Unit 3: Software Development
(3b. Programming Languages, A Level Only Content)

Marks: /36

Answer **all** the questions.

1(a).   Identify an attribute in the Lizard class.

--[1]

 (b).   Livid Lizards is a computer game in which players get to fire lizards from a cannon to knock down walls. Players get to pick different types of lizards, each with qualities and special powers.

The game is coded using an object-oriented language. Below is the code for the lizard class:

```
class Lizard

        private speed
        private mass
        private size

        public procedure new(givenSpeed, givenMass, givenSize)
                speed=givenSpeed
                mass=givenMass
                size=givenSize
        endprocedure

        public function breakBlock(brick)
                if speed*mass>=brick.getStrength() then
                        speed=((speed*mass)-brick.getStrength())/mass;
                        return true
                else
                        return false
                endif
        endfunction

        ...
        ...
        ...

    endclass
```

Lizard is a class. Describe what is meant by a class.

--[2]

(c).

(i) Describe what is meant by the term *inheritance*.

---**[3]**

(ii) Explain **one** way the game's developers might use inheritance for Livid Lizards.

---**[3]**

2(a).

(i) A high-level language states what is required but not how to do it. The statements do not have to be in a specific order.

Identify the type of language described.

--[1]

(ii) State **one** typical use for this type of language and give **one** reason for your choice.

--[2]

(b).   Some high-level languages are object-oriented.

Describe **three** features of an object-oriented language.

1

2

3

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[6]

3(a). Mobile Treasure Hunt is a game played on a mobile phone. The game shows the user's position on a map of their local area. Treasure randomly appears on the map and users must move to the appropriate area to collect the treasure before it disappears.

Below is part of the code from Mobile Treasure Hunt.

```
class Treasure

    private value
    private weight
    private name

    public procedure new(givenName)
        name=givenName
        weight=20
        value=randomInteger(1,20)
    endprocedure

    public procedure changeName(givenName)
        name=givenName
    endprocedure

endclass

class TreasureChest inherits Treasure

    private locked

    public procedure new(givenName)
        super.new(givenName)
        locked=false
        value=randomInteger(1,100)
        weight=randomInteger(80,120)
    endprocedure

    public procedure pickLock()
        if getRandomNumber()>0.5 then
            locked=false
        endif
    endprocedure

endclass
```

Fig. 2.1

Explain what is meant by the term 'encapsulation' with reference to the attribute called name.

--**[3]**

(b).   Describe what is meant by the term 'inheritance', referring to the code in Fig. 2.1.

--**[3]**

(c).   Identify all attributes and methods in the TreasureChest class.

Methods: _____

Attributes: _____

--**[2]**

4.   A Little Man Computer (LMC) assembly language program is stored in memory as shown in Fig. 3.1.

0	LDA &7
1	ADD #4
2	OUT
3	HLT
4	6
5	2
6	10
7	15
8	16
9	17

Fig. 3.1

In this variant of LMC the symbols & and # are used to denote different modes of addressing.

Given that the output is 17, state the addressing mode represented by each symbol.

(i)   & _____ [1]

(ii) # _____ [1]

An assembler is used on the code.

5(a).   Place ticks in the table to show which statements apply to the modes of addressing shown for a low-level instruction in the form **ADD 123**.

	Addressing mode			
	Immediate	Direct	Relative	None of these
123 is the address of the data to use				
ADD is an operand				
The data to use in a calculation is 123				
The address 123 holds a value which is the address of the data to use				

[4]

(b).   Caz is studying low-level languages. She has lost some of her notes on modes of addressing, but has the following part of an example.

Address in current instruction register (CIR) is 3
Address to be used is 3+11=14

Name and explain **two** modes of addressing that this example could show.

---[4]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1	a		• Speed (1) / mass (1) / size (1).	1	For 1 mark.
	b		• A template (1) defining methods and attributes (1) used to make objects (1).	2	Up to 2 marks for a valid description.
	c	i	• Inheritance is when a class takes on the methods (1) and attributes (1) of a parent class (1). • The inheriting class may override some of these methods / attributes (1) and may have additional extra methods and attributes of its own (1).	3	Up to 3 marks for a valid description.
		ii	• The company may wish to use inheritance to create different types of lizards (1 – AO1.2) using the lizard class as the base class (1 – AO2.1) and different types of lizard inheriting from it (1 – AO2.1).	3	Up to 3 marks for a valid explanation. Maximum 1 mark for demonstrating understanding (AO1.2). Up to 2 marks for applying knowledge and understanding (AO2.1).
			Total	**9**	
2	a	i	• Declarative	1	**Examiner's Comments** Most candidates answered this correctly.
		ii	eg *Use:* • Medical diagnosis • Expert systems *Reason:* • Answer to one question affects the next question / Can find alternative solutions	2	Max one mark for use and max one mark for reason. Accept other example uses with reasons **Examiner's Comments** Nearly all candidates achieved at least one mark in this question.

Question			Answer/Indicative content	Marks	Guidance
	b		• Self-contained object / (instance of a) class / entity / real world object … • … contains routines / methods / attributes / data • Program split into small units/object… • … which are used (by other objects) to build a complex system • Uses encapsulation… • …to hide data within objects / object only accessed through methods • Inheritance… • … / superclass / subclass / derived classes	6	Marks in pairs, max 3 pairs **Examiner's Comments** Those who knew what object oriented language was did quite well, with the average response able to gain four marks and a fair proportion gaining maximum marks on this.
			Total	9	

	Question		Answer/Indicative content	Marks	Guidance
3	a		When an attribute is made private (so it can't be directly accessed or changed from outside the class) (1) Public methods are used to read / amend the attribute's value (1) The attribute name's value can only be amended through the method changeName. (1)	3	
	b		When a class has the attributes and methods of its parent class. (1) It may also have methods and attributes of its own (1) TreasureChest inherits from the class Treasure (1)	3	
	c		Methods: (constructor/new), changeName, pickLock (1) Attributes: value, weight, name, locked (1)	2	Do not penalise for not including constructor. Only give method mark if both other methods are listed Only give attributes mark if all four attributes are listed.
			Total	8	
4		i	& immediate addressing	1	
		ii	# indirect addressing	1	
			Total	2	

Question			Answer/Indicative content	Marks	Guidance
5	a			4	One mark per correct row in table **Examiner's Comments** Most candidates were able to get some marks on this although disturbingly there was a large proportion of candidates who put the last tick in the empty cell, presumably because it didn't have anything in it yet.
	b		Relative addressing… …uses offset 3 to calculate real address from base address 11 Indexed addressing… …modifies address 3 by adding number 11 from index register	4	**Examiner's Comments** Another question that was expected to differentiate between candidates. Those of higher ability generally managed to get three or four marks on this question, most candidates could get one or two marks by addressing modes but the difference was in the ability to describe what it did.
			Total	8	

The table in answer 5a:

	Addressing mode			
	Immediate	Direct	Relative	None of these
123 is the address of the data to use		✔		
ADD is an operand				✔
The data to use in a calculation is 123	✔			
The address 123 holds a value which is the address of the data to use				✔