



# Cambridge International AS & A Level

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**COMPUTER SCIENCE**

**9608/43**

Paper 4 Further Problem-solving and Programming Skills

**May/June 2021**

PRE-RELEASE MATERIAL



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.**

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**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.

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

Teachers and candidates should read this material prior to the June 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 – File storage**

Jeff wants a program to help him manage his collection of books. He wants to be able to perform tasks such as search for specific books and add new ones. He has decided he wants a computer program to do this.

**TASK 1.1**

Design a record structure using **pseudocode** to store data about his books.

He wants to store the following:

- unique code for each book (between 100 and 999)
- title of the book
- main author
- year of publication.

**TASK 1.2**

Write program code to:

- create your record structure
- create an array to store the records about the books
- input data for 10 books from the user
- store each book as a separate record in an array
- output the data in each record with an appropriate message.

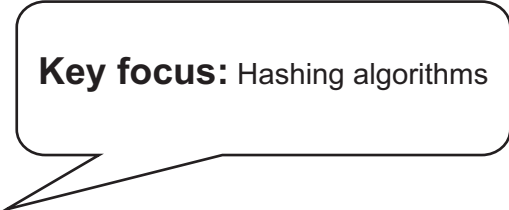
**TASK 1.3**

The program needs to store the records in the array into a file.

Write a subroutine to store the records in a serial file.

**TASK 1.4**

Write a procedure to read the records from a serial file and output them with an appropriate message.



**Key focus:** Hashing algorithms

**TASK 1.5**

Each book has a unique code. The unique code allows the book's details to be stored in a random file using a hashing algorithm.

Develop an appropriate hashing algorithm – you may need to research some examples of hashing algorithms.

**TASK 1.6**

Manually calculate the file location for several books using your hashing algorithm.

**TASK 1.7**

Write a pseudocode algorithm to perform the hash calculation.



**Key focus:** Random files

**TASK 1.8**

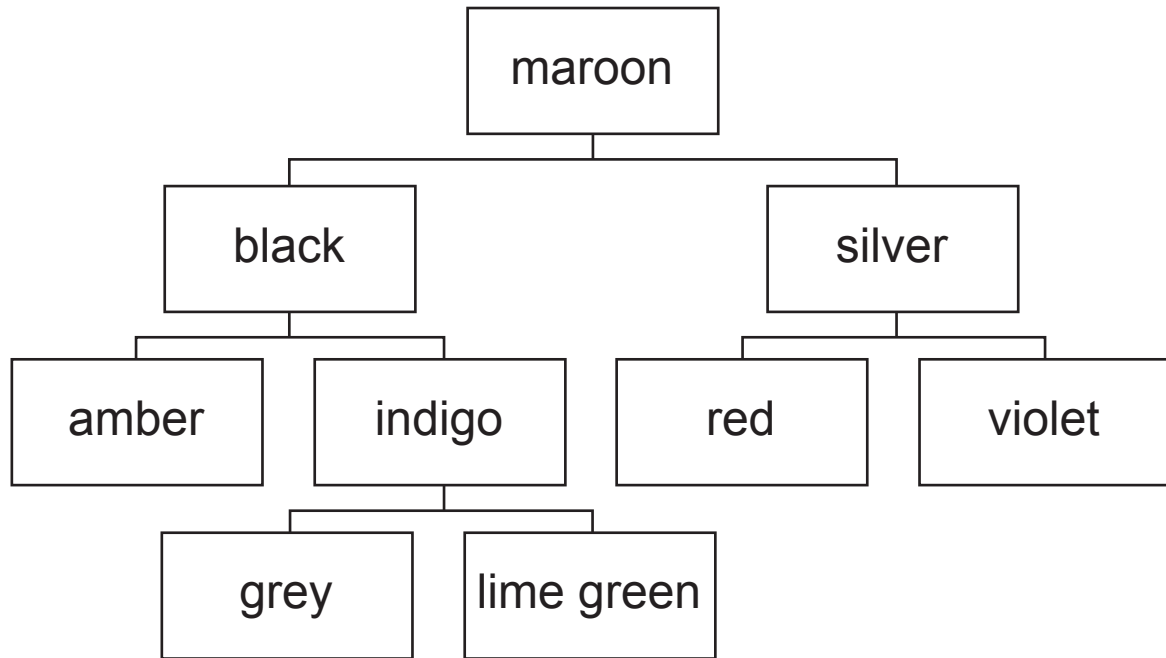
Write a pseudocode algorithm to store a record in its hashed location in the random file.

**TASK 1.9**

Write a pseudocode algorithm to read a record from its hashed location in the random file.

**TASK 2 – Binary tree**

The following is a binary tree, created from a set of data:

**TASK 2.1**

Identify the root node and leaf nodes in the binary tree.

**Key focus:**  
Binary tree

**TASK 2.2**

Add the following data to the binary tree:

pink      yellow      blue      purple      fuchsia      turquoise

**TASK 2.3**

Write program code to store the binary tree as a 1D array of records.

Each record should contain a pointer to the node on its left, a pointer to the node on its right and its data.

Store the binary tree shown in the array.

**TASK 2.4**

Write program code to add a new data item to the binary tree.

**TASK 2.5**

Write program code to find the position of a specific colour in the binary tree.

**TASK 2.6**

Write program code to output the contents of the binary tree in alphabetical order.

### TASK 3 – Object-oriented programming (OOP)

A virtual shop in a computer game sells a range of tools such as a spade and a screwdriver.

The tools are stored on shelves in the virtual shop.

#### TASK 3.1

The program needs a class for the tools.

The information stored about each tool must include:

- name
- cost
- image file name (e.g. 'spade.jpeg').



**Key focus:**  
Creating classes

Write program code for the class tools.

The constructor should take all of the attributes as parameters.

Write program code for the attributes and the constructor method.

#### TASK 3.2

Write program code to create a get and set method for each of the tool attributes.

#### TASK 3.3

The program needs a class for the shelves in the store.

Each shelf has the following information:

- position of the shelf on the wall (between 0 and 4)
- array of objects of type tool (maximum of 10 items per shelf).

Write program code for the class shelves.

The constructor should set the position of the shelf but should not set any tools.

Write program code for the attributes and the constructor method.

#### TASK 3.4

Write program code for a set method to add a new tool to the shelf in the next available position.

#### TASK 3.5

Write program code to define a procedure that takes a shelf object as a parameter and outputs the name and cost of each tool on that shelf.



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