue his/her studies part time in a University.

- i. Explain the problem with the following model? [2]
- ii. Modify the diagram to allow a doctor to become a student at a university. [3]



Q3

- (a) Explain the meaning of responsibility driven design. [3]
- (b) Explain the single responsibility principle as applied in Object Oriented design [3]
- (c) Using the specification below for a property management company
 1. Draw a class diagram showing the major classes, their attributes and their relationships. [8]

Highgate is a property management company that manages the renting of properties on behalf of landlords who own the properties. The name, and mobile number of the landlord of a property is maintained. When a property is rented the start date and end date needs to be recorded in addition to the tenants. Each property has a property number, address, description, number of occupants allowed. For each tenant their name, date of birth and gender, mobile number needs to be kept. A property may have single occupancy or multiple occupancy. A property may not be currently occupied. One tenant is assigned to be the primary tenant who the agency contacts if there are any issues.

2. For each of the 3 required features below carry out the activities listed on the next page.

Required features.

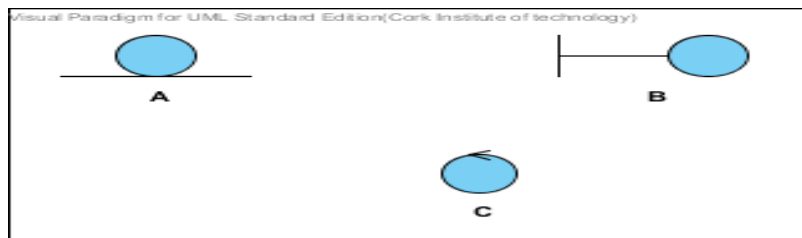
1. Determine if a property identified by its property number is currently rented.
2. If a property is rented the determine names of all of its tenants.
3. The number of properties owned by a landlord.

- i. Identify the class that has overall responsibility for the feature. [3]
- ii. Identify operations for different classes that would allow for the feature to be delivered. [8]

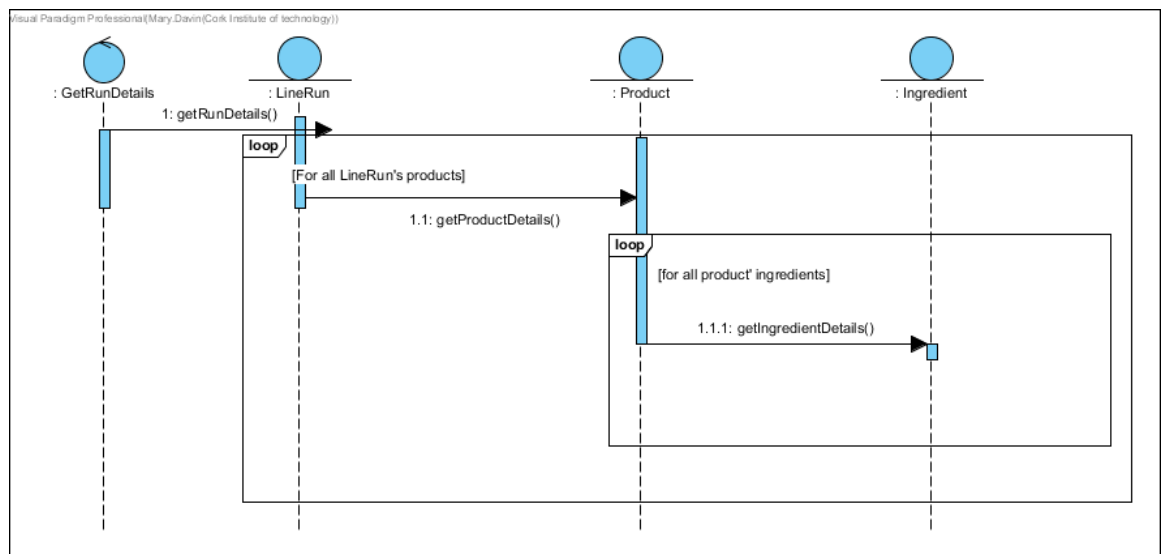
Q4

(a) With reference to figure below which icon would you use to represent. [3]

- i. *A business object containing useful information?*
- ii. *A communication path between systems or between a human and a system?*
- iii. *An object that coordinates a system process, creates or retrieves objects?*

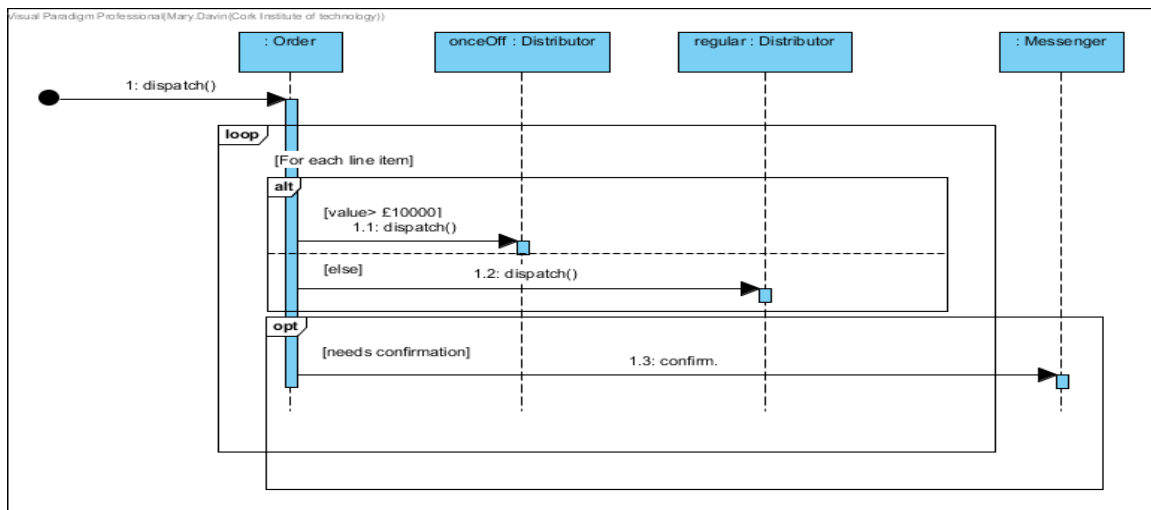


(b) Draw a class diagram that would support the following sequence diagram which illustrates ingredients used to manufacture products on a linerun in a factory. [6]



(c) Refer to the following diagram to explain the meaning of each of the following interaction fragment operators [3]

- i. *loop*
- ii. *alt*
- iii. *opt*



(d) Draw a sequence diagram showing the interaction that takes place when the **main** function executes. [8]

```

public class M {

    public static void main(String[] args) {
        M m = new M();
        m.f();
    }

    public void f() {
        Subject s = new Subject();
        Observer o1 = new Observer();
        Observer o2 = new Observer();
        s.addObserver(o1);
        s.addObserver(o2);

        s.changeState();
    }

}
  
```

```

class Observer {
    public void update() {}
}
  
```

```

class Subject {
    private Collection c;

    public void addObserver(Observer o) {
        c.add(o);
    }

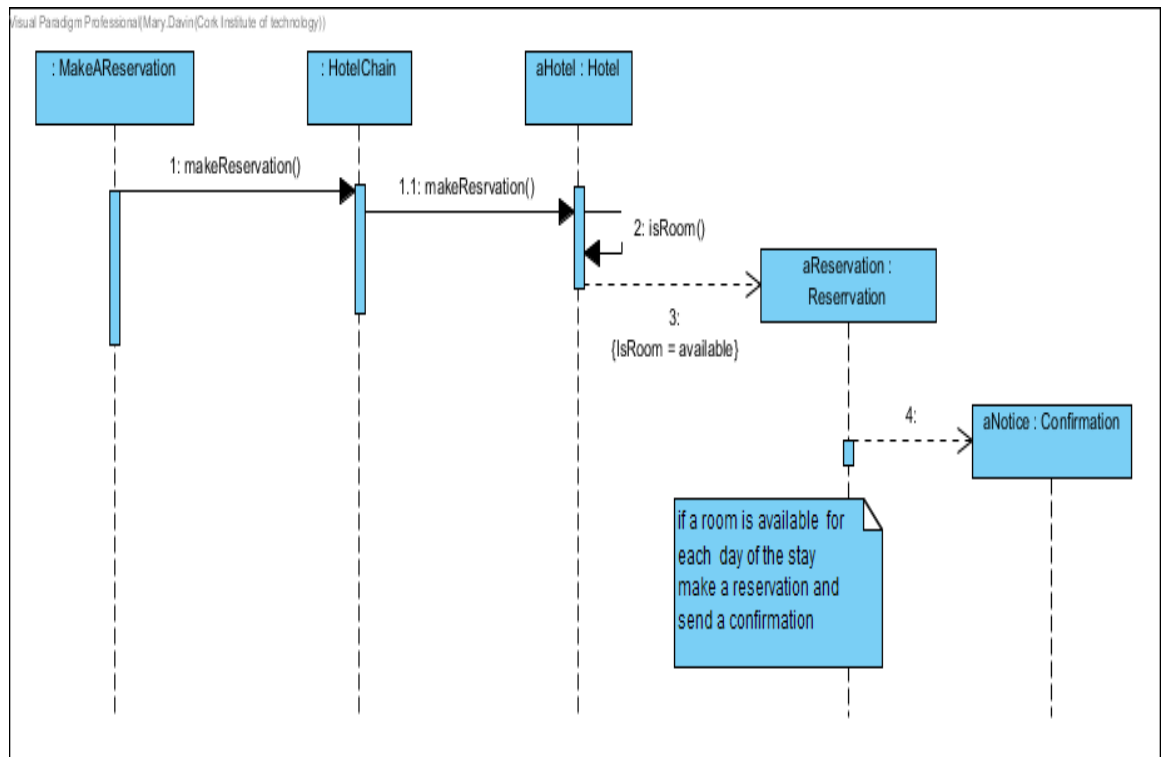
    public void changeState() {
        // Change state of subject
        notifyObservers();
    }

    public void notifyObservers() {
        Iterator i = c.iterator();
        while (i.hasNext()) {
            Observer o = (Observer)i.next();
            o.update();
        }
    }

}
  
```

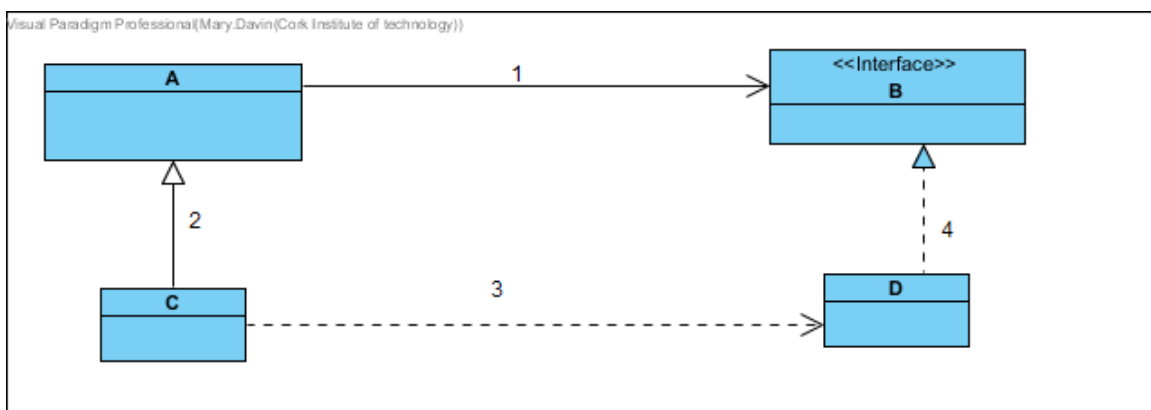
(e) Use the sequence diagram below to answer the following questions [4]

- (i) What is a create message
- (ii) What is a guard condition
- (iii) Self-delegation
- (iv) Identify which object would be of type controller



Q5

(a) Differentiate between each of the 4 relationships as used in the diagram below [4]



- (b) When should you favour **composition** over **inheritance** as a means of reusing code? [2]
- (c) What is meant by **Interface Segregation Principle**? Illustrate your answer with an example.
- (d) What is meant by the **Open Closed Design Principle (OCP)**? [4]
- (e)
- Explain** how the OCP principle could be applied to the code below
 - Reverse engineer** code into a class diagram.

```
public interface Shape{
    public double calculateArea();
}

public class Rectangle implements Shape{
    double length;
    double width;
    public double calculateArea(){
        return length * width;
    }
}

public class Circle implements Shape{
    public double radius;
    public double calculateArea(){
        return (22/7)*radius*radius;
    }
}

public class AreaCalculator{
    public double calculateShapeArea(Shape shape){
        return shape.calculateArea();
    }
}
```

[10]

- (f) Explain the meaning of delegation using the following example [5]

