Unit 2: Algorithms 1

Term	Definition
Algorithm	In programming, an algorithm is a set of instructions that can be used to solve a given problem.
Pseudo code	A notation resembling a simplified programming language that is used in designing computer programs.

When writing an algorithm, the instructions must be clear and in the correct order to produce the required solution to the given problem.

Algorithms are written in pseudo code. The pseudo code will be presented using the following conventions:

Construct	Example usage
Declare subroutines	`Declare CapitalLetterOfName` `End Subroutine`
Call a subroutine	`call SubroutineNeeded`
Declare and use arrays	`myarray[99]`
Literal outputs	`output "Please enter a number"`
Variable names	`myvariable`
Define variable data type	`myvariable is integer`
Data types	`integer, character, string, boolean`
Assignment	`set counter = 0`
Selection	`if . . . else . . . end if`

Indent at least single space after if or do or repeat etc.	`if counter = 1`
	`  output counter`
	`end if`

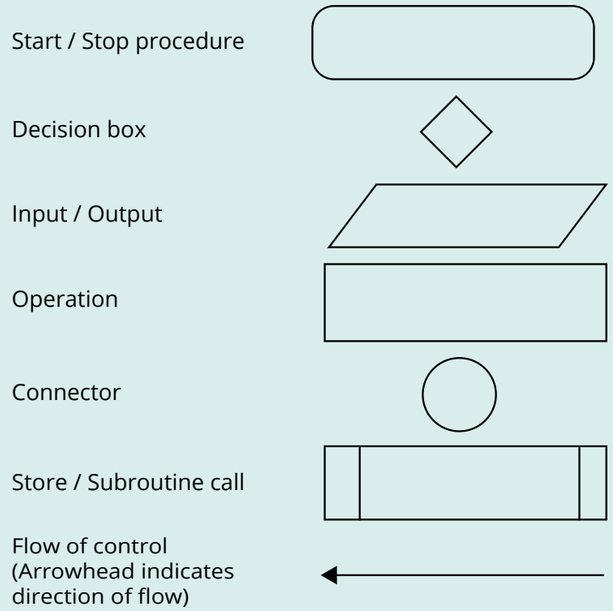
Annotation	`(Some annotation goes here)`
Comments (for Java only)	`/** Comments for Java **/`

Repetition	`for i . . . next i`
	`repeat . . . until`
	`do . . . loop`
	`do . . . while`
	`while . . . repeat`

Logical operators `AND NOT XOR` will be upper case

Logical `TRUE` and `FALSE` will be upper case

Algorithms can also be presented using flowcharts.



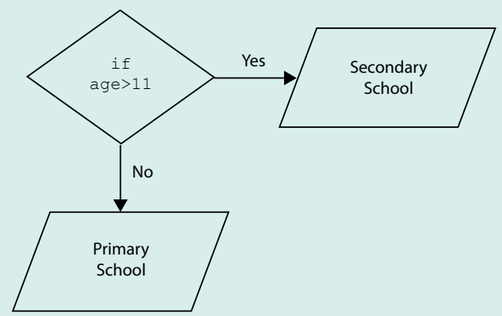
Sequence, selection and iteration

Algorithms consist of series of instructions in a specific order. This is the order or sequence in which the instructions must be carried out for the algorithm to work.

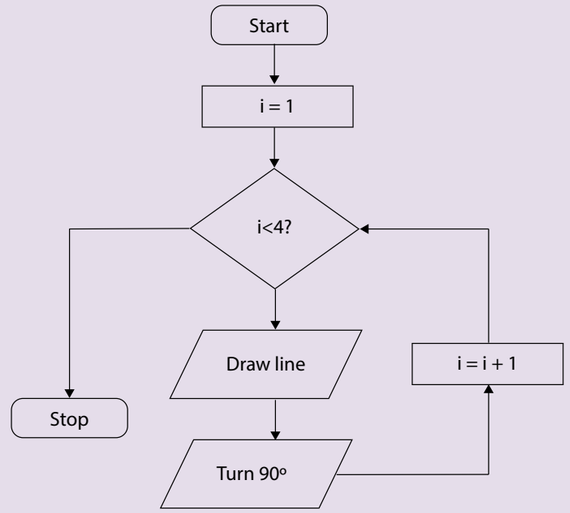
A selection instruction is one where a decision must be made. An instruction in an algorithm will give different options for the next instruction.

If a set of steps to be carried out more than once or many times. This is called iteration and often referred to as a loop in the program.

```
if age > 11 then
     print "Secondary school"
else
     print "Primary School"
     end if
```



If a program must repeat a set of instructions four times, we can use a '`for i…next`' loop.



Using count and rogue values with loops

All loops must eventually be terminated.

If a loop must be repeated a known number of times, a count can be used. When the count reaches the required number, the loop will terminate.

```
count = 0

repeat
   input data
   count = count + 1
until count = 10
```

A rogue value is a value that falls outside the range of possible values for the data being processed that will cause the loop to terminate.

```
total = 0

repeat
   input age
   if age > 0 then
        total = total + age
   end if
until age = -1
```

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String handling

Term	Definition
String	A string is a sequence of keyboard characters.
String handling	Manipulating data in a string. e.g. selecting first three characters.

The following conventions will be used for string handling.

Construct	Example usage
Variable names	`myvariable`
Define variable as string	`myvariable is String`
Length of string	`len (string)`
Mid string where x is the offset and y is the length	`mid (string, start, length)`
Replace part of a string	`replace (string, find, replacewith)`
Compare two strings	`str(Comp (string1, string2)`

To create a string, we need to define a variable as a string and assign a value to the variable.

```
greeting is String
greeting = "Hello from me!"
print greeting
```

Hello from me!

To find out how many characters are in a string, use the 'len' command. Any keyboard stroke is counted as a character, so spaces and special characters are counted as well as letters and numbers.

```
greeting is String
greeting = "Hello from me!"
length = len(greeting)
print length
```

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To discover the contents of all or part of a string, the 'mid' command is used.

```
txt is String
partMessage is String
txt = "Have a happy birthday"
partMessage = mid(txt, 8, 5)
print partMessgae
```

happy

The 'replace' command is used o replace part of a string.

```
txt is String
message is String
txt = "Have a happy birthday"
message = replace(txt, "happy",
"fantastic")
print message
```

Have a fantastic birthday

The process of combining a string with text or combining two strings with or without additional text is called concatenation.

```
txt1 is String
txt2 is String
concatString is String
txt1 = "Sarah"
txt2 = "Smith"
print "Welcome " & txt1 & txt2
```

Welcome Sarah Smith

Sorting and Searching

Term	Definition
Sorting	In computer science, arranging in an ordered sequence is called sorting.
Searching	To examine data in a file to find items that match given criteria.

Sorting

The two sorting algorithms required for this qualification are the bubble sort and the merge sort.

```
Declare BubbleSort(bubbleList):
     exchanges = True
     passnum = len(bubbleList)-1
     while passnum > 0 and exchanges = True
          exchanges = False
          for i = 1 to n
               if bubbleList[i]>bubbleList[i+1]:
                    exchanges = True
                    temp = bubbleList[i]
                    bubbleList[i] = bubbleList[i+1]
                    bubbleList[i+1] = temp
               end if
          next i
          passnum = passnum-1
     end while
end Subroutine

bubbleList=[20,30,40,90,50,60,70,80,100,110]
BubbleSort(bubbleList)
print(bubbleList)
```

The two searching algorithms required for this qualification are the linear and the binary search. The linear search is a very simple search algorithm. Each item in the data set is compared with the search condition in sequence until the item is found or the end of the data set is reached.

```
Declare linearSearch(dataList, searchItem)

position = 0
found = false

while position < len(dataList) and found = false
     if dataList[position] = searchItem then
          found = true
     else
          position = position + 1
     end if
end while

testList = [1,3,21,45,57,17,34,65]
linearSearch(testList, 45)
linearSearch(testList, 20)
```

Details of the merge sort and the binary search are included in the WJEC Notes.