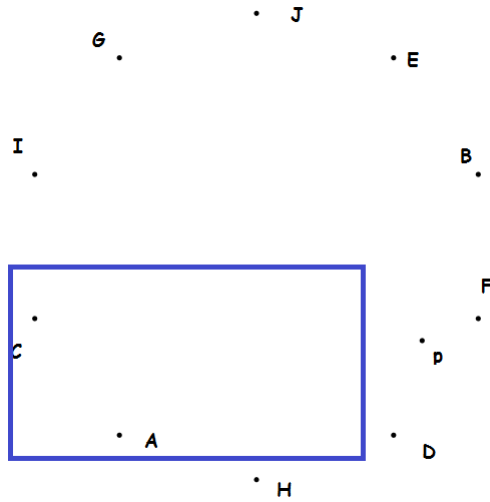


COS226 Group Activity

1. KdTree

- (a) Given the set of points in the diagram below, draw the KdTree and matching graph (with red and blue lines) for the points starting with A and continuing in increasing alphabetical order for at least 5 points. Do not insert p.



- (b) Draw the bounding boxes for each of the points A to E. Note that each node of the KdTree corresponds to an axis-aligned rectangle (also known as its bounding box) in the unit square. The bounding box of each point will give the endpoints of the red or blue line that runs through the point.

- (c) Using the box (drawn above), which nodes of the KdTree are visited by `range(box)` to collect the list of Points? Read the assignment to help figure this out.

- (d) Which of the nodes of the KdTree are visited when `nearest(p)` is called?

2. Suppose you have a `RectHV` instance variable which is the blue box from the previous page's diagram. Which method would return:
 - (a) true if the parameter were A or C but false for B or D.
 - (b) true if the parameter were a box whose corners are defined by point H and point F but false if the parameter were a box whose corners were defined by I and J.
 - (c) 0 if the parameter were A or C but would return a positive number if the parameter were B or D.

3. Give the total memory usage in bytes for N `Point2D` objects from the KdTree assignment (using tilde notation). Algorithms textbook 1.4

```
public class Point2D implements Comparable<Point2D> {
    private final double x;    // x coordinate
    private final double y;    // y coordinate
}
```

4. How many `get()` calls can a BST implementation perform per second for a BST that contains 1,000 random keys? You can assume that the keys are integers. When timing do not include the time to build the BST. (Algorithms textbook 3.2)

(a) How would you go about measuring this?

(b) You generate a sequence of N `get()` queries and count only the non-recursive calls.

N	T(N)	get() count
100	0.00	1367
1000	0.0020	14456
10000	0.0060	150165
100000	0.04	1454749
1000000	0.351	14500124
10000000	3.549	145211340
5000000	1.688	66857090

What further values of N should you select? Give an expected range for the final answer.