Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

COMPUTER SCIENCE **9608/41**

Paper 4 Written Paper **October/November 2018**

MARK SCHEME

Maximum Mark: 75

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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[Turn over

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1: Marks must be awarded in line with: • the specific content of the mark scheme or the generic level descriptors for the question • the specific skills defined in the mark scheme or in the generic level descriptors for the question • the standard of response required by a candidate as exemplified by the standardisation scripts.
GENERIC MARKING PRINCIPLE 2: Marks awarded are always **whole marks** (not half marks, or other fractions).
GENERIC MARKING PRINCIPLE 3: Marks must be awarded **positively**: • marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate • marks are awarded when candidates clearly demonstrate what they know and can do • marks are not deducted for errors • marks are not deducted for omissions • answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.
GENERIC MARKING PRINCIPLE 4: Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks
1(a)(i)	1 mark for each correct statement: • bird(lays_egg). • bird(has_wings).	2
1(a)(ii)	1 mark for each correct line: • feature(eagle, lays_eggs). • feature(eagle, has_wings).	2
1(b)(i)	1 mark for each animal: tuna, crab	2
1(b)(ii)	1 mark per bullet point: • feature() • tuna, C feature(tuna, C)	2

1(c)	1 mark per bullet point to max 3:
	
	• feature(X,Y) AND bird(Y) // feature(X, has_wings)
	• AND
	• feature(X,Z) AND bird(Z) // feature(X, lays_eggs)
	
	(feature(X, Y) AND bird(Y)) AND (feature(X, Z) AND bird(Z))
		3

1(d)(i)	A programming style/classification // characteristics/features that programming language has/uses	1
1(d)(ii)	1 mark for each: • Low-level • Imperative // Procedural	2

PUBLISHED

Question	Answer	Marks

2(a)	1 mark per bullet point to max 4:
	
	• declaration of type Book
	• Title, Author and ISBN as String
	• Fiction as Boolean
	• LastRead as Date
	
	For example:
	
	`TYPE Book`
	`    DECLARE Title : String`
	`    DECLARE Author : String`
	`    DECLARE ISBN : String`
	`    DECLARE Fiction : Boolean`
	`    DECLARE LastRead : Date`
	`ENDTYPE`
		4

Question	Answer	Marks

2(b)	1 mark per bullet point to max 4:
	
	 • **Function** header
	 • … taking ISBN as parameter
	 • Converting ISBN to integer
	 • Calculating Hash (ISBN mod 2000 + 1)
	 • Returning the calculated Hash
	
	 Examples:
	
	 Python:
	
	 ```def Hash(ISBN):```
	 ``` ISBNint = int(ISBN)```
	 ``` Hash = (ISBNint % 2000) + 1```
	
	 VB.NET:
	
	 ```Function Hash (ISBN As String) As Integer```
	 ``` ISBNint = convert.toInt32(ISBN)```
	 ``` Hash = (ISBNint MOD 2000) + 1```
	 ```End Function```
	
	 Pascal:
	
	 ```function Hash(ISBN : String) : Integer```
	 ``` begin```
	 ``` ISBNint = StrToInt(ISBN)```
	 ``` Hash = (ISBNint MOD 2000) + 1```
	 ``` end;```
		4

Question	Answer	Marks
2(c)	1 mark per bullet point to max 8: • Procedure FindBook declaration **and** prompt **and** input ISBN • Validate data input has 13 characters • … and are all numeric • ..loop until valid • Call Hash() with input data **and** store return data • Open MyBooks.dat for reading as random file **and** close • Finding the record using return value Hash() • Get the data for the record • …store in variable of type Book • …output all the data for the record	**8**

Question	Answer	Marks

2(c)	Example:
	
	``
	PROCEDURE FindBook()
	  DECLARE BookInfo : Book
	
	  REPEAT
	    ISBN ← input("Enter the ISBN number")
	    Valid ← TRUE
	    Size ← LENGTH(ISBN)
	    IF size <> 13
	      THEN
	        Valid ← FALSE
	      ELSE
	        FOR i ← 1 to 13
	          IF NOT(MID(ISBN,i,1) >= '0' AND MID(ISBN,i,1)<= '9')
	            THEN
	              Valid ← FALSE
	          ENDIF
	        ENDFOR
	    ENDIF
	  UNTIL Valid
	
	  Filename ← "myBooks.dat"
	  OPENFILE Filename FOR RANDOM
	  RecordLocation ← Hash(ISBN)
	  SEEK FileName, RecordLocation
	  GETRECORD Filename, BookInfo
	  CLOSEFILE Filename
	  OUTPUT (BookInfo.Title & " " & BookInfo.Author & " " &
	          BookInfo.ISBN & " " & BookInfo.Fiction & " " &
	          BookInfo.LastRead)
	ENDPROCEDURE
	``	

Question	Answer	Marks
3(a)	• LIFO / last in first out	**1**
3(b)(i)	Points to the **next** free space on the stack	**1**
3(b)(ii)	1 mark per bullet to max 3 • Correct stack contents • StackPointer = 4	**2**

StackPointer

4

StackContents

0	"Screw 1"
1	"Screw 2"
2	"Back case"
3	"Light 1"
4	
5	
6	
7	

Question	Answer	Marks

3(c)(i)	1 mark for each correct statement:
	
	``
	PROCEDURE POP
	    IF StackPointer = 0
	        THEN
	            OUTPUT ("The stack is empty")
	        ELSE
	            StackPointer ← StackPointer - 1
	            OUTPUT Parts[StackPointer]
	            Parts(StackPointer) ← "*"
	    ENDIF
	ENDPROCEDURE
	``
		5

3(c)(ii)	1 mark for each completed statement:
	
	``
	PROCEDURE PUSH (BYVALUE Value : String)
	    IF StackPointer > 19
	        THEN
	            OUTPUT "Stack full"
	        ELSE
	            Parts[StackPointer] ← Value
	            StackPointer ← StackPointer + 1
	    ENDIF
	ENDPROCEDURE
	``
		4

Question	Answer	Marks
4(a)(i)	A function/subroutine defined in terms of itself // a function/subroutine that calls itself	**1**
4(a)(ii)	06	**1**
4(b)	1 mark for each bullet point: • −60 as final return value • 3*2*1*−10 1 mark for each row in table	**6**

Call Number	Function call	Number = 0 ?	Return value
1	Calculate(3)	False	3*Calculate(2)
2	Calculate(2)	False	2*Calculate(1)
3	Calculate(1)	False	1*Calculate(0)
4	Calculate(0)	TRUE	−10

Question	Answer	Marks
4(c)(i)	1 mark per bullet point: • Each time it calls itself the variables are put onto the stack // The function call itself too many times • … it runs out of stack space // stack overflow	**2**

Question	Answer	Marks

4(c)(ii)	1 mark per bullet point to max 5:
	
	• Function header with parameter **and** Returning calculated value
	• Loop **parameter** times (up to number, or down from number)…
	• …Multiplying by loop counter
	• Multiplying by –10
	• Dealing with starting value correctly
	
	For example:
	
	``
	FUNCTION Calculate(Number : INTEGER) RETURNS INTEGER
	  DECLARE Count : INTEGER
	  DECLARE Value : INTEGER
	  Value ← –10
	  FOR Count ← 1 to Number
	    Value ← Value * Count
	  ENDFOR
	
	  RETURN Value
	ENDFUNCTION
	``
		5

Question	Answer	Marks
5(a)	1 mark per bullet point to max 2: • To restrict **direct** access to the property to the class // keep the properties secure // So the data can only be accessed by its methods // makes the program more robust • To make the program easier to debug • To ensure data going in is valid // to stop invalid changes // stop accidental changes	2

Question	Answer	Marks
5(b)	1 mark per bullet point: • Constructor method header taking 2 parameters (with correct data types if given) • Checking if Number > = 0 and < = 9 • Checking theShape is 'square' or 'triangle' or 'circle' • … if **both** valid assigning Number and Shape the parameters • … if **either** invalid report error (output/returning value/catching error)	**5**

Question	Answer	Marks

5(b)	Examples:
	
	Python
	
	<pre>def __init__(self, Num, theShape):
	    if (Num >= 0 and Num <= 9) and (theShape = "square" or theShape = "triangle" or
	theShape = "circle") :
	        self. __Number = Num
	        self.__Shape = TheShape
	    else
	        print("Error")
	    endif</pre>
	VB.NET
	
	<pre>Public Sub New(Num As Integer, theShape As String)
	    IF (Num >= 0 and Num <= 9) and (theShape = "square" or theShape = "triangle" or
	theShape = "circle") THEN
	        Number = Num
	        Shape = theShape
	    ELSE
	        Console.WriteLine("Error")
	    ENDIF
	End Sub</pre>
	Pascal
	
	<pre>constructor Cards.Create(Num : Integer, theShape : String);
	begin
	If (Num >= 0 and Num <= 9) and (theShape = "square" or theShape = "triangle" or theShape =
	"circle")
	        Number := Num;
	        Shape := theShape;
	    Else
	        Writeln("Error") ;
	end;</pre>	

Question	Answer	Marks

5(c)	1 mark per bullet point to max 2:
	
	• Function declaration for `GetNumber`
	• Returning `Number`
	
	Examples:
	
	Python
	
	``
	def GetNumber():
	    return(self.__Number)
	``
	
	VB.NET
	
	``
	Public Function GetNumber() As Integer
	   Return(Number)
	End Function
	``
	
	Pascal
	
	``
	function Cards.GetNumber() : Integer;
	begin
	   GetNumber := Number;
	end;
	``
		2

Question	Answer	Marks

5(d)	1 mark per bullet point to max 2:
	
	• Assigning to `OneS` and correct instantiation
	• Correct parameter values
	
	Examples:
	
	Python
	
	`OneS = Cards(1, "square")`
	
	VB.NET
	
	`Dim OneS As New Cards(1, "square")`
	or
	`Dim OneS As Cards = New Cards(1, "square")`
	or
	`OneS = New Cards(1, "square")`
	
	Pascal
	
	`var OneS : Cards;`
	`OneS := Cards.Create(1, "square")`
		2

5(e)	1 mark per bullet point: • **function** declaration (returning integer) and taking 2 cards as parameter • comparison of Number and Shape … • … if the same output 'SNAP' **and** return –1 • Compare Number of each to find highest and return the highest number • return either number if the same • correct use of `.GetNumber()` and `.GetShape()` throughout	**6**

Question	Answer	Marks

5(e)	Examples:
	
	Python
	
	`def Compare(P1Card, P2Card):`
	`    if P1Card.GetNumber() = P2Card.GetNumber() AND`
	`            P1Card.GetShape() = P2Card.GetShape():`
	`        Print("SNAP")`
	`            return -1`
	`    elif P2Card.GetNumber() > P1Card.GetNumber():`
	`        return P2Card.GetNumber()`
	`    else:`
	`        return P1Card.GetNumber()`
	
	VB.NET
	
	`Function Compare(P1Card As Cards, P2Card As Cards) As Integer`
	`    IF P1Card.GetNumber() = P2Card.GetNumber()AND`
	`            P1Card.GetShape() = P2Card.GetShape()THEN`
	
	`        Console.writeline("SNAP")`
	`            Return -1`
	`    ELSEIF P2Card.GetNumber() > P1Card.GetNumber() THEN`
	`            P2Card.GetNumber()`
	`    ELSE`
	`        Return P1Card.GetNumber()`
	`      ENDIF`
	`End Function`	

Question	Answer	Marks

5(e)	**Pascal**
	
	 ``pascal
	function Compare(P1Card : Cards, P2Card : Cards) : Integer;
	begin
	    if P1Card.GetNumber() = P2Card.GetNumber()AND
	            P1Card.GetShape() = P2Card.GetShape() then
	        writeline("SNAP");
	            return -1;
	    else if P2Card.GetNumber() > P1Card.GetNumber() then
	        return P2Card.GetNumber();
	    else
	        return P1Card.GetNumber();
	end;
	``	