

QUESTION 4.2

POINTS

✕ Delete Question

Title

10

PROBLEM

 Insert Images  Insert Field

Using the Manhattan norm, which point is the nearest neighbor of (1,1)?

- () $(3.5, 3)$
 (X) $(4.5, 1)$
 () $(4.25, 2)$
 () $(2.75, 3.75)$

↪ Add Question 4.3

✚ Add Question 5

Save

Q1 Math Fun Time

20 Points

What is the maximum number of points that can be stored in a 3-dimensional **point quadtree** of height h ? Express your answer as an exact (not asymptotic) function of h .

(Hint: It may be useful to recall the formula *for any* $c > 1$, $\sum_{i=0}^m c^i = \frac{c^{m+1}-1}{c-1}$.)

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Q2 Spatial Splitting

15 Points

A PR-QuadTree black node with $b = 1$ contains the point $(-0.76, -0.74)$. If its nearest neighbor is $(-0.74, -0.74)$, what is k for this node?

-2

Q3 Point-Region QuadTree

45 Points

Insert the following points into a PR-QuadTree with bucket parameter $b = 2$:

- (-33, 40)
- (5, 20)
- (-40, 16)
- (-38, -10)
- (8, -8)
- (-38, -28)
- (48, -48)
- (10, 28)
- (8, -2)
- (26, -2)
- (8, -12)
- (-16, -48)
- (10, -20)
- (11, -20)
- (11, 30)

Q3.1 How large is the region of the tree?

10 Points

Given all of the points, the smallest possible **side length** is

128

(Note: The answer should be power of 2 since it's a square. Answer in terms of the length, *not* k .)

Q3.2

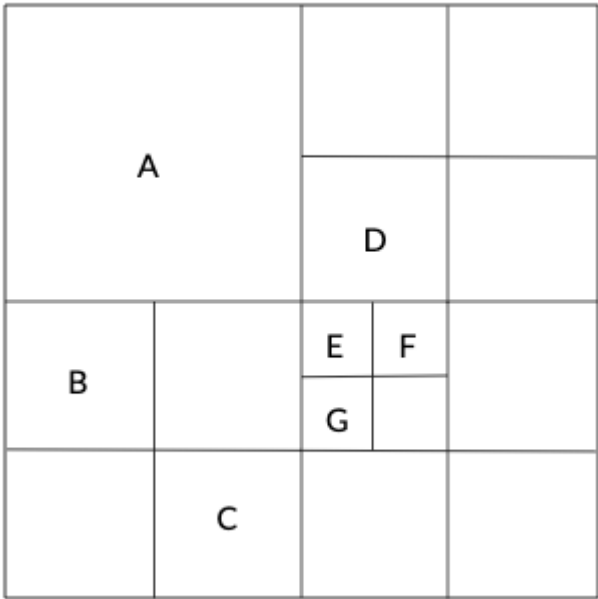
20 Points

Give the final PR-QuadTree. Use empty nodes for white nodes, nodes with points for black nodes and shaded nodes for grey nodes.

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Q3.3 Spatial decomposition

5 Points



Which points are in the **region B**?

☐ $(-33, 40)$ ☐ $(5, 20)$ ☐ $(-40, 16)$ ☒ $(-38, -10)$ ☐ $(8, -8)$ ☒ $(-38, -28)$ ☐ $(48, -48)$ ☐ $(10, 28)$ ☐ $(8, -2)$ ☐ $(26, -2)$ ☐ $(8, -12)$ ☐ $(-16, -48)$ ☐ $(10, -20)$ ☐ $(11, -20)$ ☐ $(11, 30)$

Q3.4 Spatial decomposition

5 Points

Which region does the point $(8, -8)$ fall onto?

- ☐ A
- ☐ B
- ☐ C
- ☐ D
- ☒ E
- ☐ F
- ☐ G

Q3.5 Spatial decomposition

5 Points

Which region does the point $(26, -2)$ fall onto?

- ☐ A
- ☐ B
- ☐ C
- ☐ D
- ☐ E
- ☒ F
- ☐ G

Q4 Distance Metrics

20 Points

The Euclidean norm is:

$$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

The Manhattan distance is:

$$d = |x_1 - x_2| + |y_1 - y_2|$$

Consider a PR-QuadTree that stores points:

-
-
-
-

Q4.1

10 Points

Using the Euclidean norm, which point is the nearest neighbor of (1,1)?

- ☒
- ☐
- ☐
- ☐

Q4.2

10 Points

Using the Manhattan norm, which point is the nearest neighbor of (1,1)?

- ☐
- ☒
- ☐
- ☐