Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8303835580

COMPUTER SCIENCE **9608/22**

Paper 2 Fundamental Problem-solving and Programming Skills **May/June 2021**

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **20** pages. Any blank pages are indicated.

© UCLES 2021

BLANK PAGE

© UCLES 2021

1 **(a)** Maintenance of programs may be needed for a number of different reasons.

State **two** types of maintenance **and** give a reason why each may be needed.

Type .....

Reason .....

.....

Type .....

Reason .....

.....
[4]

(b) State why characters need to be represented in ASCII or Unicode before they can be processed.

.....

..... [1]

(c) Each line of a text file contains several data items. A special character is inserted between data items before the line is written to the file.

Explain why a special character is used in this way.

.....

.....

.....

..... [2]

(d) Each pseudocode statement in the following table may contain an error due to the incorrect use of the function or operator.

Describe the error in each case, **or** write 'NO ERROR' if the statement contains no error.

Refer to the **Appendix** on page 18 for the list of built-in pseudocode functions and operators.

Statement	Error
`Code ← RIGHT("Cap" & "art", 4)`	
`Status ← MID("Computer", 7, 5)`	
`Size ← LENGTH("Password") * 2`	
`NextChar ← CHR('A')`	
`Index ← Index & 3`	

[5]

2 Study the following pseudocode.

```
DECLARE Overload : BOOLEAN

PROCEDURE LEM()

  DECLARE Status : BOOLEAN
  DECLARE Landed : INTEGER

  Overload ← FALSE
  Landed ← FALSE

  WHILE Landed = FALSE
     Status ← Sample()
     IF Status = TRUE
        THEN
           Landed ← SubA(42)
        ELSE
           Overload ← SubB(37)
           IF Overload = TRUE
              THEN
                 CALL Display("Alarm 1202")
           ENDIF
     ENDIF
  ENDWHILE

ENDPROCEDURE
```

(a) Examine the pseudocode **and** complete the following table:

	Answer
The identifier name of a global variable	
The name of the loop structure	
The identifier involved in a data type mismatch	
The name of a procedure that takes a parameter	
The name of a function	

[5]

(b) Draw a program flowchart to represent the pseudocode algorithm.

Variable declarations are not required in program flowcharts.

[5]

3 (a) (i) Module names and parameters are features that may be represented on a structure chart.

State **two other** features than can be represented on a structure chart.

Feature 1 .....

Feature 2 .....

[2]

(ii) The headers for three modules in a program are defined in pseudocode as follows:

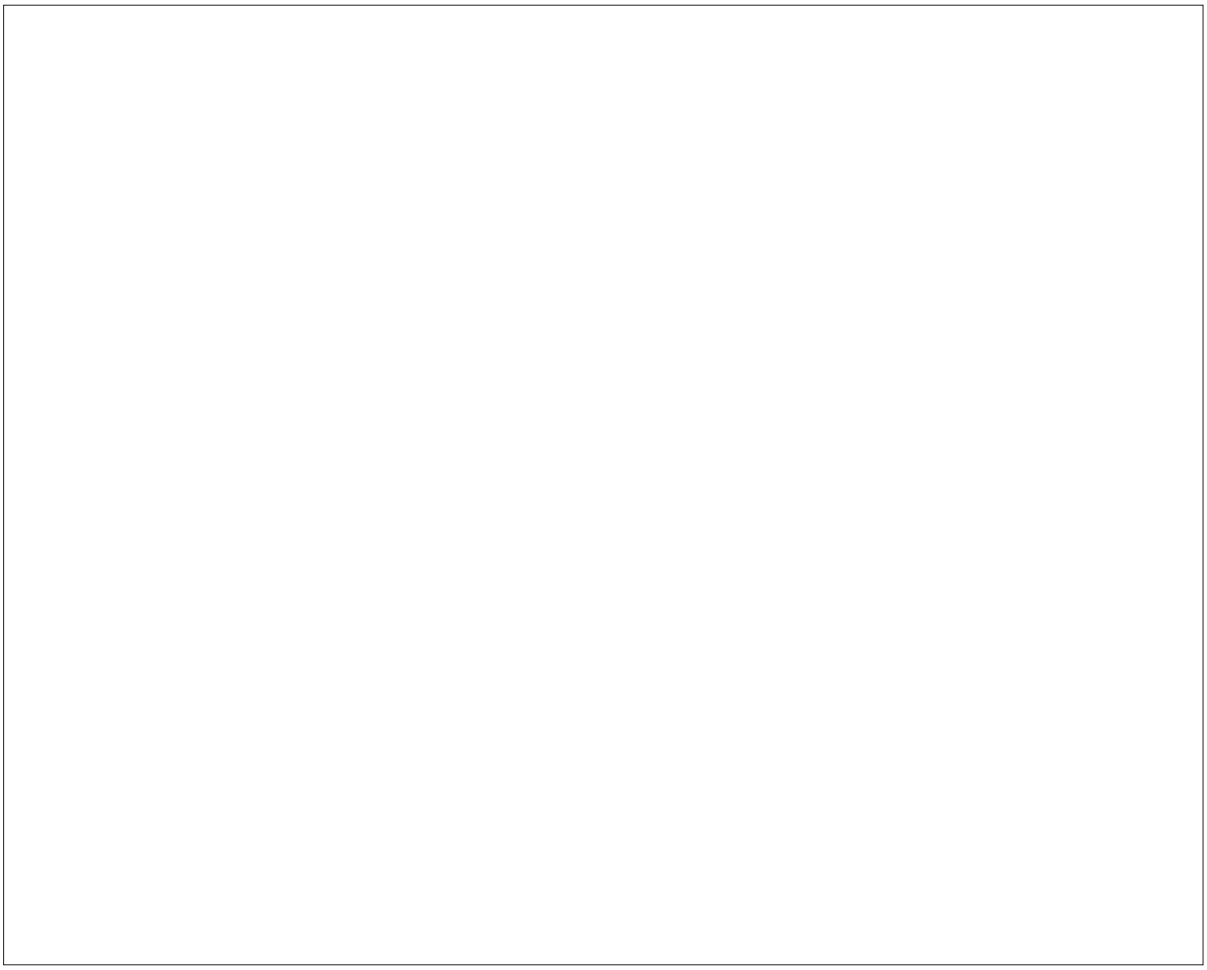
Pseudocode module header
`PROCEDURE Create(S2 : INTEGER, P3 : STRING)`
`PROCEDURE Modify(S2 : INTEGER, BYREF P4 : STRING)`
`FUNCTION Delete(P4 : INTEGER, M4 : STRING) RETURNS INTEGER`

A fourth module, `Membership()`, may call any one of the three modules.

Draw a structure chart to represent the information given about the **four** modules.

[5]

(b) Draw a diagram to show the stages of the program development cycle. Use arrows to indicate how the stages are linked.



[2]

4 **(a)** Using **pseudocode**, write a post-condition loop to output every odd number between 100 and 200.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) A program contains a global 2D array `XRef`. The array consists of 100 rows and 3 columns. The array is of data type `STRING`.

A function, `Search()`, takes two parameters `Par1` and `Par2` as string values and returns an integer value.

The function returns:

- the index number of the first row where:
  - the element in column 1 of that row matches `Par1` and
  - either of the other two elements in that row match `Par2`
- `-1` if no match found in any row.

Write **program code** for the function `Search()`.

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 .....

Program code

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [7]

5 **(a)** An Integrated Development Environment (IDE) will be used to develop a program.

(i) An IDE includes features for program presentation.

State **two** of these presentation features.

Feature 1 .....

.....

Feature 2 .....

.....

[2]

(ii) Name **two** IDE features that can help with initial error detection.

Feature 1 .....

.....

Feature 2 .....

.....

[2]

(b) **(i)** A function, `Verify()`, is written in pseudocode.

Write the **two** missing lines to complete the pseudocode.

```
FUNCTION Verify(UserID : STRING) RETURNS BOOLEAN

  .....
  DECLARE Password : STRING
  OUTPUT "Please Input your password: "
  INPUT Password
  Response ← Validate(UserID, Password) AND Today()

  .....

ENDFUNCTION
```

[2]

(ii) The function, `Verify()`, is to be amended as follows:

- if the `UserID` is `"Guest"`, a password is not required and `TRUE` should be returned
- output a message to try again if the password entered is not valid
- return `FALSE` if the number of attempts to enter a valid password exceeds three.

Write **program code** for the **amended** function `Verify()`.

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 .....

Program code

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

6 A program stores data about stock items in four global 1D arrays as follows:

Array	Data type	Description	Example data value	Initial data value
`StockID`	`STRING`	the stock item ID (eight alpha-numeric characters)	`"JBCD0002"`	`""`
`Description`	`STRING`	a description of the item (alphabetic characters only)	`"soap"`	`""`
`Quantity`	`INTEGER`	the number in stock	`9`	`0`
`Cost`	`REAL`	the cost of the item	`1.45`	`0.0`

- Each array contains 10 000 elements.
- Elements with the same index relate to the same stock item. For example, `StockID[3]` contains the ID for the product whose description is in `Description[3]`.
- The `StockID` array is not sorted.

The program will be modified so that the data from the arrays can be stored in a text file for backup. You may assume that a backup file contains only valid stock data.

The programmer has started to define program modules as follows:

Module	Description

`Unpack()`	• called with two parameters:
	  ◦ an array index
	  ◦ a string value read from one line of the backup file
	• extracts the four data values from the string and assigns each to the appropriate array

`Restore()`	• called with a string representing the name of a backup file • returns `FALSE` if the file is empty • sets all elements of each array to the initial data value as given in the table • reads the backup file line by line calls `Unpack()` to extract data from each line and assign values to the corresponding arrays • returns `FALSE` if the arrays are full but there are still lines in the file, otherwise returns `TRUE`
`StockSummary()`	For all items where `StockID` does **not** contain the initial value: • counts the number of stock entries in the `StockID` array • outputs the overall value of all items in stock (cost multiplied by the quantity) • outputs the number of stock entries

© UCLES 2021

(a) Write **program code** for the module `StockSummary()`.

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 .....

Program code

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(b) Write **pseudocode** for the module `Restore()`.

.....

.....

.....

.....

.....

.....

.....

.....

..... [8]

(c) The module description of `GetValidFilename()` is as follows:

Module	Description

`GetValidFilename()`	• prompts and inputs a filename
	• validates the filename by checking that it:
	  ◦ is between 4 and 10 characters in length (inclusive)
	  ◦ contains only alphanumeric characters
	• if the filename is invalid, outputs a warning message and asks the user to try again
	• otherwise returns the valid filename

Write **program code** for the module `GetValidFilename()`.

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 .....

Program code

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [8]

Appendix

Built-in functions (pseudocode)

Each function returns an error if the function call is not properly formed.

`MID(ThisString : STRING, x : INTEGER, y : INTEGER) RETURNS STRING`
returns a string of length `y` starting at position `x` from `ThisString`

Example: `MID("ABCDEFGH", 2, 3)` returns `"BCD"`

`LENGTH(ThisString : STRING) RETURNS INTEGER`
returns the integer value representing the length of `ThisString`

Example: `LENGTH("Happy Days")` returns `10`

`LEFT(ThisString : STRING, x : INTEGER) RETURNS STRING`
returns leftmost `x` characters from `ThisString`

Example: `LEFT("ABCDEFGH", 3)` returns `"ABC"`

`RIGHT(ThisString : STRING, x : INTEGER) RETURNS STRING`
returns rightmost `x` characters from `ThisString`

Example: `RIGHT("ABCDEFGH", 3)` returns `"FGH"`

`INT(x : REAL) RETURNS INTEGER`
returns the integer part of `x`

Example: `INT(27.5415)` returns `27`

`LCASE(ThisChar : CHAR) RETURNS CHAR`
returns the character value representing the lower case equivalent of `ThisChar`
If `ThisChar` is not an upper case alphabetic character, it is returned unchanged.

Example: `LCASE('W')` returns `'w'`

`ASC(ThisChar : CHAR) RETURNS INTEGER`
returns the ASCII value of character `ThisChar`

Example: `ASC('A')` returns `65`

`CHR(x : INTEGER) RETURNS CHAR`
returns the character whose ASCII value is `x`

Example: `CHR(87)` returns `'W'`

Operators (pseudocode)

Operator	Description
`&`	Concatenates (joins) two strings Example: `"Summer" & " " & "Pudding"` produces `"Summer Pudding"`
`AND`	Performs a logical `AND` on two Boolean values Example: `TRUE AND FALSE` produces `FALSE`
`OR`	Performs a logical `OR` on two Boolean values Example: `TRUE OR FALSE` produces `TRUE`

© UCLES 2021

BLANK PAGE

© UCLES 2021

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

© UCLES 2021