Lesson 2: Introduction to Binary Search

In this lesson, learners are introduced to binary search; the second and final searching algorithm they need to know about. They will go over the steps of carrying out a binary search, and perform a binary search with playing cards and with a sample of data.

Learners will be made aware that a binary search is only possible if the data is ordered, otherwise a linear search must be performed or the data must be sorted. This is a great opportunity to acknowledge one of the reasons why sorting algorithms are useful before being introduced to them in the future lessons.

They should also be able to identify why it is generally a more efficient algorithm than linear search when dealing with ordered data due to it’s “divide and conquer” nature. This should be made apparent to learners when going over the cup demonstration on the slides and when carrying out a binary search of their own with cards and a data sample.

One of the challenges learners can often be faced with is knowing what item to check when there is an even number of items. To make things clear without the need for a mathematical formula, the slides state that the middle-left item should be the next midpoint. In the next lesson, learners will be presented with the Python code for a binary search which uses the expression midpoint DIV 2 to clarify this middle-left choice.

## **Objectives:**

- Describe how binary search is used for finding the position of an item in a list of items.

- Perform a binary search to find the position of an item in a list.

- Identify scenarios when a binary search can and cannot be carried out.

## **Materials:**

- Slides or presentation on binary search

- Playing cards (optional)

- Sample data set (optional)

## **Bell-Ringer Activity:**

- Ask students to think about a time when they had to search for a specific item in a list or a group of items. How did they go about finding it? Did they use any specific strategies or algorithms?

## **Introduction:**

- Begin the lesson by discussing the concept of searching for an item in a list.

- Explain that there are different algorithms that can be used for searching, and today they will be learning about binary search.

- Emphasize that binary search is only possible if the data is ordered, otherwise a linear search must be performed or the data must be sorted.

- Connect this to the importance of sorting algorithms, which will be covered in future lessons.

## **Direct Instruction:**

- Present the steps of carrying out a binary search using slides or a presentation.

- Explain the "divide and conquer" nature of binary search and how it makes it more efficient than linear search when dealing with ordered data.

- Use a cup demonstration on the slides to visually explain the concept of dividing the data in half at each step of the search.

- Discuss the challenge of knowing what item to check when there is an even number of items and explain that the middle-left item should be the next midpoint.

- Mention that in the next lesson, they will be presented with the Python code for a binary search which uses the expression midpoint DIV 2 to clarify this middle-left choice.

## **Guided Practice:**

- Engage students in a binary search activity using playing cards and a sample data set.

- Divide the class into pairs or small groups and provide each group with a set of playing cards and a sample data set.

- Instruct them to perform a binary search to find the position of a specific card in the set.

- Circulate among the groups to provide guidance and support as needed.

## **Independent Practice:**

- Assign students a task to perform a binary search on their own using a different sample data set.

- They can use pen and paper or a computer program to carry out the search.

- Encourage them to reflect on the efficiency of binary search compared to linear search.

## **Exit Ticket:**

- Distribute exit tickets to assess students' understanding of binary search.

- Ask them to briefly explain the steps of binary search and provide an example of a scenario where binary search can and cannot be carried out.

## **Closure:**

- Review the key points covered in the lesson, including the steps of binary search and its efficiency compared to linear search.

- Emphasize the importance of ordered data for binary search and the need for sorting algorithms in certain scenarios.

- Preview the next lesson, where they will learn the Python code for a binary search.

## **Common Core Standards:**

- CCSS.ELA-LITERACY.RST.9-10.2: Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

- CCSS.ELA-LITERACY.RST.9-10.3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.