



# **Cambridge International AS & A Level**

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**COMPUTER SCIENCE**

**9618/23**

Paper 2 Fundamental Problem-solving and Programming Skills

**October/November 2023**

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 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

**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.

**Mark scheme abbreviations**

/ separates alternative words / phrases within a marking point

// separates alternative answers within a marking point

**underline** actual word given must be used by the candidate (grammatical variants accepted)

**max** indicates the maximum number of marks that can be awarded

( ) the word / phrase in brackets is not required but sets the context

| Question                            | Answer                                                                                                                                                                                                                                                                                                                                    | Marks                |              |                                 |              |                               |           |                                 |           |                                     |           |   |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------|---------------------------------|--------------|-------------------------------|-----------|---------------------------------|-----------|-------------------------------------|-----------|---|
| 1(a)                                | <table><tr><th>Assignment statement</th><th>Data type</th></tr><tr><td><u>MyVar1</u> ← Total1 / Total2</td><td>REAL</td></tr><tr><td><u>MyVar2</u> ← 27/10/2023</td><td>DATE</td></tr><tr><td><u>MyVar3</u> ← "Sum1 / Sum2"</td><td>STRING</td></tr><tr><td><u>MyVar4</u> ← Result1 AND Result2</td><td>BOOLEAN</td></tr></table>         | Assignment statement | Data type    | <u>MyVar1</u> ← Total1 / Total2 | REAL         | <u>MyVar2</u> ← 27/10/2023    | DATE      | <u>MyVar3</u> ← "Sum1 / Sum2"   | STRING    | <u>MyVar4</u> ← Result1 AND Result2 | BOOLEAN   | 4 |
| Assignment statement                | Data type                                                                                                                                                                                                                                                                                                                                 |                      |              |                                 |              |                               |           |                                 |           |                                     |           |   |
| <u>MyVar1</u> ← Total1 / Total2     | REAL                                                                                                                                                                                                                                                                                                                                      |                      |              |                                 |              |                               |           |                                 |           |                                     |           |   |
| <u>MyVar2</u> ← 27/10/2023          | DATE                                                                                                                                                                                                                                                                                                                                      |                      |              |                                 |              |                               |           |                                 |           |                                     |           |   |
| <u>MyVar3</u> ← "Sum1 / Sum2"       | STRING                                                                                                                                                                                                                                                                                                                                    |                      |              |                                 |              |                               |           |                                 |           |                                     |           |   |
| <u>MyVar4</u> ← Result1 AND Result2 | BOOLEAN                                                                                                                                                                                                                                                                                                                                   |                      |              |                                 |              |                               |           |                                 |           |                                     |           |   |
| 1(b)                                | <table><tr><th>Expression</th><th>Evaluates to</th></tr><tr><td>Fraction &gt;= 0.2 AND NOT Active</td><td><b>FALSE</b></td></tr><tr><td>INT((Fraction1 * 100) + 13.3)</td><td><b>33</b></td></tr><tr><td>STR_TO_NUM(MID(Code, 4, 2)) + 5</td><td><b>28</b></td></tr><tr><td>LENGTH("TRUE" &amp; Code)</td><td><b>11</b></td></tr></table> | Expression           | Evaluates to | Fraction >= 0.2 AND NOT Active  | <b>FALSE</b> | INT((Fraction1 * 100) + 13.3) | <b>33</b> | STR_TO_NUM(MID(Code, 4, 2)) + 5 | <b>28</b> | LENGTH("TRUE" & Code)               | <b>11</b> | 4 |
| Expression                          | Evaluates to                                                                                                                                                                                                                                                                                                                              |                      |              |                                 |              |                               |           |                                 |           |                                     |           |   |
| Fraction >= 0.2 AND NOT Active      | <b>FALSE</b>                                                                                                                                                                                                                                                                                                                              |                      |              |                                 |              |                               |           |                                 |           |                                     |           |   |
| INT((Fraction1 * 100) + 13.3)       | <b>33</b>                                                                                                                                                                                                                                                                                                                                 |                      |              |                                 |              |                               |           |                                 |           |                                     |           |   |
| STR_TO_NUM(MID(Code, 4, 2)) + 5     | <b>28</b>                                                                                                                                                                                                                                                                                                                                 |                      |              |                                 |              |                               |           |                                 |           |                                     |           |   |
| LENGTH("TRUE" & Code)               | <b>11</b>                                                                                                                                                                                                                                                                                                                                 |                      |              |                                 |              |                               |           |                                 |           |                                     |           |   |
| 1(c)                                | The use of a program <u>library</u> (routines)                                                                                                                                                                                                                                                                                            | 1                    |              |                                 |              |                               |           |                                 |           |                                     |           |   |
| 1(d)                                | <b>MP1</b> Type: Adaptive<br><b>MP2</b> Reason: The (user) requirement(s) changes // to accommodate legislative changes                                                                                                                                                                                                                   | 2                    |              |                                 |              |                               |           |                                 |           |                                     |           |   |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Marks |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 2(a)     | <pre> graph TD     Start([START]) --&gt; Init[Set Min to Data[1]<br/>Set MinIndex to 1]     Init --&gt; SetIndex[Set Index to 2]     SetIndex --&gt; IsIndex{Is Index &gt; 30 ?}     IsIndex -- YES --&gt; Output[/OUTPUT MinIndex/]     Output --&gt; End([END])     IsIndex -- NO --&gt; IsData{Is Data[Index] &lt; Min ?}     IsData -- YES --&gt; Update[Set MinIndex to Index<br/>Set Min to Data[Index]]     IsData -- NO --&gt; IncIndex[Set Index to Index + 1]     Update --&gt; Join(( ))     IncIndex --&gt; Join     Join --&gt; IsIndex   </pre> <p><b>MP1</b> Initialise <code>Min</code> to first value in <code>Data</code> <b>and</b> <code>MinIndex</code> to 1<br/> <b>MP2</b> Loop through 29 more values (or 30 values in total)<br/> <b>MP3</b> Compare element from <code>Data[]</code> with <code>Min</code><br/> <b>MP4</b> Set new <code>Min</code> <b>AND</b> save <code>MinIndex</code> when element value &lt; <code>Min</code> <b>in a loop</b><br/> <b>MP5</b> Output <code>MinIndex</code></p> | 5     |
| 2(b)     | <p><b>MP1</b> Simplifies the algorithm // easier to write / understand / test / debug<br/> <b>MP2</b> It is possible to iterate through the values // can use a loop // allows the storage of many values using a single identifier</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2     |
| 2(c)     | <p><b>One</b> mark per underlined section</p> <p><u>DECLARE</u> <u>Data</u> : <u>ARRAY[1:120]</u> <u>OF</u> <u>REAL</u></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2     |

| Question     | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Marks |       |   |  |   |    |   |    |   |    |   |    |   |    |   |  |   |  |          |  |              |   |            |   |          |   |   |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|---|--|---|----|---|----|---|----|---|----|---|----|---|--|---|--|----------|--|--------------|---|------------|---|----------|---|---|
| 3(a)         | <table><thead><tr><th>Index</th><th>Array</th></tr></thead><tbody><tr><td>1</td><td></td></tr><tr><td>2</td><td>D3</td></tr><tr><td>3</td><td>D4</td></tr><tr><td>4</td><td>D1</td></tr><tr><td>5</td><td>D2</td></tr><tr><td>6</td><td>D5</td></tr><tr><td>7</td><td></td></tr><tr><td>8</td><td></td></tr></tbody></table><br><table><thead><tr><th colspan="2">Variable</th></tr></thead><tbody><tr><td>FrontOfQueue</td><td>2</td></tr><tr><td>EndOfQueue</td><td>6</td></tr><tr><td>NumItems</td><td>5</td></tr></tbody></table> <p>:</p> <p><b>MP1</b> D3, D4, D1, D2 and D5 in question order or reversed - in any five consecutive locations<br/><b>MP2</b> FoQ value matches index with D3<br/><b>MP3</b> EoQ value matches index with D5</p> | Index | Array | 1 |  | 2 | D3 | 3 | D4 | 4 | D1 | 5 | D2 | 6 | D5 | 7 |  | 8 |  | Variable |  | FrontOfQueue | 2 | EndOfQueue | 6 | NumItems | 5 | 3 |
| Index        | Array                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |       |   |  |   |    |   |    |   |    |   |    |   |    |   |  |   |  |          |  |              |   |            |   |          |   |   |
| 1            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |       |   |  |   |    |   |    |   |    |   |    |   |    |   |  |   |  |          |  |              |   |            |   |          |   |   |
| 2            | D3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |       |   |  |   |    |   |    |   |    |   |    |   |    |   |  |   |  |          |  |              |   |            |   |          |   |   |
| 3            | D4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |       |   |  |   |    |   |    |   |    |   |    |   |    |   |  |   |  |          |  |              |   |            |   |          |   |   |
| 4            | D1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |       |   |  |   |    |   |    |   |    |   |    |   |    |   |  |   |  |          |  |              |   |            |   |          |   |   |
| 5            | D2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |       |   |  |   |    |   |    |   |    |   |    |   |    |   |  |   |  |          |  |              |   |            |   |          |   |   |
| 6            | D5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |       |   |  |   |    |   |    |   |    |   |    |   |    |   |  |   |  |          |  |              |   |            |   |          |   |   |
| 7            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |       |   |  |   |    |   |    |   |    |   |    |   |    |   |  |   |  |          |  |              |   |            |   |          |   |   |
| 8            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |       |   |  |   |    |   |    |   |    |   |    |   |    |   |  |   |  |          |  |              |   |            |   |          |   |   |
| Variable     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |       |   |  |   |    |   |    |   |    |   |    |   |    |   |  |   |  |          |  |              |   |            |   |          |   |   |
| FrontOfQueue | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |       |   |  |   |    |   |    |   |    |   |    |   |    |   |  |   |  |          |  |              |   |            |   |          |   |   |
| EndOfQueue   | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |       |   |  |   |    |   |    |   |    |   |    |   |    |   |  |   |  |          |  |              |   |            |   |          |   |   |
| NumItems     | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |       |   |  |   |    |   |    |   |    |   |    |   |    |   |  |   |  |          |  |              |   |            |   |          |   |   |
| 3(b)         | <p><b>MP1</b> If NumItems <u>is / = 8</u> // (queue) full then jump to step 6<br/><b>MP2</b> Increment EndOfQueue<br/><b>MP3</b> If EndOfQueue = 9 then set EndOfQueue to 1<br/><b>MP4</b> Increment NumItems</p> <p><b>MP5</b> Set the Element at the index ...<br/><b>MP6</b> stored in EndOfQueue to value/data/item being added</p> <p>Mark as follows:<br/>Steps 1 to 4: One mark for gaps filled as shown<br/>Step 5: One mark for 'element' and one mark for other two terms</p>                                                                                                                                                                                                                                                                | 6     |       |   |  |   |    |   |    |   |    |   |    |   |    |   |  |   |  |          |  |              |   |            |   |          |   |   |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Marks    |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 4(a)     | <pre> PROCEDURE RandList()   DECLARE Count, BaseNum, ThisNum : INTEGER   CONSTANT StepVal = 10   BaseNum ← 0    FOR Count ← 1 TO 25     ThisNum ← BaseNum + INT(RAND(StepVal))     OUTPUT ThisNum     BaseNum ← BaseNum + StepVal   NEXT Count  ENDPROCEDURE </pre> <p><b>MP1</b> Procedure heading and ending<br/> <b>MP2</b> <u>Local</u> loop counter <code>Count</code> as integer<br/> <b>MP3</b> Loop to iterate 25 times or more for each unique number<br/> <b>MP4</b> 'Attempt' to generate a random number including use of <code>INT()</code> <b>in a loop</b><br/> <b>MP5</b> Ensure that number generated is greater than previous and change 'previous'<br/> <b>MP6</b> Output random number after an attempt at <b>MP5 in a loop</b></p> | <b>6</b> |
| 4(b)     | <p><b>One</b> mark for simplified logical expression:</p> <p><b>MP1</b> <code>Result[x + 1] &lt;= Result[x]</code></p> <p>ALTERNATIVE SOLUTION:</p> <p><code>Result[x] &gt;= Result[x + 1]</code></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>1</b> |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Marks |        |        |        |        |        |        |   |  |   |   |   |   |   |  |   |   |  |   |  |  |   |  |  |  |  |  |  |  |   |   |  |  |   |  |   |  |  |  |  |  |  |  |   |    |  |  |  |   |   |  |  |  |  |  |  |  |   |    |  |    |  |  |   |  |  |  |  |  |  |  |    |    |  |    |  |  |   |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |   |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|--------|--------|--------|--------|--------|---|--|---|---|---|---|---|--|---|---|--|---|--|--|---|--|--|--|--|--|--|--|---|---|--|--|---|--|---|--|--|--|--|--|--|--|---|----|--|--|--|---|---|--|--|--|--|--|--|--|---|----|--|----|--|--|---|--|--|--|--|--|--|--|----|----|--|----|--|--|---|--|--|--|--|--|--|--|--|--|----|--|--|--|--|--|--|--|--|--|--|---|
| 5        | <table><tr><th>Index</th><th>Value</th><th>Total</th><th>Mix[1]</th><th>Mix[2]</th><th>Mix[3]</th><th>Mix[4]</th></tr><tr><td>2</td><td></td><td>0</td><td>4</td><td>2</td><td>3</td><td>5</td></tr><tr><td></td><td>2</td><td>2</td><td></td><td>5</td><td></td><td></td></tr><tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>3</td><td>5</td><td></td><td></td><td>8</td><td></td></tr><tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>5</td><td>10</td><td></td><td></td><td></td><td>9</td></tr><tr><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>5</td><td>15</td><td></td><td>13</td><td></td><td></td></tr><tr><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>13</td><td>28</td><td></td><td>21</td><td></td><td></td></tr><tr><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td>56</td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> <p><b>MP1</b> Row 1 (initialisation)</p> <p>Each iteration (1 – 5):</p> <p><b>MP2</b> 1 – Total 2</p> <p><b>MP3</b> 2 – Total 5</p> <p><b>MP4</b> 3 – Total 10</p> <p><b>MP5</b> 4 – Total 15</p> <p><b>MP6</b> 5 – Total 28 <b>and</b> final Mix[1] = 56</p> | Index | Value  | Total  | Mix[1] | Mix[2] | Mix[3] | Mix[4] | 2 |  | 0 | 4 | 2 | 3 | 5 |  | 2 | 2 |  | 5 |  |  | 3 |  |  |  |  |  |  |  | 3 | 5 |  |  | 8 |  | 4 |  |  |  |  |  |  |  | 5 | 10 |  |  |  | 9 | 2 |  |  |  |  |  |  |  | 5 | 15 |  | 13 |  |  | 2 |  |  |  |  |  |  |  | 13 | 28 |  | 21 |  |  | 2 |  |  |  |  |  |  |  |  |  | 56 |  |  |  |  |  |  |  |  |  |  | 6 |
| Index    | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Total | Mix[1] | Mix[2] | Mix[3] | Mix[4] |        |        |   |  |   |   |   |   |   |  |   |   |  |   |  |  |   |  |  |  |  |  |  |  |   |   |  |  |   |  |   |  |  |  |  |  |  |  |   |    |  |  |  |   |   |  |  |  |  |  |  |  |   |    |  |    |  |  |   |  |  |  |  |  |  |  |    |    |  |    |  |  |   |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |   |
| 2        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0     | 4      | 2      | 3      | 5      |        |        |   |  |   |   |   |   |   |  |   |   |  |   |  |  |   |  |  |  |  |  |  |  |   |   |  |  |   |  |   |  |  |  |  |  |  |  |   |    |  |  |  |   |   |  |  |  |  |  |  |  |   |    |  |    |  |  |   |  |  |  |  |  |  |  |    |    |  |    |  |  |   |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |   |
|          | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2     |        | 5      |        |        |        |        |   |  |   |   |   |   |   |  |   |   |  |   |  |  |   |  |  |  |  |  |  |  |   |   |  |  |   |  |   |  |  |  |  |  |  |  |   |    |  |  |  |   |   |  |  |  |  |  |  |  |   |    |  |    |  |  |   |  |  |  |  |  |  |  |    |    |  |    |  |  |   |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |   |
| 3        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |        |        |        |        |        |        |   |  |   |   |   |   |   |  |   |   |  |   |  |  |   |  |  |  |  |  |  |  |   |   |  |  |   |  |   |  |  |  |  |  |  |  |   |    |  |  |  |   |   |  |  |  |  |  |  |  |   |    |  |    |  |  |   |  |  |  |  |  |  |  |    |    |  |    |  |  |   |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |   |
|          | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 5     |        |        | 8      |        |        |        |   |  |   |   |   |   |   |  |   |   |  |   |  |  |   |  |  |  |  |  |  |  |   |   |  |  |   |  |   |  |  |  |  |  |  |  |   |    |  |  |  |   |   |  |  |  |  |  |  |  |   |    |  |    |  |  |   |  |  |  |  |  |  |  |    |    |  |    |  |  |   |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |   |
| 4        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |        |        |        |        |        |        |   |  |   |   |   |   |   |  |   |   |  |   |  |  |   |  |  |  |  |  |  |  |   |   |  |  |   |  |   |  |  |  |  |  |  |  |   |    |  |  |  |   |   |  |  |  |  |  |  |  |   |    |  |    |  |  |   |  |  |  |  |  |  |  |    |    |  |    |  |  |   |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |   |
|          | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10    |        |        |        | 9      |        |        |   |  |   |   |   |   |   |  |   |   |  |   |  |  |   |  |  |  |  |  |  |  |   |   |  |  |   |  |   |  |  |  |  |  |  |  |   |    |  |  |  |   |   |  |  |  |  |  |  |  |   |    |  |    |  |  |   |  |  |  |  |  |  |  |    |    |  |    |  |  |   |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |   |
| 2        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |        |        |        |        |        |        |   |  |   |   |   |   |   |  |   |   |  |   |  |  |   |  |  |  |  |  |  |  |   |   |  |  |   |  |   |  |  |  |  |  |  |  |   |    |  |  |  |   |   |  |  |  |  |  |  |  |   |    |  |    |  |  |   |  |  |  |  |  |  |  |    |    |  |    |  |  |   |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |   |
|          | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 15    |        | 13     |        |        |        |        |   |  |   |   |   |   |   |  |   |   |  |   |  |  |   |  |  |  |  |  |  |  |   |   |  |  |   |  |   |  |  |  |  |  |  |  |   |    |  |  |  |   |   |  |  |  |  |  |  |  |   |    |  |    |  |  |   |  |  |  |  |  |  |  |    |    |  |    |  |  |   |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |   |
| 2        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |        |        |        |        |        |        |   |  |   |   |   |   |   |  |   |   |  |   |  |  |   |  |  |  |  |  |  |  |   |   |  |  |   |  |   |  |  |  |  |  |  |  |   |    |  |  |  |   |   |  |  |  |  |  |  |  |   |    |  |    |  |  |   |  |  |  |  |  |  |  |    |    |  |    |  |  |   |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |   |
|          | 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 28    |        | 21     |        |        |        |        |   |  |   |   |   |   |   |  |   |   |  |   |  |  |   |  |  |  |  |  |  |  |   |   |  |  |   |  |   |  |  |  |  |  |  |  |   |    |  |  |  |   |   |  |  |  |  |  |  |  |   |    |  |    |  |  |   |  |  |  |  |  |  |  |    |    |  |    |  |  |   |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |   |
| 2        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |        |        |        |        |        |        |   |  |   |   |   |   |   |  |   |   |  |   |  |  |   |  |  |  |  |  |  |  |   |   |  |  |   |  |   |  |  |  |  |  |  |  |   |    |  |  |  |   |   |  |  |  |  |  |  |  |   |    |  |    |  |  |   |  |  |  |  |  |  |  |    |    |  |    |  |  |   |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |   |
|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       | 56     |        |        |        |        |        |   |  |   |   |   |   |   |  |   |   |  |   |  |  |   |  |  |  |  |  |  |  |   |   |  |  |   |  |   |  |  |  |  |  |  |  |   |    |  |  |  |   |   |  |  |  |  |  |  |  |   |    |  |    |  |  |   |  |  |  |  |  |  |  |    |    |  |    |  |  |   |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |   |
|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |        |        |        |        |        |        |   |  |   |   |   |   |   |  |   |   |  |   |  |  |   |  |  |  |  |  |  |  |   |   |  |  |   |  |   |  |  |  |  |  |  |  |   |    |  |  |  |   |   |  |  |  |  |  |  |  |   |    |  |    |  |  |   |  |  |  |  |  |  |  |    |    |  |    |  |  |   |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |   |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Marks |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 6        | <pre> FUNCTION TestNum(ThisNum : STRING) RETURNS INTEGER    IF LEFT(ThisNum,3) = RIGHT(ThisNum 3) THEN     RETURN 3   ENDIF    IF RIGHT(ThisNum, 3) = "000" THEN     RETURN 2   ENDIF    IF MID(ThisNum, 4, 1) = MID(ThisNum, 5, 1)___     AND MID(ThisNum, 5, 1) = MID(ThisNum, 6, 1) THEN     RETURN 1   ENDIF    RETURN 0  ENDFUNCTION </pre> <p> <b>MP1</b> Function heading and ending <b>including</b> parameter and return type<br/> <b>MP2</b> Test for Condition 1<br/> <b>MP3</b> Test for Condition 2<br/> <b>MP4</b> Test for Condition 3<br/> <b>MP5</b> Return the highest value if more than one condition is satisfied<br/> <b>MP6</b> Return zero if no condition matched </p> | 6     |

| Question | Answer                                                                                                                                                                                                                                    | Marks |
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| 7(a)     | <p> <b>MP1</b> iteration / looping<br/> <b>MP2</b> naming all four modules correctly in the correct sequence //_e.g.<br/> Module-A repeatedly calls Sub-Y1, then SubY2 then Sub-9 </p>                                                    | 2     |
| 7(b)(i)  | <pre> TYPE MyType   DECLARE RA    : INTEGER   DECLARE RB    : STRING   DECLARE RC    : BOOLEAN ENDTYPE </pre> <p> <b>MP1</b> TYPE MyType . . . ENDTYPE<br/> <b>MP2</b> RA as integer and RB3 as string<br/> <b>MP3</b> RC as Boolean </p> | 3     |
| 7(b)(ii) | <pre> PROCEDURE Sub-9 (BYREF Param : MyType) </pre> <p> <b>MP 1</b> One mark for BYREF<br/> <b>MP 2</b> One mark for the rest of the statement </p>                                                                                       | 2     |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Marks |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 8(a)     | <pre> PROCEDURE ReceiveFile(FileName : STRING)   DECLARE FileData      : STRING   DECLARE CharCount     : INTEGER   CONSTANT Terminator = "*****"    OPENFILE FileName FOR WRITE   FileData ← GetData()   CharCount ← 0    WHILE FileData &lt;&gt; Terminator     WRITEFILE FileName, FileData     CharCount ← CharCount + LENGTH(FileData)     FileData ← GetData()   ENDWHILE    CLOSEFILE FileName    OUTPUT CharCount (, " characters were written to ",                                      FileName)  ENDPROCEDURE </pre> <p><b>MP1</b> OPEN file in WRITE mode and subsequently CLOSE<br/> <b>MP2</b> Conditional loop until terminator received<br/> <b>MP3</b> 'Attempted' use of GetData() – Ignore CALL ...<br/> <b>MP4</b> Fully correct use GetData() to return the data <b>in a loop</b><br/> <b>MP5</b> Maintain CharCount <b>in a loop</b><br/> <b>MP6</b> Write each line to the file - <b>except</b> the terminator <b>in a loop</b><br/> <b>MP7</b> Final output of message giving number of characters written <b>outside loop</b></p> | 7     |
| 8(b)     | <p><b>Max 3 marks</b></p> <p>Problem:</p> <ul style="list-style-type: none"> <li>• If the file being sent contains a line of the string "*****"</li> <li>• then the file being written by ReceiveFile() will end at this point // subsequent file lines will be lost</li> </ul> <p>Solution:</p> <ul style="list-style-type: none"> <li>• Read the file (at the sending end) to find the number of lines it contains</li> <li>• Send an initial message which defines the number of lines in the file</li> </ul> <p>ALTERNATIVE SOLUTION:</p> <ul style="list-style-type: none"> <li>• (Transmitter program) chooses a <b>different</b> terminator string / character that doesn't occur in the file</li> <li>• Transmitter program sends the terminator string / character before first line of file / before the transfer begins</li> </ul>                                                                                                                                                                                                               | 3     |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Marks |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 8(c)     | <pre> PROCEDURE Chat(Destination : STRING, Port : INTEGER)   DECLARE Data      : STRING   DECLARE Finished  : BOOLEAN   CONSTANT Terminator = "Bye"   CONSTANT STX = CHR(2)   CONSTANT ETX = CHR(3)    Finished ← FALSE    REPEAT     Data ← GetData()     OUTPUT Data     IF Data = Terminator THEN       Finished ← TRUE     ENDIF      IF NOT Finished THEN //about to reply       INPUT Data       Transmit(STX &amp; Destination &amp; MyID &amp; Data &amp; ETX,                Port)        IF Data = Terminator THEN         Finished ← TRUE       ENDIF     ENDIF    UNTIL Finished = TRUE  ENDPROCEDURE </pre> <p>Conditional loop<br/> <b>MP1 Conditional loop</b><br/> <b>MP2</b> Test for terminator in both cases<br/> <b>MP3</b> Use <code>GetData()</code> to get the data from the message<br/> <b>MP4</b> OUTPUT the data in a loop<br/> <b>MP5</b> INPUT the data reply<br/> <b>MP6</b> 'Attempted' use of <code>Transmit</code> to send it in a loop<br/> <b>MP7</b> Correct formation of parameters to <code>Transmit()</code></p> | 7     |
| 8(d)     | <p><b>Note: Max 3 marks (from either limitation or modification list)</b></p> <p>Limitation:</p> <ol style="list-style-type: none"> <li><code>GetData()</code> does not return a value until a message has been received</li> <li>So once a message has been sent the user has to wait for a reply // chat is half-duplex</li> </ol> <p>Modification:</p> <ol style="list-style-type: none"> <li>If no response allow the receiver to exit chat at any time ...</li> <li><code>GetData()</code> should immediately return a suitable message // set a time limit</li> <li>... which <code>Chat()</code> can detect and respond by allowing the conversation to continue</li> </ol>                                                                                                                                                                                                                                                                                                                                                                      | 3     |