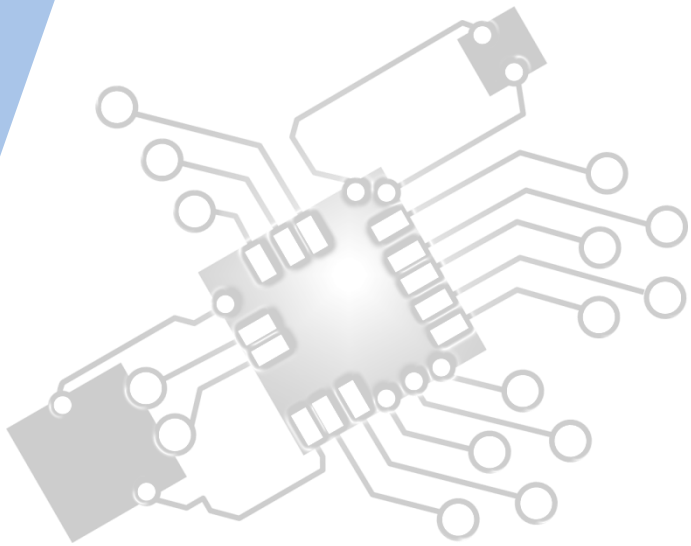
Computational thinking, problem-solving and programming:

Connecting computational thinking and program design

IB Computer Science



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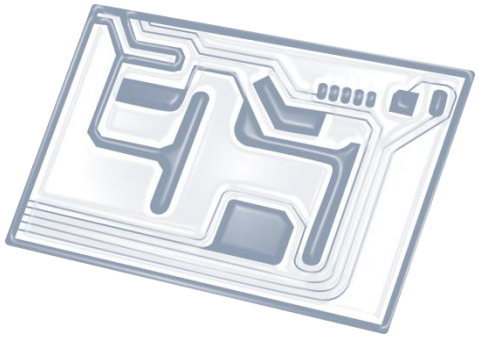
HL Topics 1-7, D1-4



1: System design

2: Computer Organisation

3: Networks

4: Computational thinking

5: Abstract data structures

6: Resource management

7: Control

D: OOP

HL & SL 4.2 Overview

4.2.1 Describe the characteristics of standard algorithms on linear arrays

4.2.2 Outline the standard operations of collections

4.2.3 Discuss an algorithm to solve a specific problem

4.2.4 Analyse an algorithm presented as a flow chart

4.2.5 Analyse an algorithm presented as pseudocode

4.2.6 Construct pseudocode to represent an algorithm

4.2.7 Suggest suitable algorithms to solve a specific problem

4.2.8 Deduce the efficiency of an algorithm in the context of its use

4.2.9 Determine the number of times a step in an algorithm will be performed for given input data

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Topic 4.2.2

Outline the **standard operations** of **collections**

Collections?

- As far as the IB is concerned, collections are **UNORDERED** lists usually of **UNKNOWN length** or size.
- In practice we usually program collections using **`LinkedLists`** in Java.
- This means that we must remember there are a few things that LinkedLists **CAN** do that collections **CANNOT**.

Standard collection operations

`.addItem( data )` = add data item to the collection

`.resetNext()` = start at the beginning

`.hasNext()` → tells whether there is another item in the list

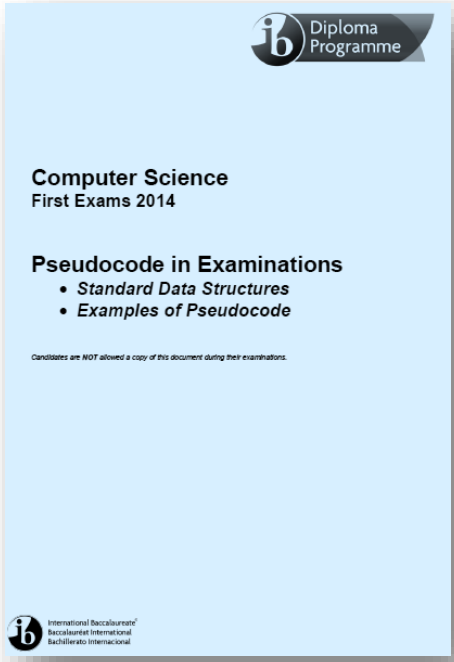
`.getNext()` → retrieves a data item from the collection

`.isEmpty()` → check whether collection is empty

Be careful not to use methods not on this list, like .size() or .length()

ONLY these methods are allowed

IB: Collection methods



Collections

Collections store a set of elements. The elements may be of any type (numbers, objects, arrays, Strings, etc.).

A collection provides a mechanism to iterate through all of the elements that it contains. The following code is guaranteed to retrieve each item in the collection exactly once.

```
// STUFF is a collection that already exists
STUFF.resetNext()
loop while STUFF.hasNext()
    ITEM = STUFF.getNext()
    // process ITEM in whatever way is needed
end loop
```

Method name	Brief description	Example: HOT, a collection of temperatures	Comment
`addItem()`	Add item	`HOT.addItem(42)` `HOT.addItem("chile")`	Adds an element that contains the argument, whether it is a value, String, object, etc.
`getNext()`	Get the next item	`TEMP = HOT.getNext()`	`getNext()` will return the first item in the collection when it is first called. Note: `getNext()` does not remove the item from the collection.
`resetNext()`	Go back to the start of the collection	`HOT.resetNext()` `HOT.getNext()`	Restarts the iteration through the collection. The two lines shown will retrieve the first item in the collection.
`hasNext()`	Test: has next item	`if HOT.hasNext() then`	Returns TRUE if there are one or more elements in the collection that have not been accessed by the present iteration: The next use of `getNext()` will return a valid element.
`isEmpty()`	Test: collection is empty	`if HOT.isEmpty() then`	Returns TRUE if the collection does not contain any elements.

Collections (Pseudocode)

```
NAMES = new Collection()
NAME = ""
loop while NAME <> "quit"
   input NAME
   if NAME <> "quit" then
       if NAMES.contains(NAME) then
           output NAME , " returned"
           NAMES.remove(NAME)
       else
           output NAME , " is leaving"
           NAMES.addItem(NAME)
       end if
   end if
end loop

output "The following students left and did not return"

NAMES.resetNext()
loop while NAMES.hasNext()
   output NAMES.getNext()
end loop
```

Task:
This program inputs NAMES of students who are leaving school early - for example to visit the doctor.
The names are collected in a Collection list.
When a student returns, tying the same name again removes that name from the list. At the end of the day, the secretary types "quit" to end the program and see a list of all students who left but did not return.