

0 1

A queue data structure can be implemented as a static data structure using an array.

Figure 1 shows data that has been stored in a stack implemented using an array *S*.

Figure 1

[7]		
[6]		
[5]		
[4]		
[3]		
[2]	Jib	Top = 2
[1]	Skye	
[0]	Harry	

0 1 . 1

What value will be returned by applying the `peek` operation to *S*?

[1 mark]

0 1 . 2

What value will be returned by applying the `pop` operation to *S*?

[1 mark]

0 1 . 3

Explain how a single stack can be used to reverse the order of the items in a queue.

[2 marks]

02

Figure 3 shows a graph containing five nodes. **Figure 4** shows how the graph in **Figure 3** could be represented using three one-dimensional arrays: Data, Dir1 and Dir2.

Figure 3

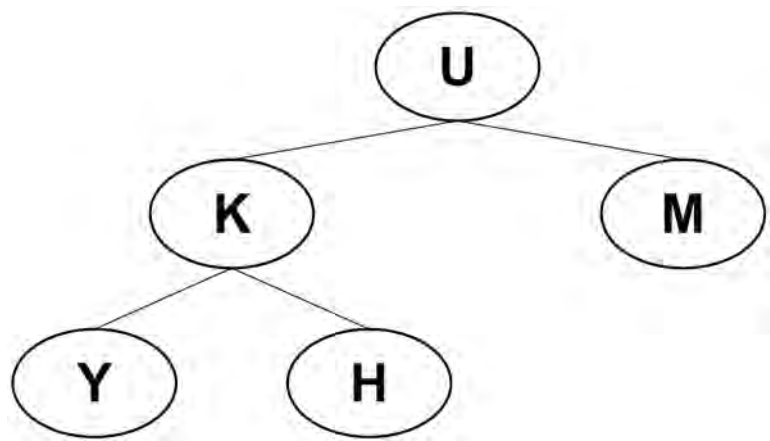


Figure 4

Index	Data	Dir1	Dir2
[0]	U	1	4
[1]	K	2	3
[2]	Y	-1	-1
[3]	H	-1	-1
[4]	M	-1	-1

02.1

The graph in **Figure 3** is a binary tree. A binary tree is a rooted tree where each node has at most two child nodes.

There are three properties that a graph needs to have for it to be a tree. One of those properties is that it contains no cycles.

State the other **two** properties of this graph that make it a tree.

[2 marks]

Figure 5 contains pseudo-code for an algorithm that uses the arrays in **Figure 4**.

Figure 5

```

Done ← False
Pos ← -1
Current ← 0
WHILE Done = False
    WHILE Current ≠ -1
        Pos ← Pos + 1
        Temp[Pos] ← Current
        Current ← Dir1[Current]
    ENDWHILE
    IF Pos = -1 THEN
        Done ← True
    ELSE
        OUTPUT Data[Temp[Pos]]
        Current ← Dir2[Temp[Pos]]
        Pos ← Pos - 1
    ENDIF
ENDWHILE

```

0 2 . 2 Complete the unshaded cells in **Table 1** to show the result of tracing the algorithm shown in **Figure 5** using the arrays in **Figure 4**.

Table 1

[illegible]

Copy the contents of the unshaded cells in **Table 1** into the table in your Electronic Answer Document.

0 2 . 3 The array Temp needs to be able to store three values when used with the binary tree shown in **Figure 3**, on page 6.

For some binary trees with only five nodes, the array Temp would need to be able to store five values.

Describe the structure of a five-node binary tree that would require Temp to be able to store five values.

[2 marks]

0 2 . 4 State the type of data structure the algorithm shown in **Figure 5** implements using the array Temp.

[1 mark]

0 2 . 5 Describe the changes that need to be made to the algorithm shown in **Figure 5** so that the order that the data values are output in is reversed.

In your answer, you should only describe changes to the existing lines of code in the algorithm; you must **not** suggest the addition of extra lines of code.

[1 mark]