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Variable Decrease-Conquer
Interpolation Search

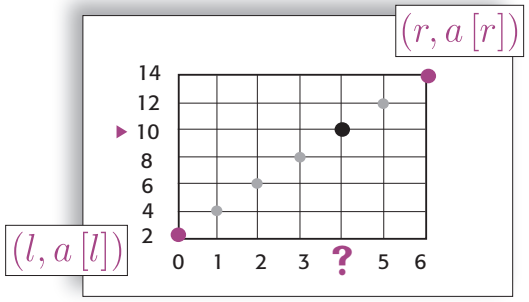
➪ **Order statistic**

➪ **Order statistic**

Quiz
What is the equation of the line passing through the points defined by the array index-value pairs?

Ideally,

$$a[\,] = \{2, 4, 6, 8, 10, 12, 14\}$$



Exercise
Use the formula to calculate the index of search key 10. Repeat for 9.

$$v = 10$$

$$x = l + \left\lfloor \frac{(v - a[l])(r - l)}{a[r] - a[l]} \right\rfloor$$

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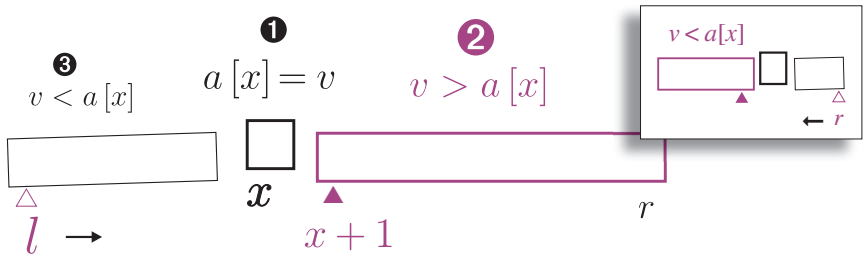
Interpolation Search
Basic Procedure

When array values are related linearly to their index, case 1 occurs on the first step.



Student setup iteration

Exercise
Design a non-recursive algorithm. **Hint:** start from the binary search pseudocode.

Value must be in upper indices.

- case 1: found, stop
- case 2: v in right sub-list, discard left
- case 3: v in left sub-list, discard right

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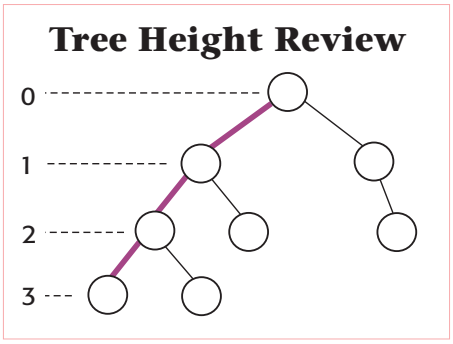
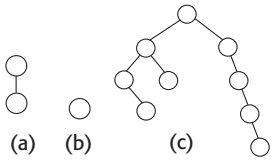
Variable Decrease-Conquer
Binary Search Tree

Recall, a general tree is a special directed graph with no back, cross, or forward edges.

Review: what is a BST?



Quiz
What are the heights of these trees?



Basic search procedure

- compare node
- If equal return else if smaller search left else search right

Height reduction sequence

Height of left or right depending on search key

Decrease-conquer pattern?

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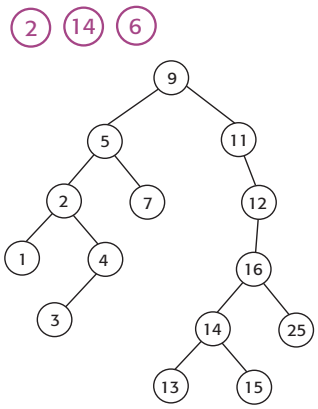
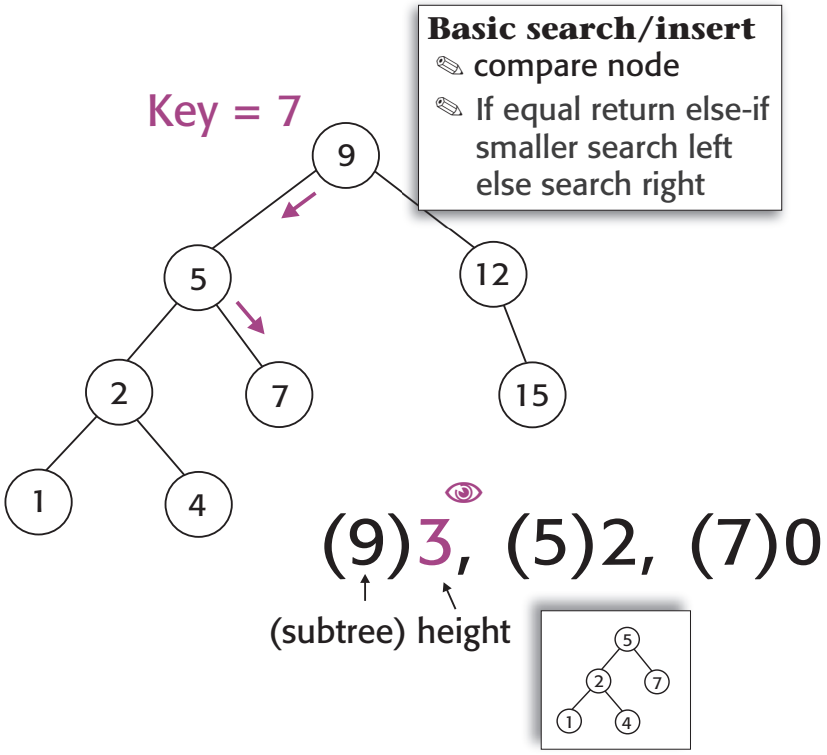
Binary Search Tree
Variable Height Reduction

Exercise
For each key, write the sequence of subtree/height called by the tree search.

Recall, a tree may be characterized by its root.





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Variable Decrease-Conquer

🕮 Performance

```
3,5,8,10,14,15,27,31,36,39,42,55,70,
74,81,85,93,98,100,101,115,120,125,
131,189,200,212,223,349,350,400,401
```

Exercise
Compare decrease pattern in instance size to binary search.

➪ Decrease pattern

402
189
101

➪ Worse and average cases

- ✎ Interpolation search
- ✎ Binary search tree

➪ Compare to binary search

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The Selection Problem
Motivation

0	1	2	3	4	5	6	7	8
4	1	10	9	7	12	8	2	15

Value of element with equal number of smaller and larger elements.

- **What is the median?**
- **Obvious algorithm**
- **Drawback**

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