In d-dimensional space, each node in a point quadtree stores one point and has up to 2^d children. In dimension 3, this means 8 children. The root level has one node, level 1 has 8 nodes, level 2 has 64 nodes, and generally, level i has 8^i nodes. Since each node stores a single point, the maximum number of points in a tree of height h is

$$\sum_{i=0}^{h} 8^i = \frac{8^{h+1}-1}{8-1} = \frac{8^{h+1}-1}{7}.$$

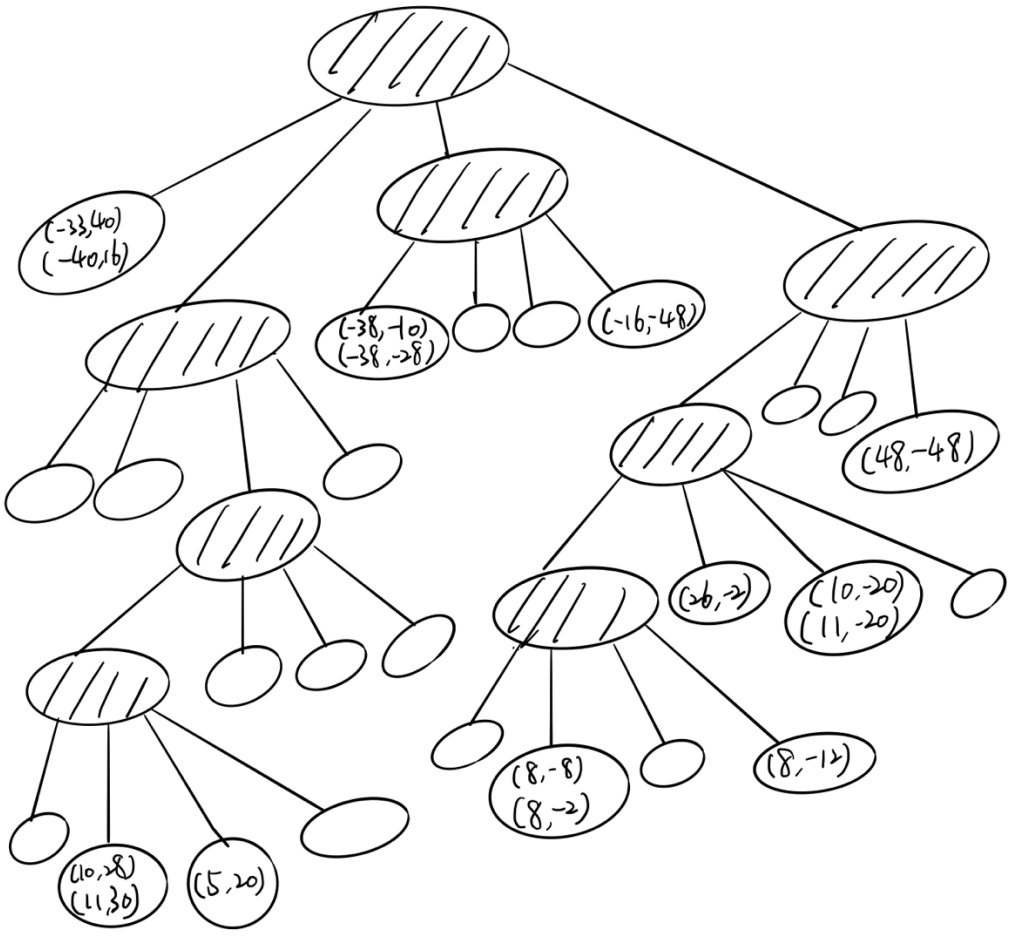
1.

2. -2 — The split is at 3/4, which means we have 1/4 x 1/4 cells, or 2^{-2}

3.

    1. 128 — We have to accommodate x and y values up to ±48, and the smallest power of 2 greater than that is 64, which means that [-64,64) is a length of 128

    2.



    3. (-38,-10), (-38,-28)

    4. E

5. F

2.

2.1. (3.5,3)

2.2. (4.5,1)