Thinking Exercise

Compare Efficient Search

➪ Amortized efficiency

Assume a general sequence of keys.

Exercise
Compare in terms of efficiency. Suggest applications for each or situations where one could be preferred.

Binary, interpolation, BST

- ✎ Setup (preparation)
- ✎ Maintenance (insert/delete)
- ✎ Finds cost (first, a sequence) ◀

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Motivation: List Search

- ➪ **Review efficient search**
- ➪ **Analysis of approach**
  - ▸ ✎ Transform list instance
  - ✎ Transform data structure (later)
- ➪ **Problem transformation**

Seems some efficiency may be gained from a presort in case of a sequence of finds where a setup cost is amortized.

Transform-and-Conquer

Transform Instance

➪ Instance simplification

Find an instance from which it is easier to get the answer.

5 1 5 7 6 5 7 ✗

1 5 5 5 6 7 7

```
for $i \leftarrow 0$ to $n-2$ do
    for $j \leftarrow i+1$ to $n-1$ do
        if $A[i] = A[j]$ then
            return false
return true
```

Algorithm *PresortElementUniqueness*
Input $A[0..n-1]$
Output "true" if no equal elements, "false" otherwise

```
▶ sort the array $A$
for $i \leftarrow 0$ to $n-2$ do
    if $A[i] = A[i+1]$ then
        return false
return true
```

Efficiency?

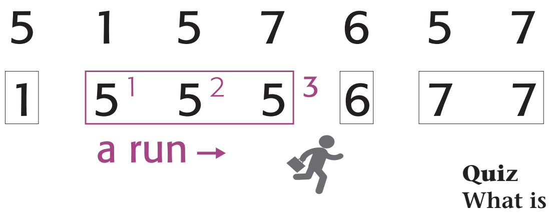
Transform to Simpler Instance
The Mode Statistic

Exercise
What’ the output for input: 5,7,1,5,7,6,5,7?

```
? Output  …  📖
Algorithm PresortMode
Input $A[0..n-1]$
? Output  …  📖
▶ 1: sort the array $A$
  2: $i \leftarrow 0$, $modefreq \leftarrow 0$
  3: while $i \le n-1$ do
  4:     $runlen \leftarrow 1$, $runvalue \leftarrow A[i]$
  5:     while $i + runlen \le n-1$ and $A[i+runlen] = runvalue$ do
  6:         $runlen \leftarrow runlen + 1$
  7:     if $runlen > modefreq$ then
  8:         $modefreq \leftarrow runlen$, $modevalue \leftarrow runvalue$
  9:     $i \leftarrow i + runlen$
 10: return $modevalue$
```

Loop 5-6 runs a variable number of times depending on input instance.

Quiz
Why consider basic (prefer) the highlighted operation?



Quiz
What is the mode?

Performance?

Transform to Simpler Instance
Compare to Brute Force

- Presort vs. arbitrary instance
- The mode statistic
- Search: amortized cost
- Form of instance simplification

Exercise
Compare to the brute force procedure described in textbook.

Exercise
Compare efficient search algorithms to sequential search.