Cambridge Assessment International Education

# Cambridge International AS & A Level

**COMPUTER SCIENCE** **9608/43**

Paper 4 Further Problem-solving and Programming Skills **October/November 2021**

PRE-RELEASE MATERIAL

*4526018082*

No additional materials are needed.

**This material should be given to the relevant teachers and candidates as soon as it has been received at the centre.**

**INSTRUCTIONS**

- You should use this material in preparation for the examination.
- You should attempt the practical programming tasks using your chosen high-level, procedural programming language.

This document has **8** pages. Any blank pages are indicated.

DC (CE/SW) 221501

Teachers and candidates should read this material prior to the November 2021 examination for 9608 Paper 4.

**Reminders**

The syllabus states:

- there will be questions on the examination paper which do not relate to this pre-release material
- you must choose a high-level programming language from:
    - Visual Basic (console mode)
    - Python
    - Pascal / Delphi (console mode).

**Note:** A mark of **zero** will be awarded if a programming language other than those listed is used.

The practical skills for Paper 4 build on the practical skills covered in Paper 2. We recommend that candidates choose the same high-level programming language for this paper as they did for Paper 2. This will give candidates the opportunity for extensive practice and allow them to acquire sufficient expertise.

Questions on the examination paper may ask the candidate to write:

- structured English
- pseudocode
- program code.

A program flowchart should be considered as an alternative to pseudocode for documenting a high-level algorithm design.

Candidates should be confident with:

- the presentation of an algorithm using either a program flowchart or pseudocode
- the production of a program flowchart from given pseudocode and vice versa.

Candidates will also benefit from using pre-release materials from previous examinations.
These are available on the teacher support site.

**Declaration of variables**

The syllabus document shows the syntax expected for a declaration statement in pseudocode.

```
DECLARE <identifier> : <data type>
```

If Python is the chosen language, each variable's identifier (name) and its intended data type must be documented using a comment statement.

**Structured English – Variables**

An algorithm in pseudocode uses variables, which should be declared. An algorithm in structured English does not always use variables. In this case, the candidate needs to use the information given in the question to complete an identifier table. The table needs to contain an identifier, data type and description for each variable.

**TASK 1 – Recursion**

Iterative algorithms can be written as recursive algorithms and vice versa.

**TASK 1.1**

Research the advantages and disadvantages of recursive algorithms compared to iterative algorithms.

**TASK 1.2**

Identify the recursive calls in the following pseudocode algorithm.

```
FUNCTION Recursive(Num1, Num2 : INTEGER) RETURNS INTEGER
   IF Num1 < 0 OR Num2 < 0
      THEN
         RETURN 1
      ELSE
         IF Num1 < Num2
            THEN
               Num1 ← Num1 - 2
               RETURN 20 + 2 * Recursive(Num1, Num2)
            ELSE
               Num2 ← Num2 - 2
               RETURN 10 + 2 * Recursive(Num1, Num2)

         ENDIF
   ENDIF
ENDFUNCTION
```

**Key focus:**
Recursion

**TASK 1.3**

Dry run the above algorithm, complete the following trace table and identify the final return value when the function is called as follows:

```
Recursive(5, 3)
```

| Function call | Num1 | Num2 | Return value |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Final return value .....

**TASK 1.4**

Dry run the algorithm when the function is called with `Recursive(10, 15)`.

Create a trace table to show your working.

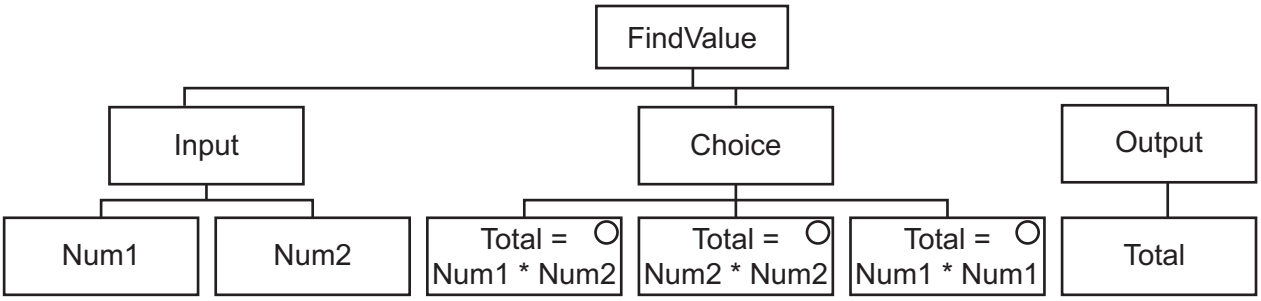
**TASK 1.5**

Rewrite the recursive algorithm as an iterative algorithm.

**TASK 2 – Jackson Structured Programming (JSP)**

Study the following JSP structure diagram:

**Key focus:**
JSP structure diagram




**TASK 2.1**

State the meaning of the circular symbol on the diagram.

**TASK 2.2**

Write an algorithm using pseudocode to represent the diagram.

**TASK 2.3**

Draw the JSP structure diagram for the following pseudocode algorithm.

```
PROCEDURE CalculateResult()
   X ← 0
   WHILE X < 10
      INPUT X
      INPUT Y
   ENDWHILE
   IF X > Y
      THEN
         Total ← NewTotal(X, Y)
      ELSE
         Total ← NewTotal(Y, X)
   ENDIF
   OUTPUT Total
ENDPROCEDURE
```

**TASK 3 – File processing and exception handling**

Helena is writing a computer program to store data about patients in a hospital.

**TASK 3.1**

Write, using pseudocode, the declaration for a record structure to store the patient's data.

The record needs to store:

unique number e.g. 15756

ward e.g. D1

doctor ID e.g. 15PR

date of admission e.g. 03/04/2021

**Key focus:**
Hashing

**TASK 3.2**

The patient records are stored in a random access file.

A hashing algorithm is applied to the patient's unique number to generate the location in the file to store the record.

Write a function that:

- takes a patient's unique number as a parameter
- calculates the hash value (using a hashing algorithm of your choice)
- returns the location.

**TASK 3.3**

Write a function that:

- takes the record to store in the file as a parameter
- generates the hash value using the function from **TASK 3.2**
- stores the record in the generated location in the file
- returns true if the record was successfully saved and false otherwise.

**Key focus:**
File handling

**TASK 3.4**

Write a function that is called when the program starts.

The function should:

- take as input the patient's unique number
- find the record for that patient's number in the file
- return either the record, if found, or a null record otherwise.

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