

Cambridge International AS & A Level

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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.

- 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

..... [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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..... [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
      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.

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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.

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

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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 10000 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
<code>Unpack()</code>	<ul style="list-style-type: none"> • called with two parameters: <ul style="list-style-type: none"> ◦ 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
<code>Restore()</code>	<ul style="list-style-type: none"> • called with a string representing the name of a backup file • returns <code>FALSE</code> 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 <code>Unpack()</code> to extract data from each line and assign values to the corresponding arrays • returns <code>FALSE</code> if the arrays are full but there are still lines in the file, otherwise returns <code>TRUE</code>
<code>StockSummary()</code>	<p>For all items where <code>StockID</code> does not contain the initial value:</p> <ul style="list-style-type: none"> • counts the number of stock entries in the <code>StockID</code> 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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(c) The module description of `GetValidFilename()` is as follows:

Module	Description
<code>GetValidFilename()</code>	<ul style="list-style-type: none">• prompts and inputs a filename• validates the filename by checking that it:<ul style="list-style-type: none">◦ 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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