Computer Science (H046, H446)	
searching and sorting - Time complex Mr. Montgomery	xity
Please note that you may see slight differences between this paper and the original. Candidates answer on the Question paper.	Duration: Not set
OCR supplied materials: Additional resources may be supplied with this paper.	
Other materials required: Pencil Ruler (cm/mm)	

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Centre numbe	er	Candidate number		

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer all the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is 40.
- The total number of marks may take into account some 'either/or' question choices.

A 1-dimensional array stores a set of numbered cards from 0 to 7. An example of this data is shown in Fig in 4.1



Fig 4.1

The programmer wants to search for a specific card in the array.

State whether a binary search or a linear search would be the most appropriate method to search for a specific card, and justify your answer.

Search method Cinear Stach	
Justificatio	desta
n breeze seach only waster	1 or ordered took and
since to the data's not numerically	glowed since 2 is before 0
Quen Thurs Zis lover brown will	Art week linear works since
is Raslogly runs hough every yen	in the arm storting from 1/31 1
, ,	

2(a) Linear search and binary search are two different algorithms which can be used for searching arrays.

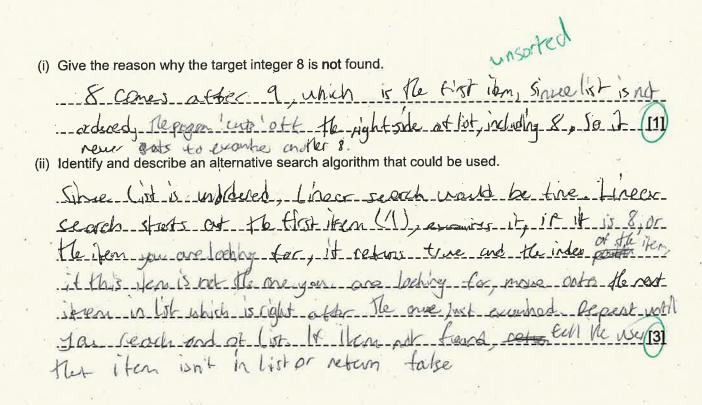
When comparing linear and binary search it is possible to look at the best, worst and average number of items in the array that need to be checked to find the item being searched for. Assume every item in the array is equally likely to be searched for.

Complete the table below

	Worst Case number of searches	Average Case	Best Case	
Binary Search	Olton 1) loan	Log ₂ (n)-1	1	
Linear Search	O(n) n	n/2	to (964) 1 -	

(b)	As the size of an array increases the average number of checks grows to meant by logarithmic growth.	ogarithmicall	y. State what is
	The increase haves each time, not necessarily		B.O.O
	not necessarily	haves	
, (ċ)	Assuming an array is sorted give a situation when a linear search would search.		er than a binary
	It the item you are looking for is & the wray (it is the smallest it to is tisst).	e Eint	Henri the

	A programmer has been tasked with writing a function that uses a binary search to return a Boolean
tun _	pseudocode, write an algorithm for the function. date them = integer (input C'enter number to secret (est))
4 1	- Procedure
	function bearpearch largy, requested ten)
	skurt-Panker 20
,	
	end Panter = length (arrang) -1
	middle Barler = Excet Panker + endpointer) p/V 2
	while start points = end pointer
	if array [state Ponk] = = requested less then
*! *	setura Ince true
	it requested been > array [mode Panter] Her
	Stratforber = maddle pointer +1
	middle Pohor = (Stort purper + Prod Pohor) DIV 2
	else
	end Birder = middle Painer -1
	middle partic = (Statpoint + endPoint) DIV 2
	and it
	exit
3	
	return the only runs it ikm not to in light
	end function [18]
	False B.O.O
E	8.0.0



(b) The target integer 8 exists in a list of integers 1, 4, 6, 9, 8, 12, 15 but is not found during a binary

search. There are no errors in the code.

4 A program needs to sort an array of lowercase strings into descending alphabetic order. An example of the data is shown in Fig. 4.1.

sheep rabbit dog fox cow horse cat do	еег
---------------------------------------	-----

espectue: sheep, radoit, horse, tox, dey, der, , con, , con Show how a bubble sort would sort the data in Fig. 4.1. person steep, sabot, deg, to, low, pose, just, dur Sleep, could, too, dog, here, con, deer, cot -perssz: -- sheep, robot, - Jan-jalag-, hore, tow, deer-, tout > Sheep, soublet, top, how, dog, deer, low, cost -Poss-3: -- Steep, - soublet-, for, horse, day, deer, -com, con-Thee , rabbit, herse, tet, deg, deer, con, cot -perss. Show, cabby hose, for, deg, don, conjust - Tesp, rabbit, have, ten, day, dier, con, cot. Since no wens pead table swapped in puss 5, the · Bubble sect our Through living inter each pass over by Kend [6] of each bus, at least 1 item will be in its flood and conserve position. You need to show lidentify every swap individually when showing how bubble sort works.

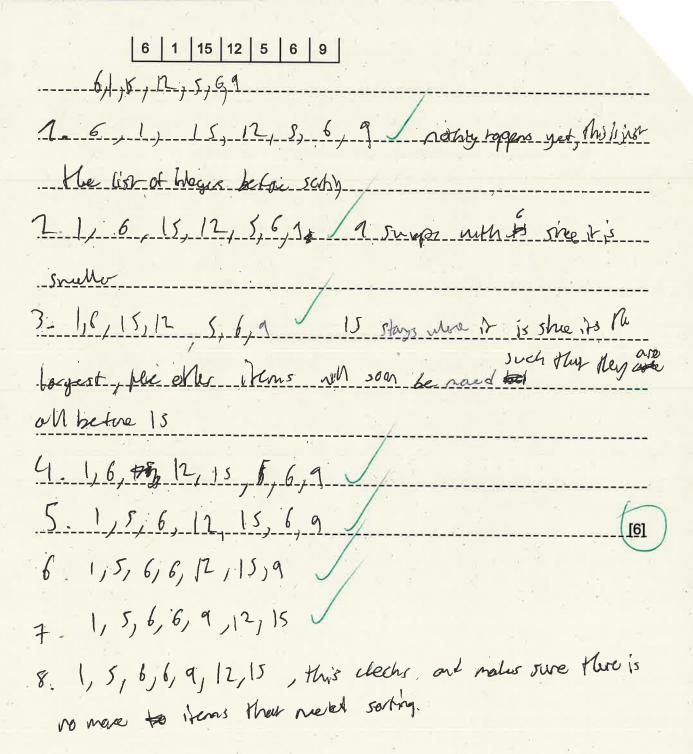
5(a) A programmer needs to sort an array of numeric data using an insertion sort.

(i) The following, incomplete, algorithm performs an insertion sort.

Complete the algorithm.



(ii) Show how an insertion sort would sort the following data:



(i) Using Big-O notation state the best case complexity of insertion sort.	
(26) $(2(n)$	([1]
(ii) Explain what your answer to part (b)(i) means.	
The best weeks is it the list is afrecedy serted, murin	¥
The algorith only has to run through the list which is n	Sprou
Mese nis the length of lity to make since the list is se	med
and That no more items need to be sugged I res	
Chaga while stands for best case in blg-0 notation	
Explain what linear time complexity (2)	[3]
means.	

END OF QUESTION PAPER

