READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO NOT WRITE IN ANY BARCODES.

Answer all questions.
No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The maximum number of marks is 75.
There is an Appendix on pages 19 and 20. Some questions will refer you to this information.

1 A programmer wants to write a program to calculate the baggage charge for a passenger's airline flight.

Two types of ticket are available for a flight:

- economy class (coded E)
- standard class (coded S)

Each ticket type has a baggage weight allowance as shown below. The airline makes a charge if the weight exceeds the allowance.

<table>
<thead>
<tr>
<th>Ticket type</th>
<th>Baggage allowance (kg)</th>
<th>Charge rate per additional kg ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>'E'</td>
<td>16</td>
<td>3.50</td>
</tr>
<tr>
<td>'S'</td>
<td>20</td>
<td>5.75</td>
</tr>
</tbody>
</table>

(a) A program flowchart will document the program. The flowchart will contain the following statements:

<table>
<thead>
<tr>
<th>Statement number</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Charge ← 0</td>
</tr>
<tr>
<td>2</td>
<td>INPUT BaggageWeight</td>
</tr>
<tr>
<td>3</td>
<td>Charge ← ExcessWeight * ChargeRate</td>
</tr>
<tr>
<td>4</td>
<td>Is ExcessWeight &gt; 0 ?</td>
</tr>
<tr>
<td>5</td>
<td>INPUT TicketType</td>
</tr>
<tr>
<td>6</td>
<td>ExcessWeight ← BaggageWeight - BaggageAllowance</td>
</tr>
<tr>
<td>7</td>
<td>BaggageAllowance ← 16</td>
</tr>
<tr>
<td>8</td>
<td>ChargeRate ← 3.5</td>
</tr>
<tr>
<td>9</td>
<td>OUTPUT Charge</td>
</tr>
<tr>
<td>10</td>
<td>ChargeRate ← 5.75</td>
</tr>
<tr>
<td>11</td>
<td>BaggageAllowance ← 20</td>
</tr>
<tr>
<td>12</td>
<td>Is TicketType = 'E' ?</td>
</tr>
</tbody>
</table>

Complete the flowchart by putting the appropriate statement number in each flowchart symbol. Statement 5 has been done for you.
(b) The programmer needs data to test the flowchart.

Complete the table of test data below to show **five** tests.

<table>
<thead>
<tr>
<th>TicketType</th>
<th>BaggageWeight</th>
<th>Explanation</th>
<th>Expected output</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(c) The program design is to be amended. The value input by the user for the ticket type is to be validated. Part of the amended flowchart is shown below.

![Flowchart](image)

Write **pseudocode** to use a pre-condition loop for this validation.

```
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
```

[3]
A sensing device sends bit values to a computer along data channels.

- Channel 1 transmits a sequence of binary values from a sensor
- Channel 2 transmits at regular intervals to indicate whether the sensor is switched on or off:
  - 0 indicates switched off
  - 1 indicates switched on

A program tests the bits received from the sensing device.

A program reads the signal from Channel 2 after every six values from Channel 1.

A built-in function `READ(<ChannelNumber>)` reads a value from the specified channel.

Pseudocode for the program is as follows:

```plaintext
01 BitCount ← 0
02 Status2 ← READ(2)
03 WHILE Status2 = 1
04 FOR ReadingCount ← 1 TO 6
05   ThisBit ← READ(1)
06   IF ThisBit = 1
07     THEN
08       BitCount ← BitCount + 1
09     ENDIF
10   IF BitCount = 5
11     THEN
12       OUTPUT "Error - Investigate"
13       BitCount ← 0
14     ENDIF
15 ENDFOR
16 Status2 ← READ(2)
17 ENDWHILE
```
(a) Trace the execution of the program for the following sequence of bits.

<table>
<thead>
<tr>
<th>Channel 1</th>
<th>Channel 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 0 1 1 0 1 1 0 0 1 1</td>
<td>1 1 1 0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Status2</th>
<th>ReadingCount</th>
<th>ThisBit</th>
<th>BitCount</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

(b) Identify the following constructs in the given program, using line numbers.

For multi-line constructs give the first line number only.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Line number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment</td>
<td></td>
</tr>
<tr>
<td>Selection</td>
<td></td>
</tr>
<tr>
<td>Iteration</td>
<td></td>
</tr>
</tbody>
</table>
You will need to refer to the list of pseudocode string-handling functions in the Appendix.

<table>
<thead>
<tr>
<th>Character</th>
<th>Decimal</th>
<th>Character</th>
<th>Decimal</th>
<th>Character</th>
<th>Decimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;Space&gt;</td>
<td>32</td>
<td>I</td>
<td>73</td>
<td>R</td>
<td>82</td>
</tr>
<tr>
<td>A</td>
<td>65</td>
<td>J</td>
<td>74</td>
<td>S</td>
<td>83</td>
</tr>
<tr>
<td>B</td>
<td>66</td>
<td>K</td>
<td>75</td>
<td>T</td>
<td>84</td>
</tr>
<tr>
<td>C</td>
<td>67</td>
<td>L</td>
<td>76</td>
<td>U</td>
<td>85</td>
</tr>
<tr>
<td>D</td>
<td>68</td>
<td>M</td>
<td>77</td>
<td>V</td>
<td>86</td>
</tr>
<tr>
<td>E</td>
<td>69</td>
<td>N</td>
<td>78</td>
<td>W</td>
<td>87</td>
</tr>
<tr>
<td>F</td>
<td>70</td>
<td>O</td>
<td>79</td>
<td>X</td>
<td>88</td>
</tr>
<tr>
<td>G</td>
<td>71</td>
<td>P</td>
<td>80</td>
<td>Y</td>
<td>89</td>
</tr>
<tr>
<td>H</td>
<td>72</td>
<td>Q</td>
<td>81</td>
<td>Z</td>
<td>90</td>
</tr>
</tbody>
</table>

(a) For each statement, write the value assigned to the variable.

(i) Term ← CHARACTERCOUNT("TSUNAMI")

Term ...........................................................................................................................................[1]

(ii) Answer1 ← ASC('G') + ASC(<Space>)

Answer1 ....................................................................................................................................[1]

(iii) Answer2 ← CHR(CHARACTERCOUNT("HELLO") + 70)

Answer2 ....................................................................................................................................[1]

(iv) Word ← SUBSTR("Welcome home", 4, 7)

Word .........................................................................................................................................[1]
Question 3(b) continues on page 10.
(b) A programmer wants to design a procedure to calculate a customer ID number from the customer's surname.

The procedure will:

- input the surname
- isolate each character in the surname and find the corresponding ASCII code
- calculate the total of all these ASCII codes
- this total is the customer ID

(i) Complete the pseudocode for this procedure.

You will need to refer to the list of pseudocode string-handling functions in the Appendix.

```
PROCEDURE CalculateCustomerID

OUTPUT "Key in surname"
INPUT Surname
Length ← .................................................................
CustomerID ← 0
FOR i ← 1 TO Length
    // NextChar is a single character from Surname
    NextChar ← ............................................................
    NextCodeNumber ← ASC(NextChar)
    CustomerID ← CustomerID + ........................................
ENDFOR
OUTPUT "Customer ID is ", CustomerID
```

[3]
(ii) Write **program code** for procedure `CalculateCustomerID`.

Visual Basic and Pascal: You should include declaration statements for variables. Python: You should show a comment statement for each variable used with its data type.

**Programming language** .................................................................

.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
.......................................................................................................
...................................................................
(c) The programmer decides that it would be better to write the procedure as a function. The user will now input the surname in the main program.

Write **program code** for the following:

State your programming language .........................................................................................................................

(i) The function header for this new function *CalculateCustomerID*

............................................................................................................................................................................[3]

(ii) The additional statement required within the function body to complete the change from a procedure to a function.

............................................................................................................................................................................
............................................................................................................................................................................[1]

(iii) The statement in the main program which:

• calls the function for surname Wilkes
• assigns the result to variable *ThisID*

............................................................................................................................................................................[3]

(d) (i) The new function *CalculateUserID* is an example of a ‘user-defined function’.

State two differences between a built-in function and a user-defined function.

1 ............................................................................................................................................................................
............................................................................................................................................................................

2 ............................................................................................................................................................................
............................................................................................................................................................................[2]

(ii) State two things that built-in and user-defined functions have in common.

1 ............................................................................................................................................................................
............................................................................................................................................................................

2 ............................................................................................................................................................................
............................................................................................................................................................................[2]
4 A company employs Ahmed as a programmer.

(a) At College, before joining the company, Ahmed used two items of software for programming:

- a text editor
- a compiler

Describe how he could have developed programs using these software tools.

Include in the description the terms ‘object code’ and ‘source code’.

...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
...................................................................................................................................................
.......................................................................................................................................................
The program records the following data for each product:

- product code
- product description
- product retail price

The text file `PRODUCTS` stores each data item on a separate line, as shown below:

<table>
<thead>
<tr>
<th>File</th>
<th>PRODUCTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0198</td>
<td>Plums (10kg)</td>
</tr>
<tr>
<td>0202</td>
<td>Onions (20kg)</td>
</tr>
<tr>
<td>0376</td>
<td>Mango chutney (1kg)</td>
</tr>
<tr>
<td>0014</td>
<td>Mango (10kg)</td>
</tr>
</tbody>
</table>

The program uses the variables shown in the identifier table.

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRODUCTS</td>
<td>TEXT_FILE</td>
<td>Storing the code, description and retail price for all current products</td>
</tr>
<tr>
<td>PCode</td>
<td>ARRAY[1:1000] OF STRING</td>
<td>Array storing the product codes</td>
</tr>
<tr>
<td>PDescription</td>
<td>ARRAY[1:1000] OF STRING</td>
<td>Array storing the product descriptions</td>
</tr>
<tr>
<td>PRetailPrice</td>
<td>ARRAY[1:1000] OF REAL</td>
<td>Array storing the product retail prices</td>
</tr>
<tr>
<td>i</td>
<td>INTEGER</td>
<td>Array index used by all three arrays</td>
</tr>
</tbody>
</table>
(i) The first operation of the program is to read all the product data held in file \textit{PRODUCTS} and write them into the three 1D arrays.

Complete the pseudocode below.

```
OPEN ................................................................................................................................
i ← 1
WHILE ................................................................................................................................
  READFILE ("PRODUCTS", ......................................................................................)
  READFILE ("PRODUCTS", ......................................................................................)
  READFILE ("PRODUCTS", ......................................................................................)
  .......................................................................................................................................
  .......................................................................................................................................
ENDWHILE
CLOSE "PRODUCTS"
OUTPUT "Product file contents written to arrays"
```

When Ahmed designed the \textit{PRODUCTS} file, he considered the alternative file structure shown opposite.

It stores one product per line in the text file.

(ii) State one benefit and one drawback of this file design.

Benefit ...............................................................................................................................
...........................................................................................................................................

Drawback .........................................................................................................................
...........................................................................................................................................[2]
(d) To code the ‘Search by product code’ procedure, Ahmed draws a structure chart showing the different stages.

The procedure uses the variables shown in the identifier table.

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SearchCode</td>
<td>STRING</td>
<td>Product code input by the user</td>
</tr>
<tr>
<td>ThisIndex</td>
<td>INTEGER</td>
<td>Array index position for the corresponding product</td>
</tr>
<tr>
<td>ThisDescription</td>
<td>STRING</td>
<td>Product description found</td>
</tr>
<tr>
<td>ThisRetailPrice</td>
<td>REAL</td>
<td>Product retail price found</td>
</tr>
</tbody>
</table>

You can assume that before the procedure is run, all the product data is read from file PRODUCTS and then stored in three 1D arrays as described in part (c)(i).

Label the structure chart to show the input(s) and output(s).
(e) A first attempt was made at writing the 'Search for product code' module. Ahmed designs this as a function `ProductCodeSearch`.

The function returns an integer value as follows:

- if the product code is found, it returns the index position of the 1D array `PCode` being searched
- if the product code is not found, the function returns `-1`

Write program code for function `ProductCodeSearch`.

Visual Basic and Pascal: You should include the declaration statements for variables. Python: You should show a comment statement for each variable used with its data type.

Programming language .................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................
........................................................................................................[6]
Study the following pseudocode statements.

```plaintext
CONST Pi = 3.1 : REAL

DECLARE Triangle, Base, Height, Radius, Cone : REAL
DECLARE a, b, c, Answer2 : INTEGER
DECLARE Answer1 : BOOLEAN

Base ← 2.6
Height ← 10
Triangle ← (Base * Height) / 2
Radius ← 1
Height ← 2
Cone ← 2 * Pi * Radius * (Radius + Height)

a ← 13
b ← 7
c ← 3

Answer1 ← NOT((a + b + c) > 28)
Total ← 34
Total ← Total - 2
Answer2 ← a + c * c
```

Give the final value assigned to each variable.

(i) Triangle ................................... [1]
(ii) Cone ..................................... [1]
(iii) Answer1 ................................. [1]
(iv) Total .................................... [1]
(v) Answer2 ................................. [1]
# Appendix

## Built-in functions (pseudocode)

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>ONECHAR</td>
<td>Returns the single character at position Position (counting from the start of the string with value 1) from the string ThisString. For example: ONECHAR(&quot;New York&quot;, 5) returns 'Y'</td>
<td></td>
</tr>
<tr>
<td>CHARACTERCOUNT</td>
<td>Returns the number of characters in ThisString. For example: CHARACTERCOUNT(&quot;New York&quot;) returns 8</td>
<td></td>
</tr>
<tr>
<td>SUBSTR</td>
<td>Returns a sub-string from within ThisString. Value1 is the start index position (counting from the left, starting with 1). Value2 is the final index position. For example: SUBSTR(&quot;art nouveau&quot;, 5, 11) returns &quot;nouveau&quot;</td>
<td></td>
</tr>
<tr>
<td>TONUM</td>
<td>Returns the integer or real equivalent of the string ThisString. For example: TONUM(&quot;502&quot;) returns the integer 502, TONUM(&quot;56.36&quot;) returns the real number 56.36</td>
<td></td>
</tr>
<tr>
<td>ASC</td>
<td>Returns an integer which is the ASCII character code for the character ThisCharacter. For example: ASC('A') returns integer 65</td>
<td></td>
</tr>
</tbody>
</table>
CHR(Value : INTEGER) RETURNS CHAR

returns the character that ASCII code number Value represents.

For example: CHR(65) returns 'A'

RND() RETURNS REAL

returns a random number in the range 0 to 0.99999

For example: RND() returns 0.67351

INT(ThisNumber : REAL) RETURNS INTEGER

returns the integer part of ThisNumber.

For example: INT(12.79) returns 12

Errors

For any function, if the program calls the function incorrectly, the function returns an error.

Concatenation operator

& – Concatenates two expressions of STRING or CHAR data type.

For example: "South" & " " & "Pole" produces "South Pole"
'B' & "000654" produces "B000654"