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**COMPUTER SCIENCE**

**9608/43**

Paper 4 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 **19** 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.

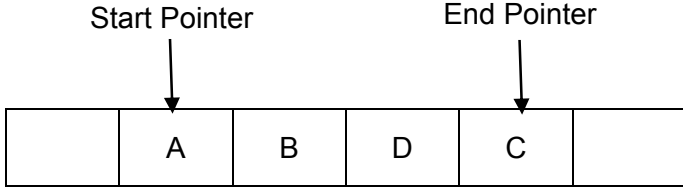
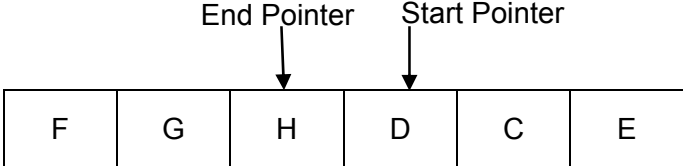
**GENERIC MARKING PRINCIPLE 5:**

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).

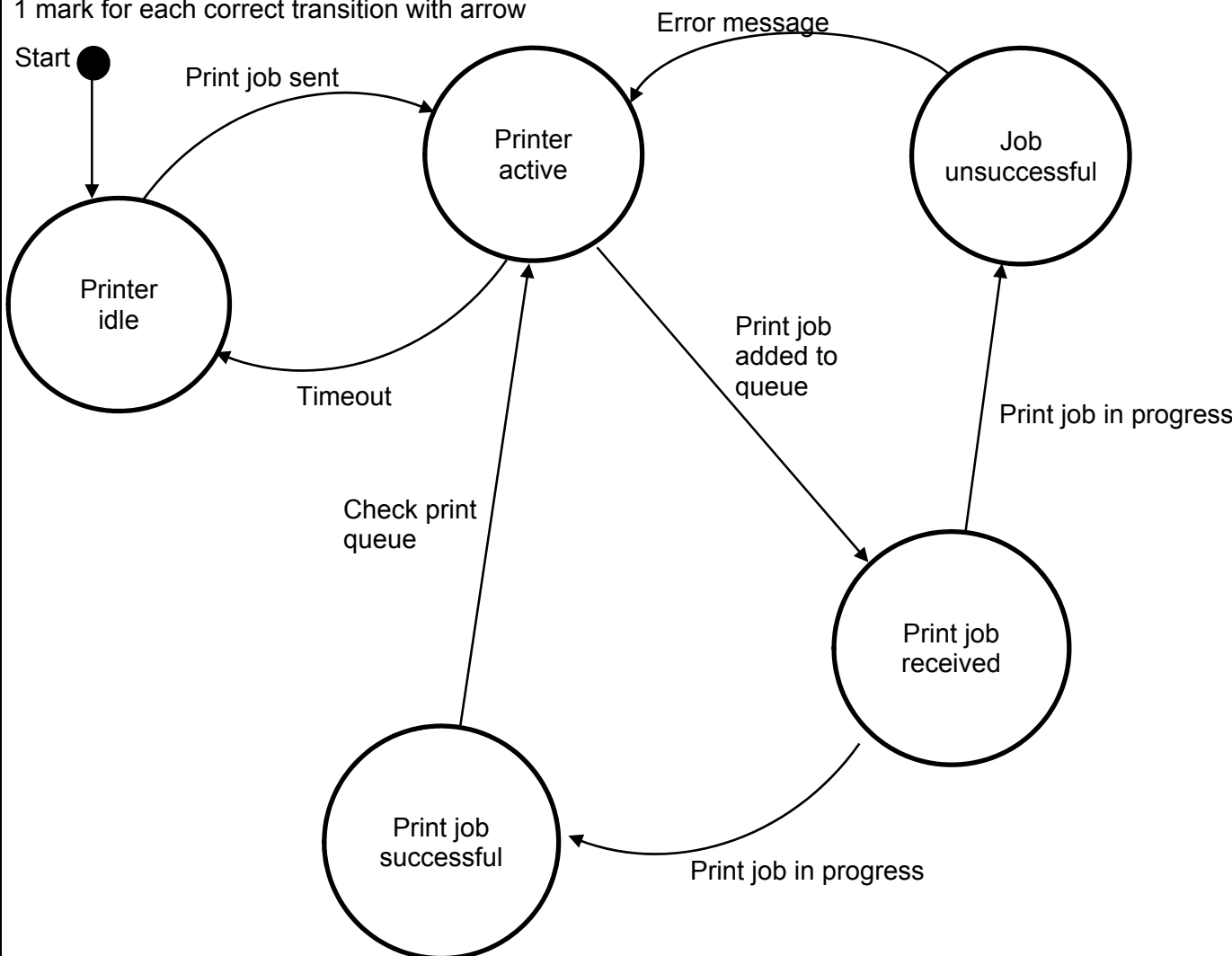
**GENERIC MARKING PRINCIPLE 6:**

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
<p>1(a)(i)</p>	<div style="text-align: center;"> <pre> graph LR     1((1)) -- A 1 --&gt; 2((2))     2 -- B 3 --&gt; 3((3))     3 -- D 7 --&gt; 4((4))     3 -- C 10 --&gt; 5((5))     4 -.-&gt; 5     5 -- A 1 --&gt; 6((6))     6 -- F 1 --&gt; 7((7))     7 -- H 2 --&gt; 8((8))     7 -- G 2 --&gt; 9((9))     9 -.-&gt; 8                     </pre> </div> <p>1 mark for each correct Activity and time</p> <ul style="list-style-type: none"> <li>• B 3</li> <li>• C 10 (following B)</li> <li>• D 7 (following B)</li> <li>• E 3 (following C and D)</li> <li>• G 2 (following F)</li> <li>• H 2 (following F)</li> </ul>	<p><b>6</b></p>
<p>1(a)(ii)</p>	<p>The shortest time to complete the project // the sequence of activities that must be completed to avoid delaying the project</p>	<p><b>1</b></p>
<p>1(a)(iii)</p>	<p>1 mark for identify, max 1 for description</p> <ul style="list-style-type: none"> <li>• GANTT</li> <li>• A table that has time across the top and activities on the left, boxes are coloured to show dependencies and find critical path // colour in the boxes to show the length of time for each task</li> </ul>	<p><b>2</b></p>

Question	Answer	Marks
1(b)(i)	<p>A, B, C and D in correct places with no alteration to start and end pointer</p> <div style="text-align: center;"> <p>Start Pointer                      End Pointer</p>  </div>	<b>1</b>
1(b)(ii)	<p>1 mark per bullet point</p> <ul style="list-style-type: none"> <li>• correct jobs in correct order...</li> <li>• ... correct location of start pointer</li> <li>• ... correction location of new end pointer</li> </ul> <div style="text-align: center;"> <p>End Pointer      Start Pointer</p>  </div>	<b>3</b>
1(b)(iii)	<p>1 mark from:</p> <ul style="list-style-type: none"> <li>• An error <b>message</b> would be generated</li> </ul>	<b>1</b>

Question	Answer	Marks
1(b)(iv)	<p>1 mark for each correct line</p> <pre> FUNCTION Remove RETURNS STRING   DECLARE PrintJob : STRING   IF <b>StartPointer</b> = EndPointer     THEN       RETURN "Empty"     ELSE       PrintJob ← Queue[<b>StartPointer</b>]       IF StartPointer = <b>5</b>         THEN           StartPointer ← <b>0</b>         ELSE           StartPointer ← StartPointer + 1       ENDIF       RETURN PrintJob     ENDIF   ENDFUNCTION </pre>	<b>4</b>
1(b)(v)	<p>1 mark per bullet point</p> <ul style="list-style-type: none"> <li>• A stack is Last In First Out (LIFO) while a queue is First In First Out (FIFO)</li> <li>• The queue removes and returns the element at <b>start pointer</b> // item is removed from the <b>start/head</b> //</li> <li>• A stack would remove and return the element at <b>end pointer</b> // item is removed from the <b>end</b></li> </ul>	<b>2</b>

Question	Answer	Marks
<p>1(c)</p>	<p>1 mark for each correct transition with arrow</p>  <pre> graph TD     Start((Start)) --&gt; Idle((Printer idle))     Idle -- "Print job sent" --&gt; Active((Printer active))     Active -- "Timeout" --&gt; Idle     Active -- "Print job added to queue" --&gt; Received((Print job received))     Received -- "Print job in progress" --&gt; Active     Received -- "Print job in progress" --&gt; Successful((Print job successful))     Successful -- "Check print queue" --&gt; Active     Received -- "Print job in progress" --&gt; Unsuccessful((Job unsuccessful))     Unsuccessful -- "Error message" --&gt; Active     </pre>	<p><b>5</b></p>

Question	Answer	Marks																																																																											
1(d)(i)	1 mark per bullet <ul style="list-style-type: none"> <li>• Way of modelling logic</li> <li>• Show <b>all</b> possible outputs // shows <b>every</b> possible outcome // <b>all</b> outcomes ...</li> <li>• ... based on the inputs</li> <li>• Determine which action to take in specific conditions // how different conditions affect the actions/outcomes</li> </ul>	<b>2</b>																																																																											
1(d)(ii)	1 mark for each row  Accept Y/X/ticks as long as clear which are Y. Accept N/X/- for empty spaces <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2"></th> <th colspan="8" style="text-align: center;">Rules</th> </tr> </thead> <tbody> <tr> <td rowspan="3" style="text-align: center; vertical-align: middle;"><b>Conditions</b></td> <td>Document printed, but quality is poor</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">N</td> <td style="text-align: center;">N</td> <td style="text-align: center;">N</td> <td style="text-align: center;">N</td> </tr> <tr> <td>Error light is flashing on printer</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">N</td> <td style="text-align: center;">N</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">N</td> <td style="text-align: center;">N</td> </tr> <tr> <td>Document printed, but paper size is incorrect</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">N</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">N</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">N</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">N</td> </tr> <tr> <td rowspan="4" style="text-align: center; vertical-align: middle;"><b>Actions</b></td> <td>Check connection from computer to printer</td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="text-align: center;">X</td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> </tr> <tr> <td>Check ink status</td> <td style="text-align: center;">X</td> <td style="text-align: center;">X</td> <td style="text-align: center;">X</td> <td style="text-align: center;">X</td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> </tr> <tr> <td>Check if there is a paper jam</td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> <td style="text-align: center;">X</td> <td style="background-color: #cccccc;"></td> <td style="background-color: #cccccc;"></td> </tr> <tr> <td>Check paper size selected</td> <td style="text-align: center;">X</td> <td style="background-color: #cccccc;"></td> <td style="text-align: center;">X</td> <td style="background-color: #cccccc;"></td> <td style="text-align: center;">X</td> <td style="background-color: #cccccc;"></td> <td style="text-align: center;">X</td> <td style="background-color: #cccccc;"></td> </tr> </tbody> </table>			Rules								<b>Conditions</b>	Document printed, but quality is poor	Y	Y	Y	Y	N	N	N	N	Error light is flashing on printer	Y	Y	N	N	Y	Y	N	N	Document printed, but paper size is incorrect	Y	N	Y	N	Y	N	Y	N	<b>Actions</b>	Check connection from computer to printer						X			Check ink status	X	X	X	X					Check if there is a paper jam						X			Check paper size selected	X		X		X		X		<b>4</b>
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Question	Answer										Marks
1(d)(iii)	1 mark each for each correct column  Accept –/X for empty spaces. Accept Y/X/Ticks as long as clear which are used										<b>5</b>
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<b>Conditions</b>	Document printed, but quality is poor	Y	Y	N	N	N					
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	Document printed, but paper size is incorrect	Y	N	Y	N	N					
<b>Actions</b>	Check connection from computer to printer				X						
	Check ink status	X	X								
	Check if there is a paper jam				X						
	Check paper size selected	X		X							

Question	Answer	Marks
1(e)(i)	<p>1 mark per bullet point to <b>max 4</b></p> <ul style="list-style-type: none"> <li>• Method header and close (where necessary) with three parameters</li> <li>• Initialised PrintID, FirstName, LastName and Credits ...</li> <li>• ... to the parameters</li> <li>• Initialised Credits to 50</li> </ul> <p><b>PYTHON</b></p> <pre>def __init__(self, NewFN, NewLN, NewPrintID):     self.__PrintID = NewPrintID     self.__FirstName = NewFN     self.__LastName = NewLN     self.__Credits = 50</pre> <p><b>PASCAL</b></p> <pre>Constructor NewPrintAccount.Create(NewFN, NewLN, NewPrintID); begin     PrintID := NewPrintID;     FirstName = NewFN;     LastName = NewLN;     Credits := 50; end;</pre> <p><b>VB</b></p> <pre>Public Sub New(NewFN, NewLN, NewPrintID As String)     PrintID = NewPrintID     FirstName = NewFN     LastName = NewLN     Credits = 50 End Sub</pre>	<b>4</b>

Question	Answer	Marks
1(e)(ii)	<p>1 mark per bullet point</p> <ul style="list-style-type: none"> <li>• method/procedure header (and close where appropriate) taking a parameter</li> <li>• <code>FirstName</code> is set to <b>parameter</b></li> </ul> <p><b>PYTHON</b></p> <pre>def __SetFirstName(self, NewFirstName):     self.__FirstName = NewFirstName</pre> <p><b>PASCAL</b></p> <pre>procedure SetFirstName(newFirstName : String); begin     FirstName := newFirstName; end;</pre> <p><b>VB</b></p> <pre>public sub SetFirstName(NewFirstName As String)     FirstName = NewFirstName End Sub</pre>	<b>2</b>

Question	Answer	Marks
1(e)(iii)	<p>1 mark per bullet point</p> <ul style="list-style-type: none"> <li>• concatenates <code>FirstName</code>, <b>space</b> and <code>LastName</code> ...</li> <li>• ... function/method header without parameter <b>and</b> returns (generated) value</li> </ul> <p><b>PYTHON</b></p> <pre>def __GetName(self):     return(self.__FirstName + " " + self.__LastName)</pre> <p><b>PASCAL</b></p> <pre>function GetName(); begin     result := FirstName + " " + LastName end;</pre> <p><b>VB</b></p> <pre>public function GetName() As String     return(FirstName &amp; " " &amp; LastName) End Function</pre>	<b>2</b>

Question	Answer	Marks
1(e)(iv)	<p>1 mark per each correct bullet point from:</p> <ul style="list-style-type: none"> <li>• <b>Procedure/method header and close (where necessary) passing MoneyInput</b></li> <li>• <b>At least 3 constants (e.g. freecredit10, freecredit20, twenty, 10, creditperdollar)</b></li> <li>• <b>If MoneyInput &lt; 10 calculate MoneyInput * 25</b></li> <li>• <b>If MoneyInput &gt; 9 and MoneyInput &lt; 20 then calculate MoneyInput * 25 + 25</b></li> <li>• <b>If MoneyInput &gt; 19 then calculate MoneyInput * 25 + 50</b></li> <li>• <b>All three correct calculations add to Credits, not overwrite</b></li> <li>• <b>Efficient IF (i.e. elseif)</b></li> </ul> <p><b>PYTHON</b></p> <pre>def __AddCredits(self, MoneyInput):     CreditPerDollar = 25     FreeCredit10 = 25     FreeCredit20 = 50     Twenty = 20     Ten = 10     if MoneyInput &gt;= Twenty:         Credits = Credits + (MoneyInput * CreditPerDollar) + FreeCredit20     elif MoneyInput &gt;= Ten:         Credits = Credits + (MoneyInput * CreditPerDollar) + FreeCredit10     else:         Credits = Credits + (MoneyInput * CreditPerDollar)</pre>	<b>6</b>

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Question	Answer	Marks
1(e)(iv)	<p><b>PASCAL</b></p> <pre> procedure AddCredits(MoneyInput : Real);   const CreditPerDollar = 25   const FreeCredit10 = 25   const FreeCredit20 = 50   const Twenty = 20   const Ten = 10 begin   If MoneyInput &gt; = Twenty Then     Credits := Credits + (MoneyInput * CreditPerDollar) + FreeCredit20;   Else If MoneyInput &gt; = Ten Then     Credits := Credits + (MoneyInput * CreditPerDollar) + FreeCredit10;   Else     Credits := Credits + (MoneyInput * CreditPerDollar); end;</pre> <p><b>VB.NET</b></p> <pre> Public Sub AddCredits(MoneyInput As Integer)   Const CreditPerDollar As Integer = 25   Const FreeCredit10 As Integer = 25   Const FreeCredit20 AS integer = 50   Const Twenty As Integer = 20   Const Ten AS Integer = 10   If MoneyInput &gt; = Twenty Then     Credits = Credits + (MoneyInput * CreditPerDollar) + FreeCredit20   Else If MoneyInput &gt; = Ten Then     Credits = Credits + (MoneyInput * CreditPerDollar) + FreeCredit10   Else     Credits = Credits + (MoneyInput * CreditPerDollar)   End If End Sub</pre>	

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
1(e)(v)	1 mark per bullet <ul style="list-style-type: none"><li>• Declaring <code>StudentAccounts</code> as array of 1000 elements...</li><li>• ...of type <code>PrintAccount</code></li></ul> <code>DECLARE StudentAccounts ARRAY[0:999] OF PrintAccount</code>	<b>2</b>

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Question	Answer	Marks
1(e)(vi)	<p>1 mark per bullet point to <b>max 8</b></p> <ul style="list-style-type: none"> <li>• Generating ID with '1' at the end all in <b>lowercase</b> from parameters</li> <li>• Loop through array to last occupied element ...</li> <li>• ... Check if the <code>PrintID</code> already exists</li> <li>• ... using <code>GetPrintID()</code></li> <li>• ... increment number at end of <code>PrintID</code></li> <li>• Create a new instance of <code>PrintAccount</code> ...</li> <li>• ... sending <code>FirstName</code>, <code>LastName</code>, <code>PrintID</code> as parameters</li> <li>• adding new account to <code>StudentAccounts</code> at position <code>NumberStudents</code></li> <li>• Increment <code>NumberStudents</code></li> </ul> <p><b>VB.NET</b></p> <pre> Sub CreateId(firstName, lastName)     Dim count As Integer     Dim PrintID = Left(firstName, 3).ToLower &amp; Left(lastname, 3).ToLower &amp; "1"     Dim studentAdd As Integer = 0     If numberStudents &lt;&gt; 0 Then         For x = 0 To numberStudents - 1             If studentAccounts(x).getPrintID() = username Then                 PrintID = PrintID + 1                 username = Left(firstName, 3).ToLower &amp; Left(lastname, 3).ToLower &amp; PrintID.ToString             End If         Next         studentAdd = numberStudents     End If     studentAccounts(studentAdd) = New printAccount(firstName, lastname, username)     numberStudents = numberStudents + 1 </pre>	<b>8</b>



Question	Answer	Marks
1(e)(vi)	<p><b>Python</b></p> <pre>def CreateID(firstname, lastname):     count = 0     PrintID = firstname[0:3].lower() + lastname[-3].lower() + "1"     StudentAdd = 0     if numberStudents != 0:         for x in range(0, numberStudents):             if studentAccounts[x].getPrintID() == username:                 PrintID = PrintID + 1                 username = firstname[0:3].lower() + lastname[0:3].lower + str(PrintID)             studentAdd = numberStudents         studentAccounts[studentAdd] = printAccount(firstname, lastname, username)         numberStudents = numberStudents + 1</pre> <p><b>Pascal</b></p> <pre>procedure CreateID(firstname : String, lastname: String); var     count : Integer;     studentAdd : Integer;     PrintID : String;  begin     studentAdd := 0;     PrintID := LowerCase(substr(firstname,0,3)) + LowerCase(substr(lastname,0,3))+ "1";     if numberStudents &lt;&gt; 0:         for x := 0 To numberStudents - 1;             if studentAccounts[x].getPrintID() = username:                 PrintID := PrintID + 1;                 username := LowerCase(substr(firstname, 3) +                 LowerCase(substr(lastname,0,3))+str(PrintID);              studentAdd := numberStudents;         studentAccounts[studentAdd] := printAccount.Create(firstname, lastname, username);         numberStudents := numberStudents + 1</pre>	

Question	Answer				Marks
2	1 mark for each highlighted section				<b>9</b>
	<b>Label</b>	<b>Op Code</b>	<b>Operand</b>	<b>Comment</b>	
	LOOP:	LDD	ANSWER	// Load the value from ANSWER	
		ADD	NUMONE	// Add the value from NUMONE	[1]
		STO	ANSWER		[1]
		LDD	COUNT	// Load the value from COUNT	[1]
		INC	ACC	// Increment the Accumulator	[1]
		STO	COUNT		[1]
		CMP	NUMTWO	// Is NUMTWO = COUNT?	[1]
		JPN	LOOP	// If false, jump to LOOP	[1]
		LDD	ANSWER	// Load the value from ANSWER	[1]
		OUT		// output ANSWER to the screen	[1]
		END		// End of program	
	NUMONE:	2			
	NUMTWO:	4			
	COUNT:	0			
	ANSWER:	0			

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Question	Answer	Marks
3	1 mark per bullet point to <b>max 3</b> <ul style="list-style-type: none"> <li>• Logic error // it is programmed incorrectly</li> <li>• There was an error in the design // the correct requirements were not stated</li> <li>• Run-time error // division by 0 // stack overflow // end of file reached // library not available // linking/loading error</li> <li>• Not adequately/correctly tested</li> </ul>	<b>3</b>

Question	Answer	Marks								
4	1 mark for each term. <table border="1" data-bbox="349 620 1547 983" style="margin-left: 20px;"> <thead> <tr> <th data-bbox="349 620 949 687">Definition</th> <th data-bbox="949 620 1547 687">Term</th> </tr> </thead> <tbody> <tr> <td data-bbox="349 687 949 788">Software is tested by an in-house team of dedicated testers.</td> <td data-bbox="949 687 1547 788"><b>Alpha testing/black-box/white-box</b></td> </tr> <tr> <td data-bbox="349 788 949 888">Software is tested by the customer before it is signed off.</td> <td data-bbox="949 788 1547 888"><b>Acceptance testing</b></td> </tr> <tr> <td data-bbox="349 888 949 983">Software is tested by a small selection of users before general release</td> <td data-bbox="949 888 1547 983"><b>Beta testing</b></td> </tr> </tbody> </table>	Definition	Term	Software is tested by an in-house team of dedicated testers.	<b>Alpha testing/black-box/white-box</b>	Software is tested by the customer before it is signed off.	<b>Acceptance testing</b>	Software is tested by a small selection of users before general release	<b>Beta testing</b>	<b>3</b>
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