PROGRESS OUTCOME 4

# Comparing search algorithms

## Annotation

Anahera recognises that computers need to search through a lot of data and that therefore it is very important to have fast and accurate algorithms to perform these tasks. She demonstrates her understanding by describing important factors that people rely on when searching for information on the Internet and the consequences of a slow or inaccurate search algorithm.

Anahera recognises that some algorithms perform better than others for a given search. She demonstrates her computational thinking skills by comparing linear and binary search algorithms and drawing conclusions about their efficiency.

## Background

Anahera's class has been learning about algorithms and how they relate to computer programs. They have developed and tested different algorithms for basic robotics tasks and discussed different contexts in which people depend upon fast, accurate searching and retrieval of data – searching the Internet for information, the supermarket checkout screen for prices, and so on. Before performing the investigation in this activity, the students trialled linear and binary search techniques by looking for numbers hidden under paper cups arranged in random order (representing a linear search) and sorted order (representing a binary search).

## Task

After watching a video on how a Google™ search works, the students answer questions on important factors for humans when searching for information on the Internet.

They then investigate the differences between linear and binary search algorithms by trying to guess the position of a selected word in unsorted and sorted lists of 25, 50, and 100 words. Using a spreadsheet, Ms Young reveals the word after each guess, and the students record the number of guesses it takes to find each answer.

| | Unsorted List | | Sorted List |
|---|---|---|---|
| 1 | aquatic | 1 | |
| 2 | acoustics | 2 | |
| 3 | complex | 3 | |
| 4 | muddle | 4 | |
| 5 | cooing | 5 | |
| 6 | cobweb | 6 | |
| 7 | merciful | 7 | |
| 8 | thoughtful | 8 | |
| 9 | permissible | 9 | |
| 10 | impulse | 10 | |
| 11 | long | 11 | |
| 12 | inconclusive | 12 | |
| 13 | spoon | 13 | alive |
| 14 | plausible | 14 | |
| 15 | marry | 15 | |
| 16 | mark | 16 | |
| 17 | embarrassed | 17 | amuck |
| 18 | nine | 18 | amusing |
| 19 | analyse | 19 | analyse |
| 20 | | 20 | anger |
| 21 | | 21 | |
| 22 | | 22 | |

| Search Words | How Many Guesses Unsorted | How Many Guesses Sorted |
|---|---|---|
| analyse | 19 | 5 |
| cave | | |
| belligerent | | |

After the students complete the investigation, they answer questions about linear and binary search algorithms.

## Student response

After watching the video on Google searches, Anahera gives the following answers to Ms Young's questions.

### Search Algorithms

One thing that computers need to do every day is search through a lot of data! Google Search is something we all depend upon to give us search results from the billions of web pages of information stored around the world.

Google dogs that are cute!!

All Images Videos News Maps More Settings Tools

About 3,420,000,000 results (0.79 seconds)

We have watched the Google Searching Algorithms video explaining the basics of their search algorithm works. Based on watching the video and your own experience with searching for information on the Internet, answer the following questions **in your own words**.

*What are some of the most important factors for humans when they are searching for some information on the Internet?*

I think the most important factors are:
- getting info-mation quickly because we dont have hours
- The wright info not something about cats if you said dogs
- not all over the page, easy to read in line.

*What would happen if Google used a different search algorithm that didn't meet the factors you listed above?*

- we would have to wait hours to find one thing.
- it would be inapropriate and not helpfull.
- We wouldnt use it
- would have lots of Bugs

Anahera records her results in the linear vs binary search activity on a template provided by Ms Young.

## Linear and Binary Search Algorithms

Two common search algorithms that are studied in computer science are Linear and Binary search. We are going to do an investigation into those two types of search algorithms, so you can determine which one would work the best in different situations.

We are going to place a guessing game using words that are in unsorted (random) and sorted (alphabetical order) lists. Pretend you are a computer using an algorithm to search for the word in each of the lists. Your teacher will reveal each word as per your instruction of where to search in the list.

Record how many guesses it took you to find the following words in the unsorted and sorted lists of **25 words**:

| Search Words | How Many Guesses Unsorted | How Many Guesses Sorted |
|---|---|---|
| grab | 6 | 7 |
| heavenly | 14 | 6 |
| greedy | 4 | 4 |

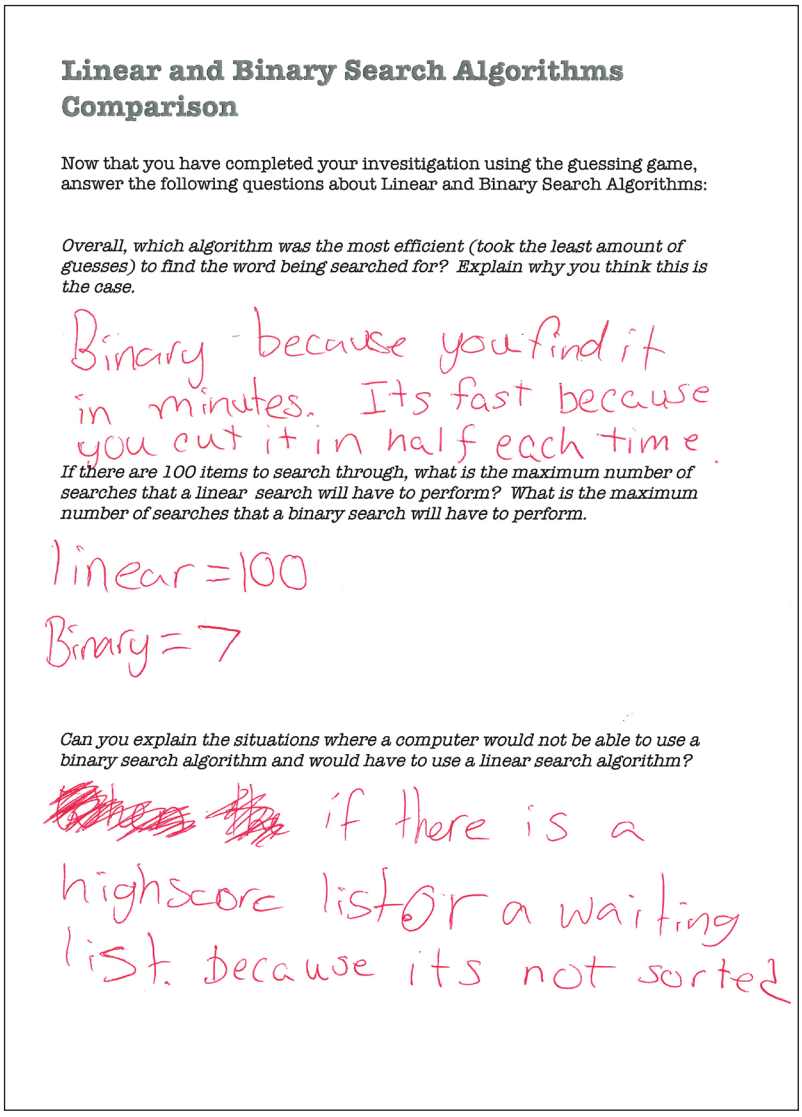
Record how many guesses it took you to find the following words in the unsorted and sorted lists of **50 words**:

| Search Words | How Many Guesses Unsorted | How Many Guesses Sorted |
|---|---|---|
| dislike | 45 | 4 |
| ear | 22 | 6 |
| clever | 14 | 5 |

Record how many guesses it took you to find the following words in the unsorted and sorted lists of **100 words**:

| Search Words | How Many Guesses Unsorted | How Many Guesses Sorted |
|---|---|---|
| cave | 1 ☺ LUCKY | 7 |
| analyse | 45 | 6 |
| belligerent | 67 ☹ | 4 |

Anahera gives the following answers to the questions on linear vs binary search algorithms.



## Linear and Binary Search Algorithms Comparison

Now that you have completed your invesitigation using the guessing game, answer the following questions about Linear and Binary Search Algorithms:

*Overall, which algorithm was the most efficient (took the least amount of guesses) to find the word being searched for? Explain why you think this is the case.*

Binary - because you find it in minutes. Its fast because you cut it in half each time.

*If there are 100 items to search through, what is the maximum number of searches that a linear search will have to perform? What is the maximum number of searches that a binary search will have to perform.*

linear = 100

Binary = 7

*Can you explain the situations where a computer would not be able to use a binary search algorithm and would have to use a linear search algorithm?*

[redacted] if there is a highscore list or a waiting list. because its not sorted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