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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.

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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 .....

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Type .....

Reason .....

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[4]

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

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..... [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.

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(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]

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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	

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

Variable declarations are not required in program flowcharts.

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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]

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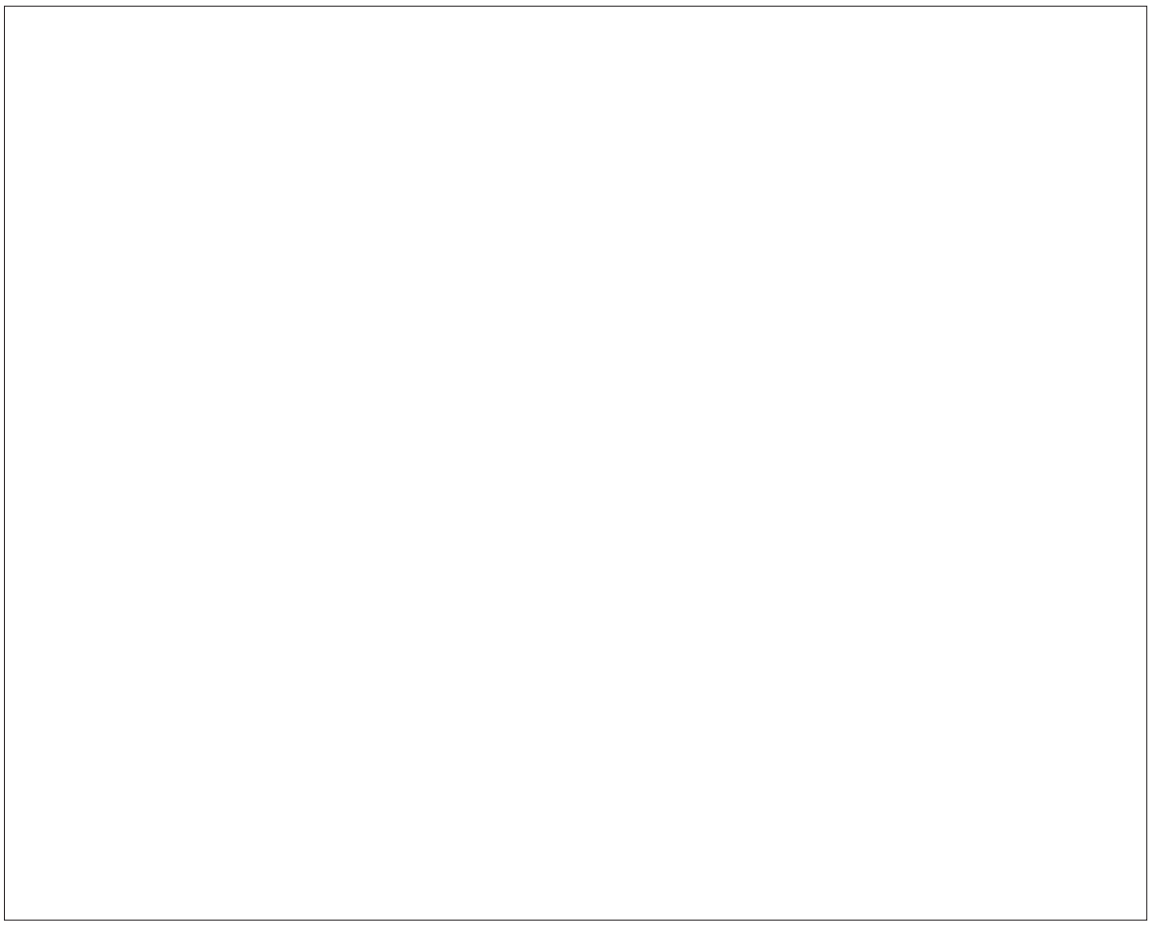
(b) Draw a diagram to show the stages of the program development cycle. Use arrows to indicate how the stages are linked.



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

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(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.

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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

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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 .....

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Feature 2 .....

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[2]

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

Feature 1 .....

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Feature 2 .....

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[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]

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(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

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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

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(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

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

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(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

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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`

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