You will submit your solution to this assignment to the Curator System (as `HW1`). Your solution must be either a plain text file (e.g., NotePad) or a typed MS Word document; submissions in other formats will not be graded.

Partial credit will only be given if you show relevant work.

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1. [50 points] Write an implementation of an algorithm to perform a range search in a BST. Base your solution on the BST interface given for Minor Project 2, and assume that the following public method has been added to the interface:

```
 public Vector<T> rangeSearch(T lower, T upper) {

    Vector<T> matches = new Vector<T>();
    rangeSearchHelper(lower, upper, root, matches);
    return matches;
}
```

Complete the implementation by writing the body of the private recursive helper function shown below.

```
private void rangeSearchHelper(T lower, T upper, BinaryNode sroot,
                                                    Vector<T> matches) {

   . . .
}
```

Your implementation should operate as efficiently as possible. It should put references to all the matching data objects, if any, into the `Vector` object that is returned by the public function.

2. [25 points] Suppose you have a collection of *N* different integer values, where *N* is at least 2. If you insert the values into a BST in one order, and then insert the same values into a second BST in a different order, is it possible that the two resulting BSTs will have the same structure? If yes, give an example. If no, explain clearly why not.

3. [25 points] Suppose you have a collection of *N* different points in the xy-plane, where *N* is large. If you insert the points into a PR quadtree that does not use buckets, then some of the branches may be very "stalky". If you insert the same points into a PR quadtree that does use buckets, you would expect that there would be fewer "stalky" branches.

If a bucket size of 4 is used, what would you expect the effect to be on a typical PR quadtree branch? That is, if you compared branches the two trees that contained the same subsets of points, what difference would you expect to see? Quantify your answer if possible; that is, what is the minimum difference you would expect and what is the maximum difference you would expect, and why?