MODULE L STANDARD ALGORITHMS · L2

Binary search

Original practice questions · 21 marks · ~25 minutes · OCR J277 spec 2.1.3

Name _____ Date _____

Instructions. Answer all questions in the spaces provided. The marks for each part are shown in brackets [ ]. The total for this worksheet is **21 marks**. Code on this sheet is written in OCR Exam Reference Language. You do **not** need to remember the code for a binary search.

1

Total: 4 marks

A garden centre's computer system holds three lists.

(a) Tick (✓) **one** box in each row to show whether a binary search could be used on the list **as it is now**. **[3]**

List	Yes	No
`4, 9, 15, 22, 31, 48`		
`"Ash", "Elm", "Fir", "Oak", "Pine", "Yew"`		
`12, 5, 18, 3, 27, 30`		

(b) Give the condition that a list must meet before a binary search can be used on it. **[1]**

2 **Total: 7 marks**

A warehouse robot keeps the codes of the parcels on its shelf in a sorted list:

```
103   118   125   140   152   167   171   186   194   205   219
```

When a list, or the part of a list still being searched, has an even number of items, the robot takes the item to the **left** of the centre as the middle item.

(a) Show how a binary search finds parcel **205** in the list. At each stage, give the middle item that is checked and the items that are discarded. **[4]**

(b) The robot then uses a binary search to look for parcel **130**, which is not in the list.

(i) Give the parcel codes that are checked, in the order they are checked. **[2]**

(ii) State how the binary search shows that parcel 130 is not in the list. **[1]**

3 **Total: 8 marks**

A sensor company stores the serial numbers of its devices in a sorted array called `codes`. The function `findCode()` looks for a serial number in the array. It returns the index where the number is stored, or -1. The array is indexed from 0.

```
01 function findCode(codes, target)
02     low = 0
03     high = codes.length - 1
04     while low <= high
05         mid = (low + high) DIV 2
06         if codes[mid] == target then
07             return mid
08         elseif codes[mid] < target then
09             low = mid + 1
10         else
11             high = mid - 1
12         endif
13     endwhile
14     return -1
15 endfunction
```

(a) Identify the searching algorithm used in `findCode()`. Give **one** reason from the code for your answer. **[2]**

Algorithm:

Reason:

(b) The array `codes` holds these values:

Index	0	1	2	3	4	5	6	7
Value	12	19	23	37	41	56	64	78

Complete the trace table for the function call `findCode(codes, 23)`. You may not need to use all the rows. **[4]**

low	high	mid	Value returned

(c) State the purpose of line 09. **[1]**

(d) State what it means when the function returns -1 at line 14. **[1]**

4 **Total: 2 marks**

A city library's system stores 100 000 book records, sorted by book number.

(a) Explain why a binary search would usually find a book record using far fewer comparisons than a linear search. **[2]**

Total for this worksheet: 21 marks