

Lesson #13-14: Linear & Binary Search/Tower Building

Overview

There are 3 different activities involved in this lesson beginning with the Tower Building Activity from the curriculum. From there, students will participate in two activities to demonstrate linear and binary search methods.

Lesson Summary

- **Tower Building Activity**
 - Students will begin class working on this activity with their table partner
 - Give them time to struggle and work through the problem
 - Once students begin to get the answer correctly and they start sharing the solution with those around them, move on to the next activity
- **Class discussion on the solution and how students got the solution**
 - *Some sort of manipulative would be good for students to demonstrate
 - *Legos or other manipulatives were not available to me, so I made a PPT with animations that show the solution so ALL students can understand
 - Students write down information on what linear and binary searches are
- **Linear vs Binary Search Efficiency Example**
 - Choose about 15 children to line up at the front of the classroom. Give each child a card (cards will have a random number on it ranging from 1-25). Keep the numbers hidden from the rest of the class.
 - Give another child a container with four or five sweets in it. Their job is to find a specific number. They can “pay” to look at a particular card. If they find the correct number before using all their sweets, they get to keep the rest.
 - Repeat if you wish to.
 - Now have the 15 students trade cards quietly and have the students sort themselves into ascending order. The searching process is repeated.
 - If the numbers are sorted, a sensible strategy is to use just one “payment” to eliminate half the children by having the middle child reveal their card. By repeating this process they should be able to find the number using only three sweets. The increased efficiency will be obvious.
- **Battleships-Linear vs Binary Search Activity**
 - **Linear Battleships**
 - Students will “play” with their table partner
 - One student has sheet 1A, the other sheet 1B.
 - Make sure they don’t show their game sheet to their

Objectives

Students will be able to:

- Describe a linear search
- Describe a binary search
- Explain conditions under which each search might be appropriate

Materials and Prep

- Tower Building Activity worksheet
- 15 Cards with various numbers ranging from 1 to 25
- Starburst candy (or any small individually wrapped candy)
- Linear Battleships worksheets
- Binary Battleships worksheets

Resources

Student Documents

- *Tower Building Worksheet*
- Linear Battleships game sheets
- Binary Battleships game sheets

Code Studio

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Video

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Assessments

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Notes

partner!

- Both students circle one battleship in the top two rows of ships on their game sheet and tell their partner its number (this is the battleship their partner is trying to find and “sink”
- Students take turns to guess where their partner’s ship is. (they say the letter name of a ship and their partner tells them the number of the ship at that letter.)
- How many shots does it take to locate your partner’s ship? This is your score for the game.
- Discussion Questions:
 - What would be the minimum and maximum scores possible? (They are 1 and 26 respectively, assuming that the children don’t shoot at the same ship twice. This method is called ‘linear search’, because it involves going through all the positions, one by one.)

○ Binary Battleships

- Repeat process above but with sheets 2A and 2B
 - The ships on these sheets are in ascending order this time
- Allow students to use any strategy they wish
- Discussion Questions:
 - What strategy did the low scorers use?
 - Which ship should you choose first? (The one in the middle tells you which half of the line the chosen ship must be in.) Which location would you choose next? (Again the best strategy is always to choose the middle ship of the section that must have the selected ship.)
 - If this strategy is applied how many shots will it take to find a ship? (Five at most).
 - This method is called ‘binary search’, because it divides the problem into two parts.
- Now that they are reminded about the binary search method, distribute sheets 2A’ and 2B’ to allow students to try again but this time stress that students use the binary search method and start with the ship in the middle
 - All students should have found their partner’s ship in 5 or less shots

CS Content

Provide a brief overview the CS content covered in this lesson.