Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2015

Centre Number

Candidate Number

Software Systems Development

Unit AS1:

Introduction to Object Oriented Development

A1S11

[A1S11]

WEDNESDAY 20 MAY, AFTERNOON

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the space provided in this question paper.
Answer **all six** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

ADVICE TO CANDIDATES

You are advised to take account of the marks for each part question in allocating the available examination time.

For Examiner's use only			
Question	Marks available	Marks	Remark
1	12		
2	23		
3	21		
4	14		
5	18		
6	12		
Total	**100**		

Examiner Only	
Marks	Remark

1 True object-oriented programming requires objects to support three qualities: **encapsulation**, **inheritance and polymorphism**. With regard to an object-oriented programming environment, provide definitions of each of these terms.

(i) Encapsulation

(ii) Inheritance

(iii) Polymorphism

[12]

Examiner Only	
Marks	Remark

2 **(a)** Methods are the basic building blocks of structured software solutions and are widely used in object-oriented programs.

Give three advantages of their use.

(i) ______________________________

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(ii) ______________________________

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(iii) ______________________________

______________________________ [3]

(b) A carpenter makes and sells a variety of garden sheds. Two sizes are constructed, **standard and deluxe**. The deluxe size costs 50% more than the standard size.

Sheds are available in the styles shown in the table below.

STYLE	**COST(£) – excluding VAT standard size**
S – square	120.00
R – rectangle	139.99
I – igloo	215.00
C – castle	349.99

Write a method, **findCost,** which passes two valid parameters and returns the **cost** of a shed. Apply VAT at a rate of 20%.

Parameters passed to the method :

- **style** of type char;
- **size** of type int (1- standard, 2 - deluxe).

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

[10]

Examiner Only	
Marks	Remark

(c) Write the code in the class method **main()** which will:

- prompt and ensure entry of a **valid** character for the style;
- prompt and ensure entry of a **valid** size for the garden shed;
- **call** the method **findCost** designed in part **(b)**;
- output the cost of the required shed.

Assume the following variables have been declared:

```
char      style;
int       size;
double    cost;
```

Examiner Only	
Marks	Remark

[10]

3 A Credit Union offers loans to its existing customers. The base rate of interest is calculated according to the amount of the loan as shown below.

Loan amount (£)	**Base Interest Rate %**
up to 50000 inclusive	5.00
over 50000 and up to 150000 inclusive	5.25
over 150000	6.05

Note: If the customer requires the loan for 7 or more years the rate is reduced by 0.5%.

(a) Complete the design of the class called **Loan** shown below.

Ensure the creation of the:

- constructor method with fields;
- **GET** and **SET** (Properties / Methods) for the field **amount** only;
- **method** to determine the **actual rate** of interest charged to the customer.

```
class Loan{
    private     String      loanCode;
    private     double      amount;
    private     int         noOfYears;

    public Loan(){
        loanCode = null;
        amount = 0.0;
        noOfYears = 0;
    }
```

// field constructor

[4]

// GET and SET (Properties / Methods) for the field **amount** only

Examiner Only	
Marks	Remark

[4]

// method to determine the **actual rate** of interest charged to the customer

[8]

(b) In the class method **main(),** write the code that will instantiate an object named **aLoan** of type Loan and output the relevant actual rate of interest which applies to that object.

Assume the following variables have been declared and assigned values.

```
String      loanCode;
double      amount;
int         noOfYears;
double      actualRate = 0.0;
```

(i) **Instantiate** the object **aLoan**

____

____

____ [3]

(ii) **Output actual rate of interest**

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____

____ [2]

Examiner Only

Marks | Remark

4 **(a)** It is important to ensure that software systems are robust and that users can recover from inadvertently causing a system crash. Exception Handling is a feature provided in object-oriented programming that allows errors to be trapped and caught or thrown.

Name one Exception that could be trapped when developing applications.

____

____ [1]

(b) Exception Handling makes use of **try / catch** blocks. Define the general structure of the try / catch block. Give a brief description of the purpose of each section.

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____ [5]

(c) With reference to the class Loan described in Q3:

```
class Loan{
     private     String     loanCode;
     private     double     amount;
     private     int        noOfYears;
```

A customised Exception has been designed for the class Loan as shown below.

Java

```
class LoanException extends Exception{

     //constructor
     public LoanException(String message)
     {
          super(message);
     }
}
```

C#

```
class LoanException : Exception{

     //constructor
     public LoanException(String message)
          : base(message)
     { }
}
```

Write the **SET** (Property / Method) for the class Loan which will validate that the loan code has the format of two characters followed by six digits. Throw a LoanException if an invalid code is detected.

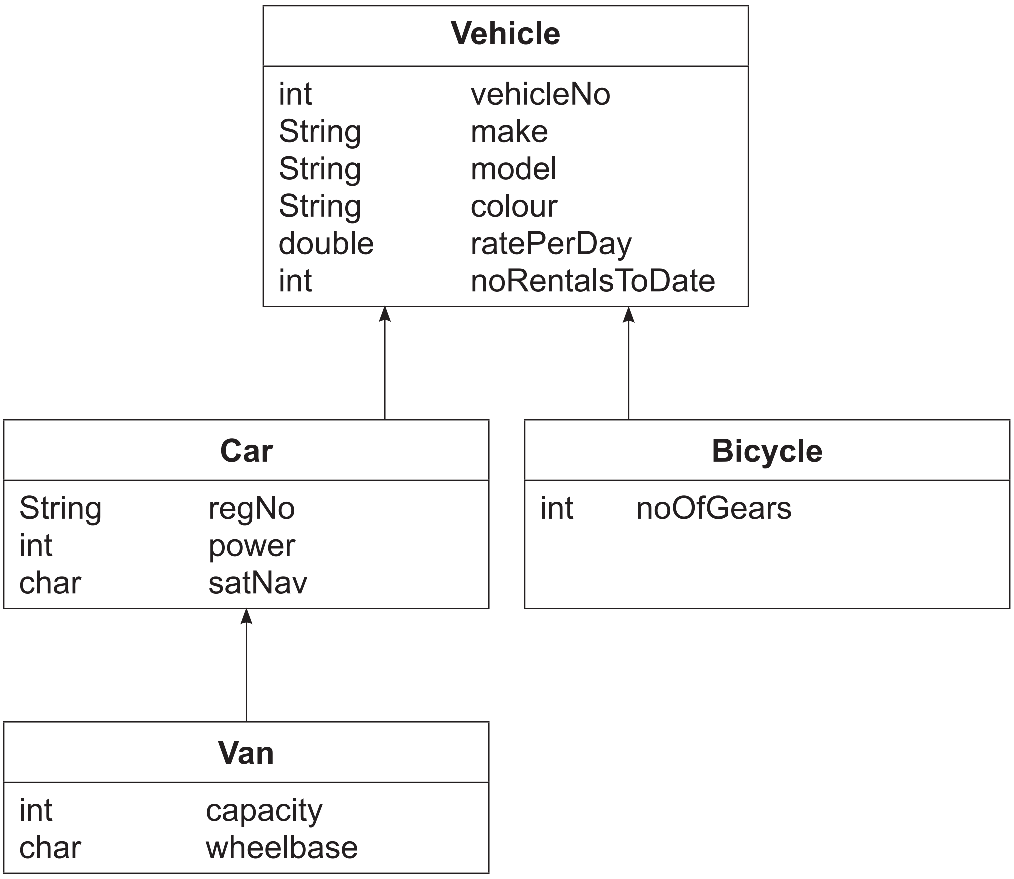
- The valid characters are CA, CI and MA.
- The digits must be in the range 100000 to 199999.

Examiner Only	
Marks	Remark

[8]

5 Green Rentals has a variety of vehicles for rent. As part of the vehicle rental system a data structure is required to allow details of cars, vans and bicycles to be handled.

Inheritance diagram for Green Rentals.



Assume the class **Vehicle** has been designed with the:

- field definitions;
- default and field constructors;
- GET and SET (Properties / Methods);
- toString() method.

(a) What modifier should be included in the class header, **class Vehicle**, to ensure that an object of type Vehicle **cannot** be instantiated?

____

____ [1]

(b) Write the code for a method, **calc_Income**, in the Vehicle class that will return the income from rentals to date.

Income is calculated as ratePerDay multiplied by noRentalsToDate

____

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____ [3]

Examiner Only	
Marks	Remark

(c) Using the concept of inheritance, define the class **Car**. Ensure the creation of the:

- class header;
- fields;
- default constructor;
- constructor that defines a car with specific details;
- GET and SET (Properties / Methods);
- toString() method to return **full** details of a car.

Examiner Only	
Marks	Remark

[8]

(d) The income for a car or van is affected by the availability of a navigation system. This is indicated by the character code held in the field satNav. Green Rentals offers two types of navigation system that increase the ratePerDay charge by the percentage shown in the table below.

satNav code	% ratePerDay increase
A – not available	0
B – standard	4.0
C – deluxe	7.5

(i) Write the modified method, **calc_Income,** for the Car class that will calculate the appropriate income based on the satNav code.

[5]

(ii) Which object-oriented programming term is used to describe this modified method.

[1]

6 Green Rentals has 150 vehicles for rental.

(a) Define an array, **vehicleArray**, to hold the details of the vehicles.

_____

_____ [2]

(b) Populate vehicleArray[0] with sample details of a car.

_____

_____

_____

_____ [2]

(c) Write the code which will output the total income for Green Rentals.

_____

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_____ [8]

THIS IS THE END OF THE QUESTION PAPER