



Cambridge
International
AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

COMPUTER SCIENCE

9608/42

Paper 4 Written Paper

May/June 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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This document consists of **21** printed pages.

PUBLISHED**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.

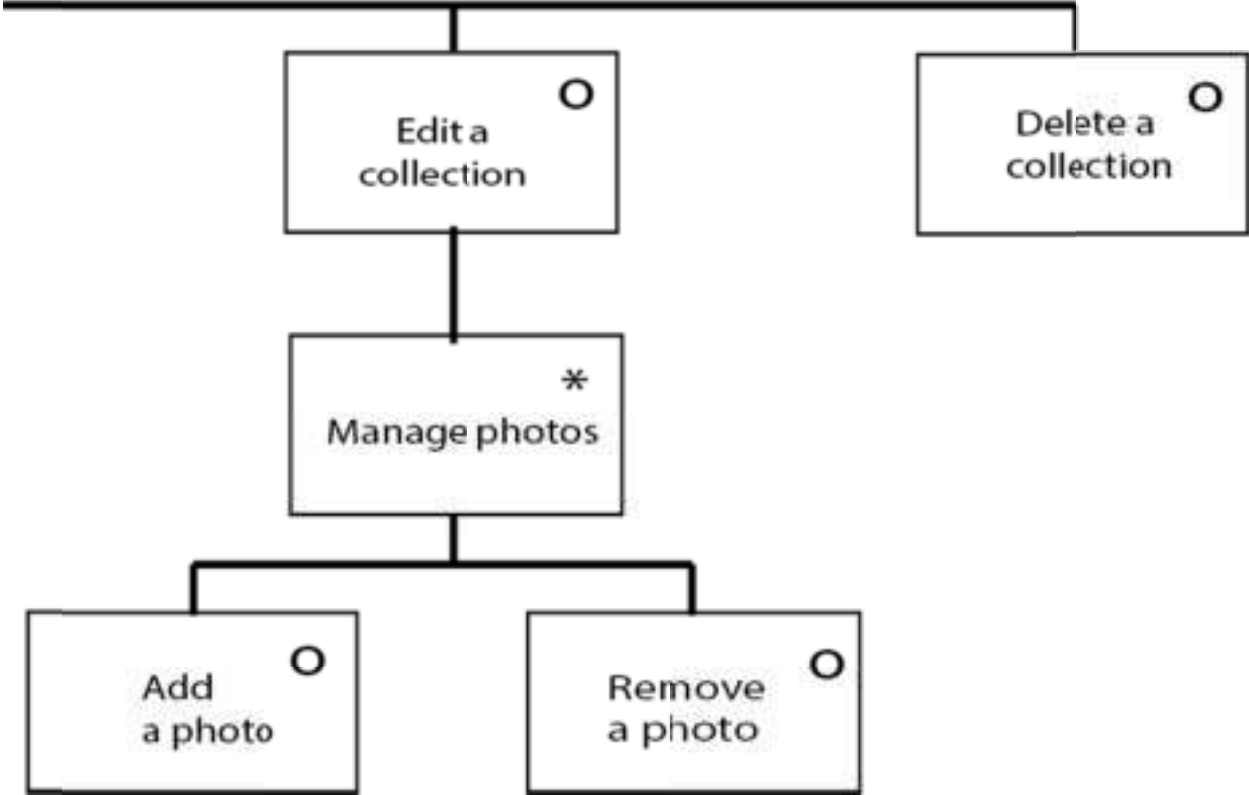
GENERIC MARKING PRINCIPLE 5:

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)	1 mark for each correctly completed pseudocode line to max 4 <pre> 01 REPEAT 02 CALL TakePhoto 03 CALL AddPhotoToCollection 04 OUTPUT "Do you want to take another photo?" 05 INPUT AddPhoto 06 UNTIL AddPhoto = "No" 07 REPEAT 08 CALL AddUser 09 OUTPUT "Do you want to add another user?" 10 INPUT NewUser 11 UNTIL NewUser = "No" 12 OUTPUT "Do you want to create another collection?" 13 INPUT NewCollection 14 UNTIL NewCollection = "No" </pre>	4

Question	Answer	Marks
1(b)	1 mark per bullet: • Edit a collection // Choose a collection // Select a collection • Manage photos • Delete a collection • both add and remove a photo // add to collection, delete to collection • appropriate selection and iteration in all boxes  <pre> graph TD Root[] --- Edit[Edit a collection] Root --- Delete[Delete a collection] Edit --- Manage[Manage photos] Manage --- Add[Add a photo] Manage --- Remove[Remove a photo] </pre>	5

Question	Answer	Marks
2(a)	1 mark for each statement 15 <code>is_a(gecko, lizard).</code> 16 <code>maxsize(gecko, 182).</code>	2
2(b)	1 mark for 2 results 2 marks for 3 correct results <code>green_iguana, cayman, smooth_iguana</code>	2
2(c)	1 mark per bullet • <code>is_a</code> used with brackets () • <code>squamata, X</code> in correct order <code>is_a(squamata, X).</code>	2
2(d)	1 mark for each bullet to max 3 • <code>is_a(X, Z)</code> • <code>and // , has(Z, Y).</code> <code>is_a(X, Z) AND has(Z, Y).</code>	3
2(e)	YES	1

Question	Answer	Marks
3(a)	CardData is partially sorted/ordered // more items in order/sorted	1
3(b)	1 mark for each correct statement <pre> 01 ArraySize ← 10 02 FOR Pointer ← 2 TO ArraySize // 10 03 ValueToInsert ← CardData[Pointer] 04 HolePosition ← Pointer 05 WHILE (HolePosition > 1 AND (CardData[HolePosition - 1] > ValueToInsert)) 06 CardData[HolePosition] ← CardData[HolePosition - 1] 07 HolePosition ← HolePosition - 1 08 ENDWHILE 09 CardData[HolePosition] ← ValueToInsert 10 ENDFOR </pre>	7
3(c)(i)	1 mark per bullet to max 2 • It doesn't check every value • The midpoint is the middle element, not the middle numerical value • When the higher/lower elements are discarded they will not be the higher/lower elements • It might discard the value you are looking for	2
3(c)(ii)	1 mark per bullet to max 4. Max 2 marks if no relation to CardData values. • Find mid-point and comparison // 25 is smaller than/compared to 52/56 • Discard/ignore greater // change upper bound to 33/52/midpoint - 1 // e.g. right hand side // only use array elements 1 - 4/5 • Find and compare to mid-point of new list e.g. 12/25 • Value is the midpoint // Continue until value found	4

Question	Answer	Marks
3(d)	1 mark for each complete statement <pre> PROCEDURE BinarySearch(CardData, SearchValue) DECLARE Midpoint : INTEGER First ← 1 Last ← ARRAYLENGTH(CardData) Found ← FALSE WHILE (First ≤ Last) AND NOT(Found) Midpoint ← (First + Last) \ 2 IF CardData[Midpoint] = SearchValue THEN Found ← TRUE ELSE IF SearchValue < CardData[Midpoint] THEN Last ← Midpoint - 1 ELSE First ← Midpoint + 1 ENDIF ENDIF ENDWHILE ENDPROCEDURE </pre>	4

Question	Answer	Marks
4(a)	1 mark per bullet: - Team methods - Official attributes - Two inheritance arrows or containment <pre> classDiagram class Member { FirstName: STRING LastName: STRING DateOfBirth: DATE Gender: STRING Constructor() Introduction() DisplayFullnameAndDateOfBirth() } class Team { TeamName: STRING TeamList: ARRAY OF Member Constructor() AddMember() DeleteMember() } class Competitor { Sport: STRING Constructor() Introduction() } class Official { JobTitle: STRING FirstAidTrained: BOOLEAN/STRING Constructor() DisplayJobTitle() } Team "1" *-- "N" Member Member < -- Competitor Member < -- Official </pre>	3

Question	Answer	Marks
4(b)	1 mark per bullet to max 5 • class declaration • <code>FirstName</code>, <code>LastName</code>, <code>DateOfBirth</code> and <code>Gender</code> all defined as private • constructor declaration • ...all four attributes assigned values from parameters • (Public) method for <code>Introduction</code> • ...outputs message with <code>FirstName</code> and <code>LastName</code> attributes // returns <code>FirstName</code> and <code>LastName</code> • Public method for <code>DisplayFullNameAndDateofbirth</code> • ... outputs message with <code>FirstName</code>, <code>LastName</code> and <code>DateOfBirth</code> // returns <code>FirstName</code>, <code>LastName</code>, <code>DateOfBirth</code> Python example code: <pre>class Member: def __init__(self, Fname, Lname, DOB, GenderVal): self.__FirstName = Fname self.__LastName = Lname self.__DateOfBirth = DOB self.__Gender = GenderVal def Introduction(self): return "Hello, I am ", self.__FirstName, " ", self.LastName def DisplayFullnameAndDateofbirth(self): print self.__FirstName, self.__LastName, self.__DateOfBirth</pre>	5

Question	Answer	Marks
4(b)	Visual Basic example code: <pre> Class Member Private Firstname As String Private Lastname As String Private DateOfBirth As Date Private Gender As String Public Sub New(ByVal Fname As String,ByVal Lname As String, ByVal DOB As Date, ByVal GenderVal As String) Firstname = Fname Lastname = Lname DateOfBirth = DOB Gender = GenderVal End Sub Public Function Introduction() As String Dim Message As String Message = "Hello, I am " + Firstname + " " + Lastname + " " + DateOfBirth Return Message End Function Public Function DisplayFullNameAndDateOfBirth As String DisplayFullNameAndDateOfBirth = Firstname + " " + Lastname + " " + DateOfBirth End Function End Class </pre>	

Question	Answer	Marks
4(b)	Pascal example code: <pre> type Member = class private Firstname : string; Lastname : string; DateOfBirth : date; Gender : string; public constructor Create(Fname, Lname, Gend, DBirth : string); function Introduction() : string; function DisplayFullNameAndDateOfBirth() : string; constructor Member.Create(Fname, Lname, Gend, DBirth : string); begin Firstname := Fname LastName := Lname Gender := Gend DateOfBirth := DBirth end; function Member.Introduction() : String; begin Introduction := "Hello, I am " + Firstname + " " + Lastname end; function Member.DisplayFullNameAndDateOfBirth As String; begin; DisplayFullNameAndDateOfBirth = Firstname + " " + Lastname + " " + DateOfBirth end; </pre>	

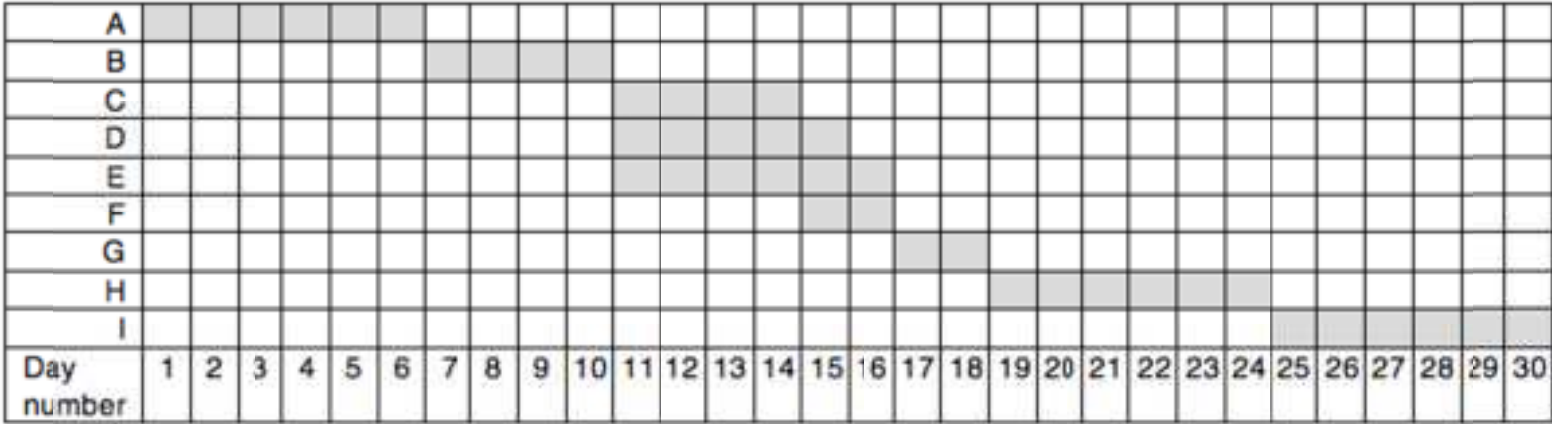
Question	Answer	Marks
4(c)	1 mark per bullet to max 5 • Class declaration that inherits from Member • Constructor declaration taking all five parameters • ...that inherits from Member • Declaration of Sport as private String • and assigning to parameter • Introduction method declaration (with polymorphism) • ...returning/outputting message with FirstName, LastName and Sport variables Python example code: <pre>class Competitor(Member): def __init__(self, Fname, Lname, DOB, GenderVal, MySport): Member.__init__(self, Fname, Lname, DOB, GenderVal) self.__Sport = MySport def Introduction(self): print "Hello, I am %s %s and my sport is %s" % (self.FirstName, self.LastName, self.__Sport)</pre>	5

Question	Answer	Marks
4(c)	Visual Basic example code: <pre> Class Competitor Inherits Member Private Sport As String Public Sub New(ByVal Fname As String, ByVal Lname As String, ByVal DOB As Date, ByVal GenderVal As String, ByVal SportVal As String) MyBase.New(Fname, Lname, DOB, GenderVal) Sport = SportVal End Sub Public Overloads Function Introduction() As String Dim Message As String Message = "Hello, I am " + Firstname + " " + Lastname + " and my sport is " + Sport Return Message End Function End Class </pre>	

Question	Answer	Marks
4 (c)	Pascal example code: <pre> type Competitor = class (Member) private Sport : String; public Constructor init (Fname, Lname: String; DOB: Date; GenderVal, Sport:String); Function Introduction() : String; end; Constructor Competitor.initFname, Lname: String; DOB: Date; GenderVal, SportVal:String); begin inherited init (Fname, Lname, DOB, GenderVal); Sport := SportVal; end; Function Competitor.Introduction(); begin Result:= "Hello, I am " + Firstname + " " + Lastname + " and my sport is " + Sport end; </pre>	

Question	Answer	Marks
4(d)	1 mark per bullet • variable BMXJudge assigned value • call Official • with all 6 parameters assigned correctly Python example code: <pre>BMXJudge = Official("Omar", "Ellaboudy", "17/03/1993", "Male", true, "Judge")</pre> Visual Basic example code: <pre>BMXJudge = New Official("Omar", "Ellaboudy", "17/03/1993", "Male", true, "Judge")</pre> Pascal example code: <pre>BMXJudge := Official("Omar", "Ellaboudy", "17/03/1993", "Male", true, "Judge")</pre>	3

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Question	Answer	Marks
5(a)	1 mark per bullet • C/D/E in parallel starting after B, with correct durations. • F with dependency on C and correct duration • G with dependency on D and E with correct duration • H with correct dependency on F and G • I with dependency on H 	5
5(b)(i)	C, D, E	1
5(b)(ii)	E, F	1

Question	Answer	Marks
5(c)	1 mark per bullet to max 2 For example: • Check if the project is on track • ...so the project manager can intervene if behind • lets you identify slack time to • ...reallocate resources to support the process • find critical path • ...to ensure activities are given correct priority • see when tasks end • ...to plan the next tasks • see which tasks can run in parallel • set milestones/goals • check correct tasks are being carried out on current day • Calculate latest start time • Calculate earliest finish time • Calculate latest start time for a task	2

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graph TD
    Root["0 | 'Red' | 1 | 2 |"]
    Node1["1 | 'Blue' | 6 | 7 |"]
    Node2["2 | 'Green' | 4 | 3 |"]
    Leaf6["6 | 'Yellow' | 8 | |"]
    Leaf7["7 | 'Purple' | 9 | |"]
    Leaf4["4 | 'Brown' | | |"]
    Leaf3["3 | 'Black' | 5 | |"]
    Leaf8["8 | 'White' | | |"]
    Leaf9["9 | 'Pink' | 10 | 11 |"]
    Leaf10["10 | 'Grey' | | |"]
    Leaf11["11 | 'Orange' | | |"]
    Empty1[" | | |"]
    Empty2[" | | |"]
    Empty3[" | | |"]

    Root --> Node1
    Root --> Node2
    Node1 --> Leaf6
    Node1 --> Leaf7
    Node1 --> Leaf8
    Node2 --> Leaf4
    Node2 --> Leaf3
    Node2 --> Leaf9
    Leaf9 --> Leaf10
    Leaf9 --> Leaf11
    
```

Question	Answer	Marks
6(b)	1 mark for outputting all the leaf data values - Outputting <code>BinaryTree[CurrentNode].DataValue</code> only when both <code>LeftPointer</code> and <code>RightPointer</code> are -1 1 mark per bullet to max 7 - Function declaration ...taking <code>CurrentNode</code> or equivalent as parameter - Check if <code>BinaryTree[CurrentNode].LeftPointer</code> is not -1 recursive callwith left pointer value as parameter - Check if <code>BinaryTree[CurrentNode].RightPointer</code> is not -1... ... recursive call... ... with right pointer value as parameter Python example code: <pre>def FindLeaves(CurrentNode): global BinaryTree if(BinaryTree[CurrentNode].LeftPointer != -1): FindLeaves(BinaryTree[CurrentNode].LeftPointer) if(BinaryTree[CurrentNode].RightPointer != -1): FindLeaves(BinaryTree[CurrentNode].RightPointer) if((BinaryTree[CurrentNode].RightPointer == -1) and (BinaryTree[CurrentNode].LeftPointer == -1)): print BinaryTree[CurrentNode].DataValue return</pre>	8

Question	Answer	Marks
6(b)	Visual Basic example code: <pre> Procedure FindLeaves (CurrentNode) : if (BinaryTree[CurrentNode].LeftPointer <> -1) then FindLeaves (BinaryTree[CurrentNode].LeftPointer) End if if (BinaryTree[CurrentNode].RightPointer <> -1) then FindLeaves (BinaryTree[CurrentNode].RightPointer) end if if ((BinaryTree[CurrentNode].RightPointer = -1) and (BinaryTree[CurrentNode].LeftPointer = -1)) then Console.WriteLine (BinaryTree[CurrentNode].DataValue) End if End Procedure </pre> Pascal example code: <pre> Procedure FindLeaves (CurrentNode); Begin if (BinaryTree[CurrentNode].LeftPointer <> -1) then FindLeaves (BinaryTree[CurrentNode].LeftPointer); if (BinaryTree[CurrentNode].RightPointer <> -1): FindLeaves (BinaryTree[CurrentNode].RightPointer); if ((BinaryTree[CurrentNode].RightPointer = -1) and (BinaryTree[CurrentNode].LeftPointer = -1)) then print (BinaryTree[CurrentNode].DataValue); End; </pre>	