# MCAC 301: Design and Analysis of Algorithms

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# Can we search faster?

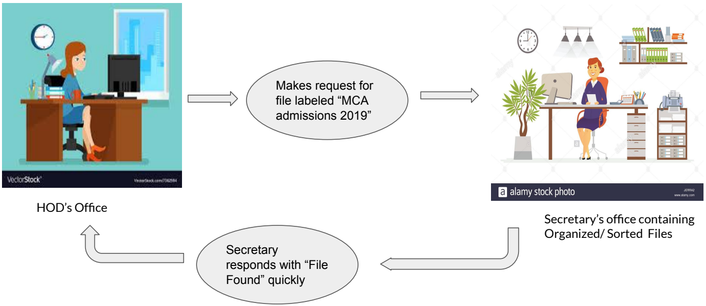


Figure A: Secretary at an office responding to the requests of the Head

1

# Searching for a word in a dictionary

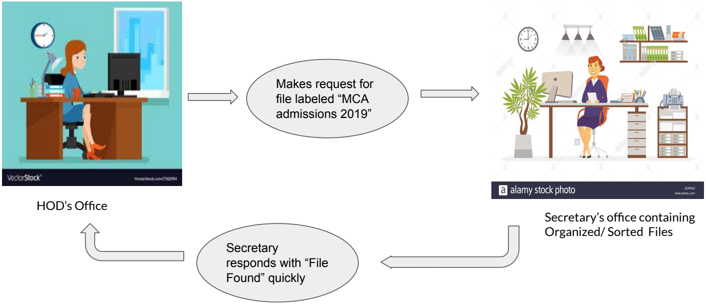


Figure A: Secretary at an office responding to the requests of the Head

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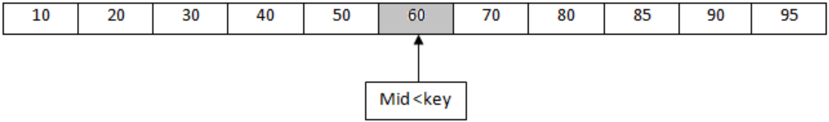
# Binary Search

**Key:** 65



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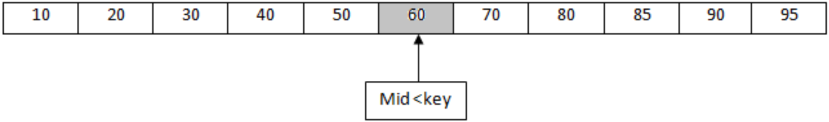

# Divide and Conquer Paradigm

1. Divide : Divide the problem into a number of subproblems of smaller Size.
2. Conquer : Solve each sub-problem.
3. Combine : Combine the solution of the subproblems to obtain the solution of the original (bigger) problem.

A subproblem is solved recursively (i.e. by applying the same algorithm on the smaller problem) so long as it's size $>$ some threshold (called the "terminating condition"). Thereafter, it is solved directly.

# Binary Search: Split in the middle

**input :** Array: $A[1 \dots n]$, $Key$
**output:** Index of key if key found, -1 otherwise

```
Binary-Search-Recursive(A, first, last, key)
/* "first" and "last" are the first and the last indices of the
   array
if first ≤ last then
    mid = (first + last)/2
    if A[mid]=key then
        return mid
    end
    if A[mid] < key then
        Binary-Search-Recursive(A, mid + 1, last, key)
    end
    else
        Binary-Search-Recursive(A, first, mid -1, key)
    end
end
```

# Frame Title

Quick Demo

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Let $B(n)$ be the number of comparisons performed by the binary search algorithm in best case. Then,

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$B(n) = 1$