



## Cambridge International AS & A Level

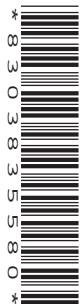
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**COMPUTER SCIENCE**

**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.

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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 .....

.....

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.

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.....

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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
```

```
            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]

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:

<b>Pseudocode module header</b>
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]





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

Dotted lines for writing the program code, followed by a bracketed number [7] at the end of the line.

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]



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"> <li>• called with two parameters: <ul style="list-style-type: none"> <li>◦ an array index</li> <li>◦ a string value read from one line of the backup file</li> </ul> </li> <li>• extracts the four data values from the string and assigns each to the appropriate array</li> </ul>
<code>Restore()</code>	<ul style="list-style-type: none"> <li>• called with a string representing the name of a backup file</li> <li>• returns <code>FALSE</code> if the file is empty</li> <li>• sets all elements of each array to the initial data value as given in the table</li> <li>• reads the backup file line by line calls <code>Unpack()</code> to extract data from each line and assign values to the corresponding arrays</li> <li>• returns <code>FALSE</code> if the arrays are full but there are still lines in the file, otherwise returns <code>TRUE</code></li> </ul>
<code>StockSummary()</code>	<p>For all items where <code>StockID</code> does <b>not</b> contain the initial value:</p> <ul style="list-style-type: none"> <li>• counts the number of stock entries in the <code>StockID</code> array</li> <li>• outputs the overall value of all items in stock (cost multiplied by the quantity)</li> <li>• outputs the number of stock entries</li> </ul>





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..... [8]

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

Module	Description
GetValidFilename()	<ul style="list-style-type: none"> <li>• prompts and inputs a filename</li> <li>• validates the filename by checking that it:               <ul style="list-style-type: none"> <li>○ is between 4 and 10 characters in length (inclusive)</li> <li>○ contains only alphanumeric characters</li> </ul> </li> <li>• if the filename is invalid, outputs a warning message and asks the user to try again</li> <li>• otherwise returns the valid filename</li> </ul>

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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