Introduction to Binary Search

What is binary search?

You would not search for a student in a high school yearbook page by page, starting from the beginning

Because it is sorted, you can approach searching through it in a more efficient way

Similarly, a sorted data set allows the use of binary search

"Divide and Conquer" strategy

Repeatedly divides search interval in half until target value is found

Binary search analogy

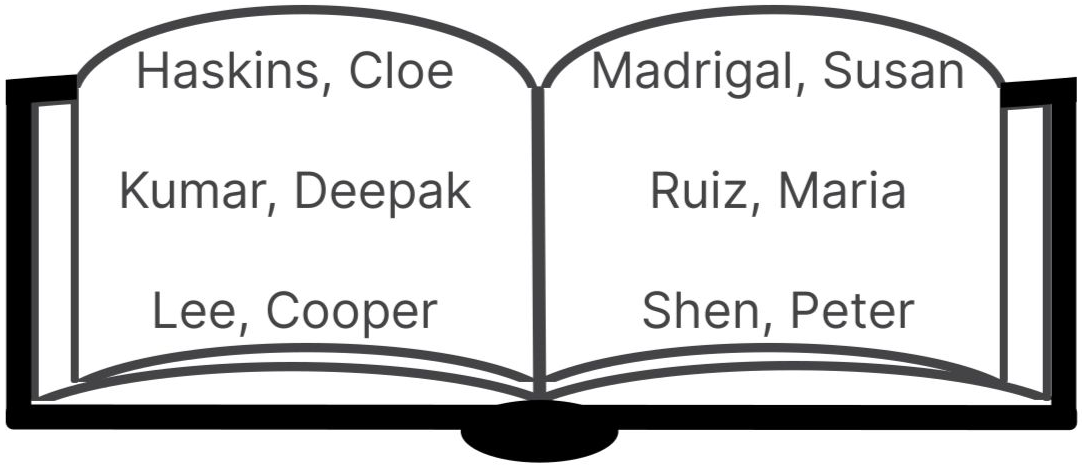
Looking for a student in yearbook

Open the yearbook to the middle of senior section

Compare target student's last name to one at the middle

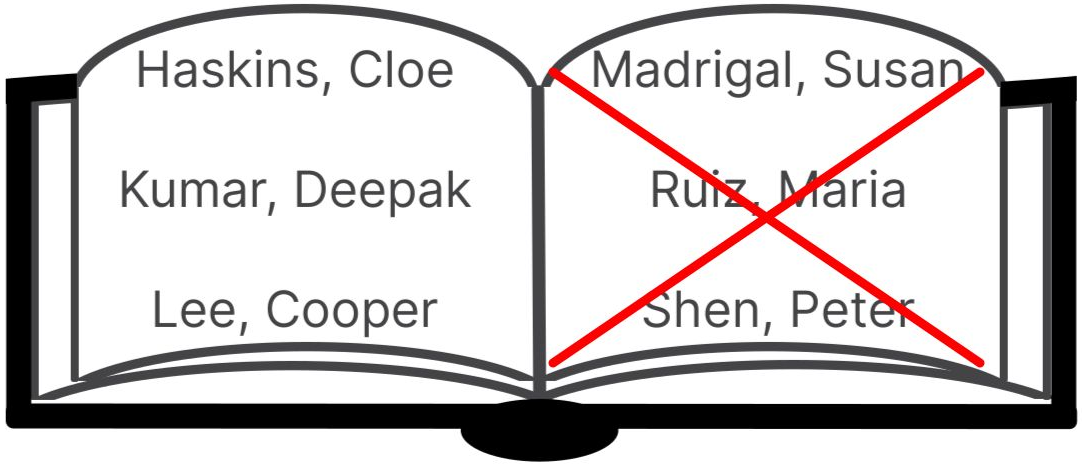
Binary search analogy

Target: Gibson



Binary search analogy

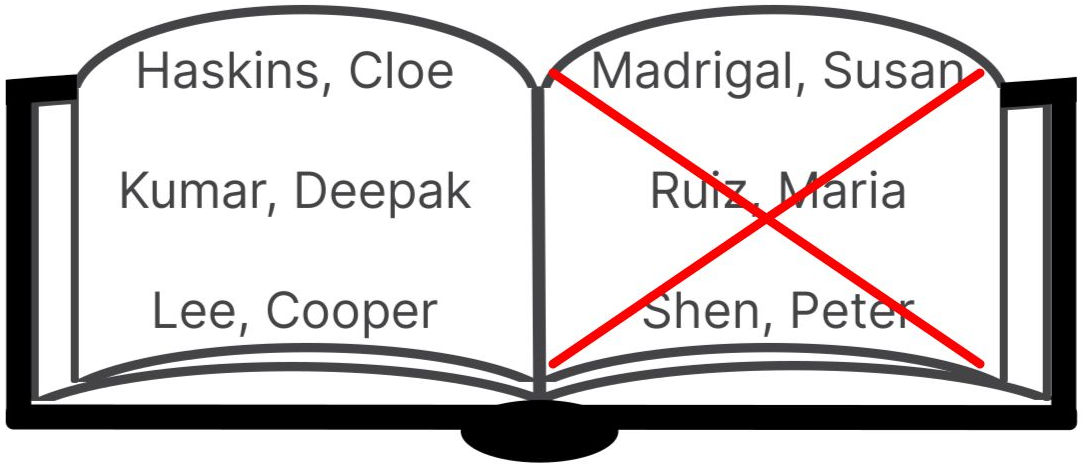
Target: Gibson



If target name comes alphabetically before it, discard the right half of the section

Binary search analogy

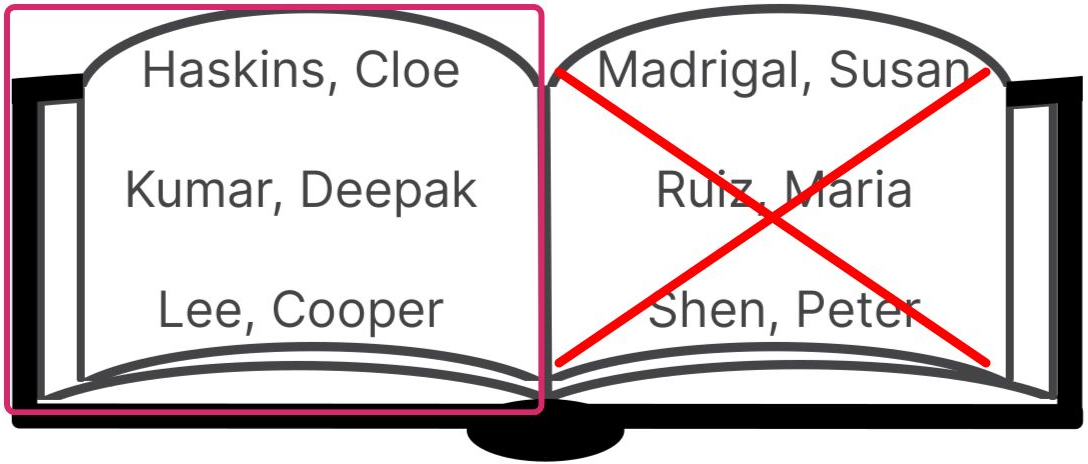
Target: Gibson



Left half becomes new search interval

Binary search analogy

Target: Gibson



Open yearbook to the middle of the new search interval, and repeat process until target is found

Binary search

Step one:
Find Lower Bound

Find Upper Bound

Find Pivot (middle index)

Check if Pivot value is equivalent to target value, if so, we are done

Target Value = 30

Binary search

Step two:
Compare target value with Pivot value:

If target value is higher than Pivot value, discard all lower values
If target value is lower than Pivot value, discard all higher values

Target Value = 30

Binary search

Step two:

Compare target value with Pivot value:

If target value is higher than Pivot value, discard all lower values
If target value is lower than Pivot value, discard all higher values

Target Value = 30

Binary search

Step two:

Compare target value with Pivot value:

If target value is higher than Pivot value, discard all lower values
If target value is lower than Pivot value, discard all higher values

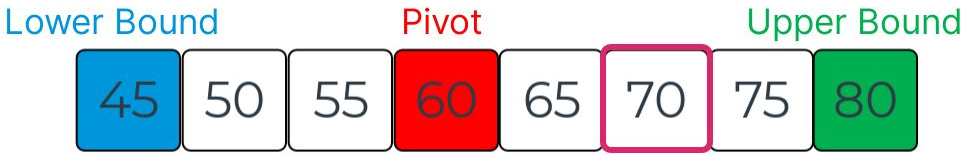
Target Value = 70

Binary search

Step two:
Compare target value with Pivot value:

If target value is higher than Pivot value, discard all lower values
If target value is lower than Pivot value, discard all higher values

Repeat steps 1 & 2 on new search interval



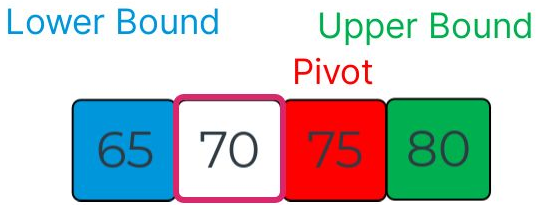
Target Value = 70

Binary search

Step two:
Compare target value with Pivot value:

If target value is higher than Pivot value, discard all lower values
If target value is lower than Pivot value, discard all higher values

Repeat steps 1 & 2 on new search interval



Target Value = 70

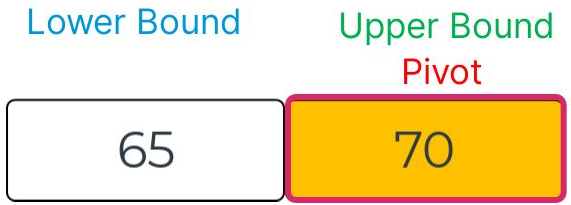
Binary Search

Step two:

Compare target value with Pivot value:

If target value is higher than Pivot value, discard all lower values
If target value is lower than Pivot value, discard all higher values

Return to step one



Target Value = 70