

0	1
---	---

The algorithm in **Figure 2** is a sorting algorithm.

- Array indexing starts at 0.
- Line numbers are included but are not part of the algorithm.

**Figure 2**

```

1  arr ← [4, 1, 6]
2  sorted ← false
3  WHILE sorted = false
4      sorted ← true
5      i ← 0
6      WHILE i < 2
7          IF arr[i+1] < arr[i] THEN
8              t ← arr[i]
9              arr[i] ← arr[i+1]
10             arr[i+1] ← t
11             sorted ← false
12         ENDIF
13         i ← i + 1
14     ENDWHILE
15 ENDWHILE

```

0	1
---	---

 . 

1
---

State the data type of the variable `sorted` in the algorithm shown in **Figure 2**.

**[1 mark]**

---

0	1
---	---

 . 

2
---

The identifier `sorted` is used in the algorithm shown in **Figure 2**.

Explain why this is a better choice than using the identifier `s`.

**[2 marks]**

---



---



---



---



0	1
---	---

.

5
---

Fill in the values in the boxes to show how the merge part of the merge sort algorithm operates. The first and last rows have been completed for you.

**[3 marks]**

7	3	4	1	2	8	5	6
---	---	---	---	---	---	---	---

--	--	--	--	--	--	--	--

--	--	--	--	--	--	--	--

1	2	3	4	5	6	7	8
---	---	---	---	---	---	---	---

0	1
---	---

.

6
---

State **one** advantage of the merge sort algorithm compared to the sorting algorithm in **Figure 2**.

**[1 mark]**

---



---

0	1
---	---

.

7
---

A programmer implementing the algorithm in **Figure 2** decided to create it as a subroutine. Line 1 was removed and the array `arr` was made a parameter of the subroutine.

State **two** reasons why the programmer decided to implement the algorithm as a subroutine.

**[2 marks]**

Reason 1: 

---

---

Reason 2: 

---

---

0	2
---	---

Show the steps involved, for either the bubble sort algorithm **or** the merge sort algorithm, to sort the array shown in **Figure 6** so the result is [1, 4, 5, 8]

**Figure 6**

[8, 4, 1, 5]

**Circle** the algorithm you have chosen:

Bubble sort

Merge sort

**[4 marks]**

Steps:

0	3
---	---

**Figure 13** shows an algorithm represented in pseudo-code. A developer wants to check the algorithm works correctly.

- Line numbers are included but are not part of the algorithm.

**Figure 13**

```
1  arr[0] ← 'c'
2  arr[1] ← 'b'
3  arr[2] ← 'a'
4  FOR i ← 0 TO 1
5      FOR j ← 0 TO 1
6          IF arr[j + 1] < arr[j] THEN
7              temp ← arr[j]
8              arr[j] ← arr[j + 1]
9              arr[j + 1] ← temp
10         ENDIF
11     ENDFOR
12 ENDFOR
```

03.1

Complete the trace table for the algorithm shown in **Figure 13**.

Some values have already been entered. You may not need to use all the rows in the table.

[6 marks]

arr			i	j	temp
[0]	[1]	[2]			
c	b	a			

03.2

State the purpose of the algorithm.

[1 mark]

---

---

---

**0 3 . 3** **Figure 13** has been included again below.

**Figure 13**

```
1  arr[0] ← 'c'
2  arr[1] ← 'b'
3  arr[2] ← 'a'
4  FOR i ← 0 TO 1
5      FOR j ← 0 TO 1
6          IF arr[j + 1] < arr[j] THEN
7              temp ← arr[j]
8              arr[j] ← arr[j + 1]
9              arr[j + 1] ← temp
10         ENDIF
11     ENDFOR
12 ENDFOR
```

An earlier attempt at writing the algorithm in **Figure 13** had different code for **lines 4** and **5**.

**Lines 4** and **5** of the pseudo-code were:

```
FOR i ← 0 TO 2
    FOR j ← 0 TO 2
```

Explain why the algorithm did not work when the value 2 was used instead of the value 1 on these two lines.

**[1 mark]**

---

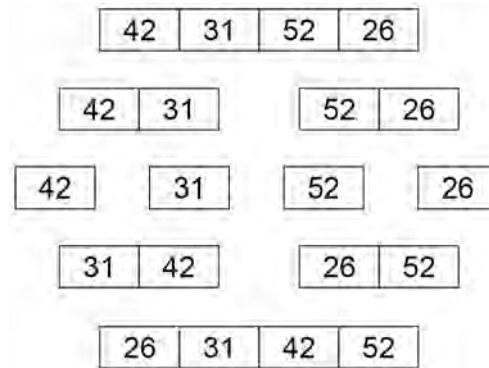
---

---

0	4
---	---

**Figure 7** shows a merge sort being carried out on a list.

### Figure 7



Explain how the merge sort algorithm works.

**[4 marks]**

[illegible]



0	5
---	---

Fill in the blank arrays to show the steps involved in applying the bubble sort algorithm to the array  $[3, 5, 1, 4, 2]$ . You only need to show the missing steps where a change is applied to the array.

**[5 marks]**

3	5	1	4	2
1	2	3	4	5