

1. A games company has developed a game called Kidz Arrowz. The players throw an arrow at a target board and are awarded different points depending on which circle the arrow lands. Fig. 1 shows the board.

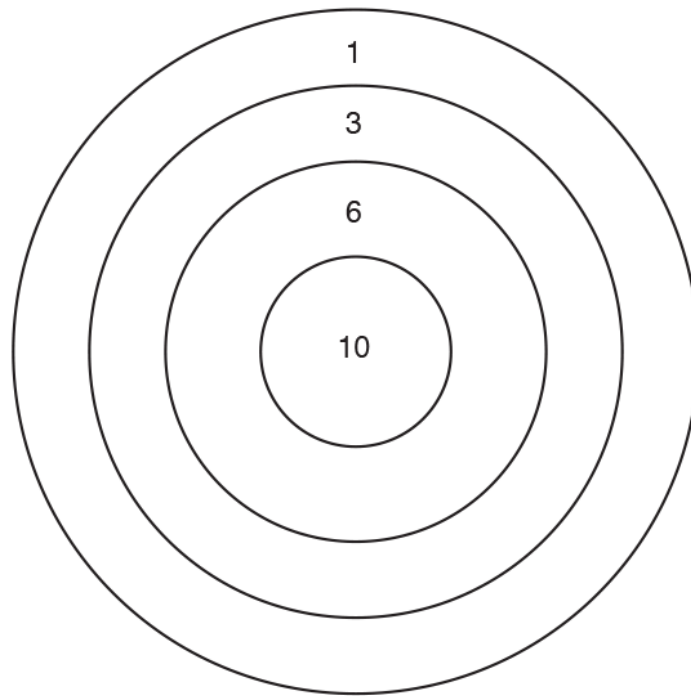


Fig. 1

A computer program is required to keep track of the scores for each competition. The user will enter the number of players, and the name of each player, in that competition to a maximum of 10.

- (i) The programmer has decided to use a bubble sort to sort the players' scores in descending order of score.

Describe the disadvantages of using a bubble sort.

[6]

(iv) An alternative sorting method is the insertion sort.

A procedure, `insertionSort`, has been written to sort an array `numbers`. The procedure is incomplete.

Complete the procedure.

```
procedure insertionSort()  
  for count = 0 to numbers.length - 1  
    position = .....  
    while position > 0 and numbers[position] < numbers[position-1]  
      temp = .....  
      numbers[position-1] = .....  
      numbers[position] = temp  
      position = .....  
    endwhile  
  next count  
endprocedure
```

[4]

3.

(i) Describe how an insertion sort is performed.

[3]

(ii) Demonstrate an insertion sort to place the following numbers into descending numerical order.

12 7 4 5 26

[4]

END OF QUESTION PAPER

Question		Answer/Indicative content	Marks	Guidance
1	i	1 mark per bullet to max 2 <ul style="list-style-type: none"> • Bubble sort is an inefficient algorithm... • Meaning it will take more time/processing cycles to sort the list. • Generally outperformed by Insertion sort/quick sort/ merge sort (accept any other sensible sorting algorithm) • The item to be sorted is at the end of the list (and so can only move back one place per pass) which is the worst case scenario for bubble sort. 	2 AO1.2 (1) AO2.2 (1)	<u>Examiner's Comments</u> Most candidates identified the inefficiency of the bubble sort but fewer could expand upon this.
	ii	There are only a small number of data items	1 AO2.2 (1)	<u>Examiner's Comments</u> Most candidates correctly identified that that the list to sort was small.
	iii	1 mark per bullet to max 6 <ul style="list-style-type: none"> • Procedure declaration • Outer loop until no swaps made using flag • Inner loop to iterate through the list... • ...allowance for largest value at end (in bounds) • Comparing elements • Swapping elements e.g. <pre> procedure sortScores() do sorted = true for j = 0 to 19 if scores[j].totalScore > scores[j+1].totalScore then temp = scores[j+1] scores[j+1] = scores[j] scores[j] = temp sorted = false endif next j until sorted = true endprocedure </pre>	6 AO1.2 (2) AO2.2 (1) AO3.2 (3)	<u>Examiner's Comments</u> Those candidates who had learnt the standard sorting algorithms had little difficulty producing good pseudocode for the bubble sort. Unfortunately, many candidates had not learnt the code for the standard algorithms.

Question		Answer/Indicative content	Marks	Guidance																																																								
	iv	<p>1 mark for each completed space</p> <pre> procedure insertionSort() for count = 0 to numbers.length-1 position = count while position > 0 and numb ers[position]<numbers[position- 1] temp = numbers[position-1] numbers[position-1] = numbers[position] numbers[position] = temp position = position-1 endwhile next count endprocedure </pre>	<p>4 AO2.2 (3) AO3.2 (1)</p>	<p>Examiner's Comments</p> <p>Candidates who were confident in analysing code often answered successfully and could calculate the correct way to index the <i>numbers[]</i> array.</p>																																																								
		Total	13																																																									
2		<p>1 mark for each correct swap identified/described</p> <table border="1"> <tbody> <tr><td>sheep</td><td>rabbit</td><td>dog</td><td>fox</td><td>cow</td><td>horse</td><td>cat</td><td>deer</td></tr> <tr><td>sheep</td><td>rabbit</td><td>fox</td><td>dog</td><td>cow</td><td>horse</td><td>cat</td><td>deer</td></tr> <tr><td>sheep</td><td>rabbit</td><td>fox</td><td>dog</td><td>horse</td><td>cow</td><td>cat</td><td>deer</td></tr> <tr><td>sheep</td><td>rabbit</td><td>fox</td><td>dog</td><td>horse</td><td>cow</td><td>deer</td><td>cat</td></tr> <tr><td>sheep</td><td>rabbit</td><td>fox</td><td>horse</td><td>dog</td><td>cow</td><td>deer</td><td>cat</td></tr> <tr><td>sheep</td><td>rabbit</td><td>fox</td><td>horse</td><td>dog</td><td>deer</td><td>cow</td><td>cat</td></tr> <tr><td>sheep</td><td>rabbit</td><td>horse</td><td>fox</td><td>dog</td><td>deer</td><td>cow</td><td>cat</td></tr> </tbody> </table>	sheep	rabbit	dog	fox	cow	horse	cat	deer	sheep	rabbit	fox	dog	cow	horse	cat	deer	sheep	rabbit	fox	dog	horse	cow	cat	deer	sheep	rabbit	fox	dog	horse	cow	deer	cat	sheep	rabbit	fox	horse	dog	cow	deer	cat	sheep	rabbit	fox	horse	dog	deer	cow	cat	sheep	rabbit	horse	fox	dog	deer	cow	cat	6	
sheep	rabbit	dog	fox	cow	horse	cat	deer																																																					
sheep	rabbit	fox	dog	cow	horse	cat	deer																																																					
sheep	rabbit	fox	dog	horse	cow	cat	deer																																																					
sheep	rabbit	fox	dog	horse	cow	deer	cat																																																					
sheep	rabbit	fox	horse	dog	cow	deer	cat																																																					
sheep	rabbit	fox	horse	dog	deer	cow	cat																																																					
sheep	rabbit	horse	fox	dog	deer	cow	cat																																																					
		Total	6																																																									

Question			Answer/Indicative content	Marks	Guidance																																																												
3		i	<ul style="list-style-type: none"> • One item at a time / serially ... • ...moved into correct position... • ...until all items in list checked 	3	<p>Do not allow swap(ped) or pivots</p> <p>Allow two lists.</p> <ul style="list-style-type: none"> • One item at a time taken from 1st list... • ...and inserted into 2nd list... • ...in the correct place. <p>Examiner's Comments</p> <p>There were quite a few very muddled answers to this question, those that were not muddled, were just plain wrong. A large proportion of candidates either were swapping for a bubble sort or using pivots; neither of which were what was required.</p>																																																												
		ii	<p>eg</p> <table border="1"> <thead> <tr> <th colspan="5">List 1</th> <th colspan="5">List 2</th> </tr> </thead> <tbody> <tr> <td>12</td><td>7</td><td>4</td><td>5</td><td>26</td> <td>12</td><td></td><td></td><td></td><td></td> </tr> <tr> <td>12</td><td>7</td><td>4</td><td>5</td><td>26</td> <td>12</td><td>7</td><td></td><td></td><td></td> </tr> <tr> <td>12</td><td>7</td><td>4</td><td>5</td><td>26</td> <td>12</td><td>7</td><td>4</td><td></td><td></td> </tr> <tr> <td>12</td><td>7</td><td>4</td><td>5</td><td>26</td> <td>12</td><td>7</td><td>5</td><td>4</td><td></td> </tr> <tr> <td>12</td><td>7</td><td>4</td><td>5</td><td>26</td> <td>26</td><td>12</td><td>7</td><td>5</td><td>4</td> </tr> </tbody> </table> <p>1 mark per correct row after row 1 in sequence to max 4</p>	List 1					List 2					12	7	4	5	26	12					12	7	4	5	26	12	7				12	7	4	5	26	12	7	4			12	7	4	5	26	12	7	5	4		12	7	4	5	26	26	12	7	5	4	4	<p>Method must be demonstrated somehow - circles, underlining, description e.g. "insert 12" etc</p> <p>Must be an insertion sort</p> <p>Do not allow swap(ped) or pivots</p> <p>Examiner's Comments</p> <p>Those who knew what an insertion sort was got this correct, a fair percentage used quick sorts or bubble sorts and as such did not receive any marks.</p>
List 1					List 2																																																												
12	7	4	5	26	12																																																												
12	7	4	5	26	12	7																																																											
12	7	4	5	26	12	7	4																																																										
12	7	4	5	26	12	7	5	4																																																									
12	7	4	5	26	26	12	7	5	4																																																								
			Total	7																																																													