Computing

Lesson 5: Binary Search

Algorithms

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Materials from the Teach Computing Curriculum created by the National Centre for Computing Education

Task 1 - Searching ordered cards

Binary search for a card

Follow the instructions below, filling in the table each time you perform a binary search. You can only turn over one card at a time.

1. Take ten cards and choose a card to search for.
2. Put the cards in order from lowest to highest.
3. Place eight of the ten cards face down in a single row without looking at them.
4. Perform a binary search for your chosen card and fill in the table.

Task 1 - Searching ordered cards

Run 1: What card are you searching for?

	Card at that position	Card found?
Position _		
Position _		
Position _		
Position _		

Task 1 - Searching ordered cards

Run 2: What card are you searching for?

	Card at that position	Card found?
Position _		
Position _		
Position _		
Position _		

Task 1 - Searching ordered cards

Run 3: What card are you searching for?

	Card at that position	Card found?
Position _		
Position _		
Position _		
Position _		

Task 1 - Searching ordered cards

How many cards did you have to look at in order to work out that it wasn’t in the set of cards?

Task 2 - Performing a binary search - Part 1

Searching for an instrument

Charlie has created a program that stores all the instruments that a music shop currently sells or hires out.

A sample of data is shown in **Figure 1**.

Banjo	Cello	Drums	Flute	Guitar	Harp	Oboe	Piano	Violin

Figure 1

Task 2 - Performing a binary search - Part 1

List the instruments that will be compared to the instrument ‘Harp’ when performing a binary search on the data shown in **Figure 1**.

List the instruments that will be compared to the instrument ‘Flute’ when performing a binary search on the data shown in **Figure 1**.

List the instruments that will be compared to the instrument ‘Trumpet’ when performing a binary search on the data shown in **Figure 1**.

Task 2 - Performing a binary search - Part 1

Describe the stages of a binary search to find the instrument ‘Drums’ when performing a binary search on the data shown in **Figure 1**.

Task 2 - Performing a binary search - Part 2

Best- and worst-case scenarios

The performance of an algorithm relates to the number of steps it takes to complete. For binary search, this depends on the number of comparisons that need to be made. The **best-case scenario** occurs when the item you are looking for results in the **smallest possible number of comparisons**.

Task 2 - Performing a binary search - Part 2

The **worst-case scenario** occurs when the item you are looking for results in the **greatest possible number of comparisons**.

Another sample of data is shown in Figure 2.

Crow	Deer	Eagle	Horse	Lion	Moose	Rhino	Tiger	Zebra

Figure 2

Task 2 - Performing a binary search - Part 2

Which animal would you search for to get the **best-case** scenario in **Figure 2**?

How many comparisons would need to be made in the **best-case** scenario in **Figure 2**?

Which animal could you search for to get the **worst-case** scenario in **Figure 2**?

How many comparisons would need to be made in the **worst-case** scenario in **Figure 2**?

Task 2 - Performing a binary search - Part 2

If the number of animals in **Figure 2** were doubled from 9 to 18, how many extra comparisons would need to be made at most? Why is that?