Introduction To Binary Search
Lesson Plan: Class 07 / ALG / 05

Overall goal of the lesson	To introduce the students to the binary search algorithm
Prior knowledge required	1) Played the number-guessing game before 2) Linear search of unsorted data

MODULE 1: **Module time:** 35 minutes

Goal:	Help the children learn the cut-in-half strategy for binary search of sorted data
Description:	The children have played the number-guessing game before. In this lesson, we talk about the strategies for reducing the number of questions required to find the number in that game. Through such discussion, we slowly "discover" the *cut-in-half* strategy. We then introduce binary search as the process of applying the cut-in-half strategy to the problem of searching sorted data.
Material required:	**Physical:** 1. One copy of worksheet per student 2. Pen/Pencil, eraser. **Electronic:** 1. Lesson presentation
Procedure Summary:	1. We go through the presentation, ensuring understanding by all the students and answering any questions from them. 2. We distribute the worksheets to the students after the presentation is done. 3. We help the students solve the problems in the worksheet.
Procedure Details:	**Slide 1:** Title Slide We greet the students and help them settle down. We then mention the topic of the lesson. **Slides 2-3:** A simple strategy for the number-guessing game We remember the number-guessing game and think about the no. of questions required to find the answer in the worst case. We begin with the simplest strategy of checking every number from 1-100. At the end of this part, we want to ensure that the children understand that we could need up to 100 questions to find the answer using this simple strategy. **Slides 4-5:** A slightly better strategy We improve upon our simple strategy by using the first question to find out if the number is odd or even. By now, the students should understand that we could need up to 51 questions to find the answer. **Slides 6-9:** A much better strategy of *cut-in-half* In the previous improvement, only our first question did better than the simple strategy. We now try to do better in each question and introduce the 'cut-in-half' strategy. After this part, the students should understand that the cut-in-half strategy reduces the size of the problem drastically with each question **Slides 10-11:** Midpoint calculation

	We now explain how to calculate the midpoint for the cut-in-half approach to prepare the students for the example that follows. **Slides 12-13**: Example showing the cut-in-half strategy in action Using the example of the number 42, we illustrate how the cut-in-half technique works. Slide 13 is the most important one in the presentation as it illustrates how the size of the problem reduces by half with each question. It is also essential for the students to understand it to enable them to solve the worksheets effectively. So, we must spend sufficient time on this part and ensure thorough understanding by the students, answering any questions they may have. **Slides 14-16:** Worst case for different problem sizes After understanding how the cut-in-half strategy works for numbers up to 100, we explore how many questions are needed for numbers up to 1024. We use inductive reasoning to find out the answer: start from numbers up to 2. We then go up to 4, 8 and so on until we reach 1024 and try to figure out how many questions are needed in each case. At the end of this part, the students should be able to understand that only one additional question is needed for each doubling of the problem size. **Slides 17-20**: Examples of searching problems with sorted and unsorted data After studying the worst case for the number-guessing game, we turn our attention to various examples of searching problems and learn that searching sorted data is easier than linear searching of unsorted data. **Slides 21-23**: Introduction to binary search With all the background information covered, we finally introduce binary search as the application of the cut-in-half strategy to the problem of searching sorted data! **Slide 24:** Summary The lesson is almost done. We take a moment to recap what we have learned so far. **Slide 25:** Conclusion We provide the students with a sneak peek of the next lesson, which will cover the details of binary search. Then, it is time for the worksheets! **Slide 26:** Thank you!