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**COMPUTER SCIENCE**

**9608/23**

Paper 2 Written Paper

**October/November 2019**

MARK SCHEME

Maximum Mark: 75

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**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.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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This document consists of **13** printed pages.

**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)	One mark for each (different) data type ... ... and one mark for a corresponding example value  Acceptable types: Integer, Real, String, Char, Boolean, Date,	6								
1(a)(ii)	Declaration	1								
1(b)	<b>Two</b> from ( <b>max 2</b> ): <ul style="list-style-type: none"> <li>• A list of identifier / variable names</li> <li>• Explanations/descriptions (of what they are used for)</li> <li>• Data types</li> </ul>	2								
1(c)(i)	One mark for each stage (Input, Output) One mark for each correct example <table border="1" data-bbox="301 781 1128 1043"> <thead> <tr> <th>Stage</th> <th>Example statement</th> </tr> </thead> <tbody> <tr> <td>Input</td> <td><code>Next = Console.ReadLine()</code></td> </tr> <tr> <td>Process</td> <td><code>x = INT(y/3)</code></td> </tr> <tr> <td>Output</td> <td><code>Console.WriteLine("Goodbye")</code></td> </tr> </tbody> </table>	Stage	Example statement	Input	<code>Next = Console.ReadLine()</code>	Process	<code>x = INT(y/3)</code>	Output	<code>Console.WriteLine("Goodbye")</code>	5
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Input	<code>Next = Console.ReadLine()</code>									
Process	<code>x = INT(y/3)</code>									
Output	<code>Console.WriteLine("Goodbye")</code>									
1(c)(ii)	One mark for statement in program code that includes (at least) two 'stages'  Example correct answers: <ul style="list-style-type: none"> <li>• <code>Next = LEN(Console.Input())</code></li> <li>• <code>Console.WriteLine(Name &amp; Address)</code></li> <li>• <code>Console.WriteLine(Console.ReadLine() &amp; " is what you entered")</code></li> </ul>	1								
1(d)	<b>Three</b> from the following ( <b>max 3</b> ): <ul style="list-style-type: none"> <li>• Blank lines</li> <li>• Capitalisation of Keywords</li> <li>• Sensible variable names</li> <li>• Use of (library/built-in) functions</li> <li>• Comments</li> <li>• PrettyPrint / keywords coloured</li> </ul>	3								
1(e)	White-box	1								

Question	Answer	Marks												
2(a)(i)	<ul style="list-style-type: none"> <li>• Count-controlled // FOR loop</li> <li>• Used when the number of iterations is known / fixed</li> </ul>	<b>2</b>												
2(a)(ii)	<pre>REPEAT   CALL AlarmReset()   Status1 ← GetStatus(Sys_A)   Status2 ← GetStatus(Sys_B) UNTIL (Status1 = TRUE AND Status2 = TRUE)</pre> <p>One mark for each of:</p> <ol style="list-style-type: none"> <li>1 REPEAT ... UNTIL</li> <li>2 Call to AlarmReset()</li> <li>3 Assignment of Status1 <b>and</b> Status2</li> <li>4 correct logical test</li> </ol>	<b>4</b>												
2(b)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th data-bbox="300 801 991 875" style="text-align: center;">Feature</th> <th data-bbox="991 801 1294 875" style="text-align: center;">Answer</th> </tr> </thead> <tbody> <tr> <td data-bbox="300 875 991 936">The symbol used to indicate an assignment</td> <td data-bbox="991 875 1294 936" style="text-align: center;">:=</td> </tr> <tr> <td data-bbox="300 936 991 1037">The line numbers for the start and end of a count-controlled loop</td> <td data-bbox="991 936 1294 1037" style="text-align: center;">180/190 and 230</td> </tr> <tr> <td data-bbox="300 1037 991 1097">The step value of the count-controlled loop</td> <td data-bbox="991 1037 1294 1097" style="text-align: center;">2</td> </tr> <tr> <td data-bbox="300 1097 991 1167">The character that indicates a comment</td> <td data-bbox="991 1097 1294 1167" style="text-align: center;">%</td> </tr> <tr> <td data-bbox="300 1167 991 1234">The name of a function</td> <td data-bbox="991 1167 1294 1234" style="text-align: center;">Mult // Read</td> </tr> </tbody> </table>	Feature	Answer	The symbol used to indicate an assignment	:=	The line numbers for the start and end of a count-controlled loop	180/190 and 230	The step value of the count-controlled loop	2	The character that indicates a comment	%	The name of a function	Mult // Read	<b>5</b>
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2(c)	Compiler / Interpreter	<b>1</b>												

Question	Answer	Marks
3	<div style="text-align: center;"> </div> <p>One mark for each of the following:</p> <ul style="list-style-type: none"> <li>• all three boxes correctly labelled</li> <li>• parameters in to <code>GetPassword()</code></li> <li>• value back from <code>GetPassword()</code></li> <li>• parameters in to <code>UpdateFile()</code></li> <li>• <code>BOOLEAN</code> value back from <code>UpdateFile()</code></li> </ul>	5

Question	Answer	Marks
4(a)	<p>One mark for each point.</p> <p>Valid string must contain:</p> <ul style="list-style-type: none"> <li>• at least one '.' characters</li> <li>• one '@' character</li> <li>• more than 5 other characters.</li> </ul>	3

Question	Answer	Marks																																																																																																									
4(b)(i)	<p>One mark for each area as outlined:</p> <table border="1" data-bbox="304 315 1299 1733"> <thead> <tr> <th data-bbox="304 315 459 376">Index</th> <th data-bbox="459 315 647 376">NextChar</th> <th data-bbox="647 315 836 376">NumDots</th> <th data-bbox="836 315 991 376">NumAts</th> <th data-bbox="991 315 1299 376">NumOthers</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>'J'</td> <td></td> <td></td> <td>1</td> </tr> <tr> <td>2</td> <td>'i'</td> <td></td> <td></td> <td>2</td> </tr> <tr> <td>3</td> <td>'m'</td> <td></td> <td></td> <td>3</td> </tr> <tr> <td>4</td> <td>'.'</td> <td>1</td> <td></td> <td></td> </tr> <tr> <td>5</td> <td>'9'</td> <td></td> <td></td> <td>4</td> </tr> <tr> <td>6</td> <td>'9'</td> <td></td> <td></td> <td>5</td> </tr> <tr> <td>7</td> <td>'@'</td> <td></td> <td>1</td> <td></td> </tr> <tr> <td>8</td> <td>'s'</td> <td></td> <td></td> <td>6</td> </tr> <tr> <td>9</td> <td>'k'</td> <td></td> <td></td> <td>7</td> </tr> <tr> <td>10</td> <td>'a'</td> <td></td> <td></td> <td>8</td> </tr> <tr> <td>11</td> <td>'i'</td> <td></td> <td></td> <td>9</td> </tr> <tr> <td>12</td> <td>'l'</td> <td></td> <td></td> <td>10</td> </tr> <tr> <td>13</td> <td>'.'</td> <td>2</td> <td></td> <td></td> </tr> <tr> <td>14</td> <td>'c'</td> <td></td> <td></td> <td>11</td> </tr> <tr> <td>15</td> <td>'o'</td> <td></td> <td></td> <td>12</td> </tr> <tr> <td>16</td> <td>'m'</td> <td></td> <td></td> <td>13</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Index	NextChar	NumDots	NumAts	NumOthers			0	0	0	1	'J'			1	2	'i'			2	3	'm'			3	4	'.'	1			5	'9'			4	6	'9'			5	7	'@'		1		8	's'			6	9	'k'			7	10	'a'			8	11	'i'			9	12	'l'			10	13	'.'	2			14	'c'			11	15	'o'			12	16	'm'			13																<b>5</b>
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Question	Answer	Marks
4(c)	<p>One mark for string and one mark for correct explanation.</p> <p>Same for second answer providing it results in a <b>different</b> path through the algorithm.</p> <p>Correct answers may be:</p> <ul style="list-style-type: none"><li>• without the correct number of '.'</li><li>• without the correct number of '@'</li><li>• without the correct number of 'other characters'</li></ul>	<b>4</b>

Question	Answer	Marks
5	<pre> FUNCTION Abbreviate(Name : STRING) RETURNS STRING    DECLARE NewString : STRING   DECLARE NextChar : CHAR   DECLARE Index : INTEGER   DECLARE Space : BOOLEAN   CONSTANT SPACECHAR = ' '    Space ← TRUE   NewString ← ""    FOR Index ← 1 TO LENGTH(Name)     NextChar ← MID(Name, Index, 1)     IF Space = TRUE       THEN         NewString ← NewString &amp; NextChar // first char  of next word          Space ← FALSE       ELSE         IF NextChar = SPACECHAR           THEN             Space ← TRUE           ENDIF         ENDIF       ENDFOR    RETURN NewString  ENDFUNCTION </pre> <p>1 mark for each of the following (<b>max 8</b>):</p> <ol style="list-style-type: none"> <li>Function header, ending and return parameters</li> <li>Declare and Initialise <code>NewString</code> to either "" or first character of name</li> <li>FOR loop picking out all characters from <code>Name</code>:</li> <li>extract an individual character <b>in a loop</b></li> <li>check for space character <b>in a loop</b></li> <li>concatenate the next character to <code>NewString</code> <b>in a loop</b></li> <li>Return <code>NewString</code></li> <li>Accommodate a string with trailing space</li> </ol>	8

Question	Answer	Marks
6(a)(i)	<p>One mark per underlined section:</p> <pre> <u>DECLARE</u> <u>Result</u> : <u>ARRAY</u> <u>[0:99, 0:1]</u> <u>OF</u> <u>STRING</u> </pre>	3



Question	Answer	Marks
6(a)(ii)	<p>'Pseudocode' solution included here for development and clarification of mark scheme. Programming language example solutions appear in the Appendix.</p> <pre> FUNCTION FindBooksBy(SearchAuthor : STRING) RETURNS                                 INTEGER      DECLARE Title : STRING     DECLARE Author : STRING     DECLARE Isbn : STRING     DECLARE Location : STRING     DECLARE Count : INTEGER      Count ← 0      OPENFILE "Library.txt" FOR READ      WHILE NOT EOF ("Library.txt")          READFILE "Library.txt", Title         READFILE "Library.txt", ThisAuthor         READFILE "Library.txt", ISBN         READFILE "Library.txt", Location          IF SearchAuthor = ThisAuthor             THEN                 Result[Count, 0] ← Title                 Result[Count, 1] ← Location                 Count ← Count + 1             ENDIF      ENDWHILE      CLOSEFILE("Library.txt")      RETURN Count  ENDFUNCTION </pre> <p>One mark for each of the following:</p> <ol style="list-style-type: none"> <li>1 Function heading (and ending) including parameters</li> <li>2 Declaration of variables used</li> <li>3 Open file for reading (Allow Library or Library.txt)</li> <li>4 WHILE loop checking for EOF():</li> <li>5 Read <b>all</b> information 'fields', in the correct order, <b>in a loop</b></li> <li>6 If the author matches write Title and Location to Result array <b>in a loop</b></li> <li>7 And increment array index <b>in a loop</b> // number found</li> <li>8 Close file and RETURN Count</li> </ol>	8

Question	Answer	Marks
6(b)	<pre> PROCEDURE DisplayResults (Author:STRING, Count:INTEGER)   DECLARE Index, GLen : INTEGER   DECLARE Gap : STRING    Gap ← "                " // 25 spaces    IF Count = 0     THEN       OUTPUT "Search found no books by: " &amp; Author     ELSE       OUTPUT "Books written by: " &amp; Author       OUTPUT "Title" &amp; LEFT(Gap, 20) &amp; "Location"       FOR Index ← 1 TO Count         GLen ← 25 - LENGTH(Result[Index, 0])         OUTPUT Result[Index, 0] &amp; LEFT(Gap, GLen) &amp;           Result[Index, 1]       ENDFOR       OUTPUT "Number of titles found: " &amp;         NUM_TO_STRING(Count)     ENDIF   ENDPROCEDURE </pre> <p>One mark for each of the following (<b>max 7</b>):</p> <ol style="list-style-type: none"> <li>1 Procedure heading and ending including parameters</li> <li>2 Declaration of local INTEGER variable for use as index</li> <li>3 Test if count = 0 <b>and if so</b> output suitable message including Author for no books found <b>otherwise</b> output the two header strings (exact format not important)</li> <li>4 A FOR loop for Count times</li> <li>5 ... output two array elements from Result array <b>in a loop</b></li> <li>6 Final output statement</li> <li>7 A reasonable attempt at calculating the number of spaces required to align 'Location' column:</li> <li>8 Alignment correct</li> </ol>	<b>7</b>

## Program Code Example Solutions

### Q6 (a) (ii): Visual Basic

```
FUNCTION FindBooksBy(ByVal SearchAuthor As String) As Integer

    Dim Title As String
    Dim Author As String
    Dim Isbn As String
    Dim Location As String
    Dim Count As Integer

    Count = 0

    FileOpen(1, "Library.txt", OpenMode.Input)

    While Not EOF(1)
        Title = LineInput(1)
        ThisAuthor = LineInput(1)
        Isbn = LineInput(1)
        Location = LineInput(1)

        If SearchAuthor = ThisAuthor Then
            Result(Count, 0) = Title
            Result(Count, 1) = Location
            Count = Count + 1
        End If
    End While

    FileClose(1)

    Return Count
END FUNCTION
```

**Q6 (a) (ii): Pascal**

```
function FindBooksBy(SearchAuthor : string) : integer;

var
  Title : string;
  Author : string;
  Isbn : string;
  Location : string;
  Count : integer;
  MyFile : text;

begin
  Count := 0;
  assign(MyFile, 'Library.txt');
  reset(MyFile);

  while not EOF(MyFile) do
  begin
    readln(MyFile, Title);
    readln(MyFile, ThisAuthor);
    readln(MyFile, Isbn);
    readln(MyFile, Location);

    if SearchAuthor = ThisAuthor then
    begin
      Result[Count, 0] := Title;
      Result[Count, 1] := Location;
      Count := Count + 1;
    end;

  end;

  close(MyFile);
  FindBooksBy := Count;

end;
```

**Q6 (a) (ii): Python**

```
def FindBooksBy(SearchAuthor):  
  
    ## Title : STRING  
    ## Author : STRING  
    ## Isbn : STRING  
    ## Location : STRING  
    ## Count : INTEGER  
  
    Count = 0  
    MyFile = open("Library.txt", 'r')  
    Title = MyFile.readline()  
  
    while Title != "":  
        ThisAuthor = MyFile.readline()  
        Isbn= MyFile.readline()  
        Location = MyFile.readline()  
        if SearchAuthor == ThisAuthor.strip():  
            Result[Count][0] = Title  
            Result[Count][1] = Location  
            Count = Count + 1  
        Title = MyFile.readline()  
  
    MyFile.close()  
    return(Count)
```