Quick Select Algorithm

Learning Objectives

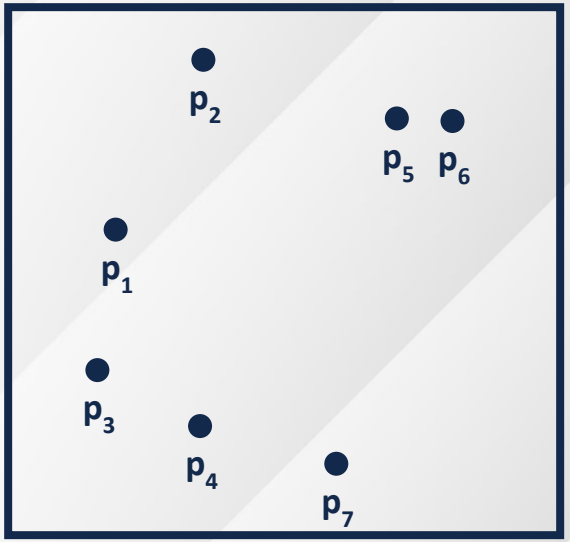
1. Implement the Quick Select Algorithm

2D Range Based Searches

Consider points in 2D: $\mathbf{p = \{p_1, p_2, \ldots, p_n\}}$

Tree Construction:

1. Find median point along a dimension
2. Partition nodes
3. Go to next dimension
4. Recursively build left subtree
5. Recursively build right subtree



Quick Select Algorithm

Partitions elements about my median, such that smaller elements are to the left and larger elements to the right

Ex. [11, 6, 44, 41, 33, 57, 2]

For a random pivot index, k = 3

[11, 6, 44, 2, 33, 57, 41], i = 0, small = 0

Quick Select Algorithm

Partitions elements in average linear time

Doesn’t sort

Ex. [11, 6, 44, 41, 33, 57, 2]

For a random pivot index, k = 3

[11, 6, 44, 2, 33, 57, 41], i = 0, small = 0

[11, 6, 44, 2, 33, 57, 41], i = 1, small = 1

Quick Select Algorithm

Partitions elements in average linear time

Doesn’t sort

Ex. [11, 6, 44, 41, 33, 57, 2]

For a random pivot index, k = 3

[11, 6, 44, 2, 33, 57, 41], i = 0, small = 0

[11, 6, 44, 2, 33, 57, 41], i = 1, small = 1

[11, 6, 44, 2, 33, 57, 41], i = 2, small = 2

Quick Select Algorithm

Partitions elements in average linear time

Doesn’t sort

Ex. [11, 6, 44, 41, 33, 57, 2]

For a random pivot index, k = 3

[11, 6, 44, 2, 33, 57, 41], i = 0, small = 0

[11, 6, 44, 2, 33, 57, 41], i = 1, small = 1

[11, 6, 44, 2, 33, 57, 41], i = 2, small = 2

[11, 6, 44, 2, 33, 57, 41], i = 3, small = 2

Quick Select Algorithm

[11, 6, 44, 2, 33, 57, 41], i = 3, small = 2

Quick Select Algorithm

[11, 6, 44, 2, 33, 57, 41], i = 3, small = 2

[11, 6, 2, 44, 33, 57, 41], i = 4, small = 3

Quick Select Algorithm

[11, 6, 44, 2, 33, 57, 41], i = 3, small = 2

[11, 6, 2, 44, 33, 57, 41], i = 4, small = 3

[11, 6, 2, 33, 44, 57, 41], i = 5, small = 4

Quick Select Algorithm

[11, 6, 44, 2, 33, 57, 41], i = 3, small = 2

[11, 6, 2, 44, 33, 57, 41], i = 4, small = 3

[11, 6, 2, 33, 44, 57, 41], i = 5, small = 4

[11, 6, 2, 33, 44, 57, 41], i = 6, small = 4

Quick Select Algorithm

[11, 6, 44, 2, 33, 57, 41], i = 3, small = 2

[11, 6, 2, 44, 33, 57, 41], i = 4, small = 3

[11, 6, 2, 33, 44, 57, 41], i = 5, small = 4

[11, 6, 2, 33, 44, 57, 41], i = 6, small = 4

[11, 6, 2, 33, 41, 57, 44]

Quick Select Algorithm

[11, 6, 44, 2, 33, 57, 41], i = 3, small = 2

[11, 6, 2, 44, 33, 57, 41], i = 4, small = 3

[11, 6, 2, 33, 44, 57, 41], i = 5, small = 4

[11, 6, 2, 33, 44, 57, 41], i = 6, small = 4

[11, 6, 2, 33, 41, 57, 44]

Recurse until you pivot around the median