# Lab 6
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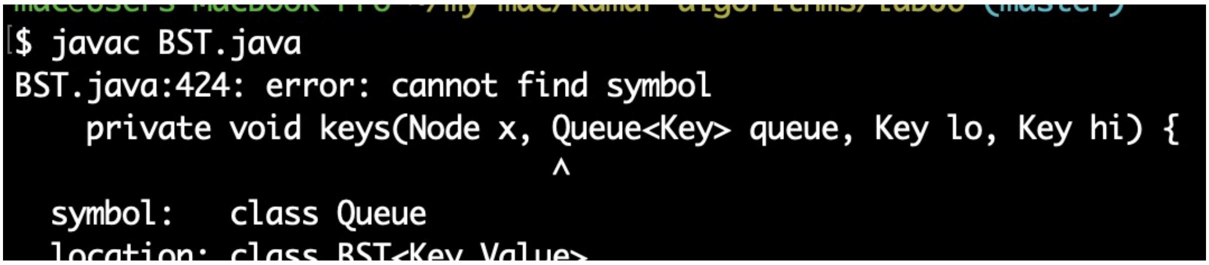
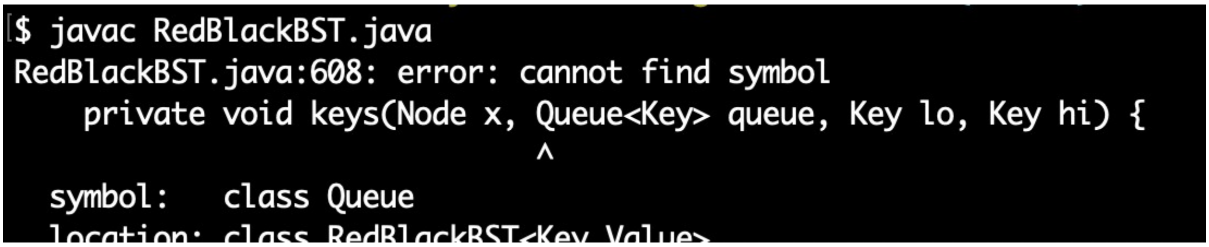
## 1) Checkout the sample BST.java and RedBlackTree.java files

So, I got a lot of error when I tried to compile these files.



```
[$ javac BST.java
BST.java:424: error: cannot find symbol
    private void keys(Node x, Queue<Key> queue, Key lo, Key hi) {
                              ^
  symbol:   class Queue
  location: class BST<Key,Value>
```



```
[$ javac RedBlackBST.java
RedBlackBST.java:608: error: cannot find symbol
    private void keys(Node x, Queue<Key> queue, Key lo, Key hi) {
                              ^
  symbol:   class Queue
  location: class RedBlackBST<Key,Value>
```

```
    Value extends Object decl
16 errors
```

```
    Value extends Obje
14 errors
mac@Users-MacBook-Pro
```

And I decided to use C++ version from [https://www.geeksforgeeks.org/c-program-red-black-tree-insertion/](https://www.geeksforgeeks.org/c-program-red-black-tree-insertion/) and modified main() function a little bit so it prints more information.

Here you can see some statistics on different inputs. It took a while to create them as the program runs for quite some time with 1 000 000 000 input.

| | 100 000 | 1 000 000 | 2 000 000 | 3 000 000 | 10 000 000 | 100 000 000 | 1 000 000 000 |
|---|---|---|---|---|---|---|---|
| Insertion | 0.032262 sec | 0.345542 sec | 0.709857 sec | 1.083931 sec | 3.780678 sec | 43.954579 sec | 7.8978819 min |
| Inorder Traversal | 0.001700 sec | 0.014995 sec | 0.029870 sec | 0.049232 sec | 0.169444 sec | 4.074239 sec | 58.810911 sec |
| Level Traversal | 0.011233 sec | 0.111430 sec | 0.225452 sec | 0.340764 sec | 1.126354 sec | 12.185512 sec | 12.298141 min |

## 2) Perf report:

After I did my benchmarks I decided not to profile this program with billion input as it would take a lot of time again.

You can find all the the reports in attached .data files.

**Files:**
million_input.data
10_million_input.data
100_million_input.data

## 3) Experiment with various input scenarios

You can find results in attached “RedBlackBST Output.txt” file.

## 4) Modified main() function used for time measurement:

Remaining code is here:
[https://www.geeksforgeeks.org/c-program-red-black-tree-insertion/](https://www.geeksforgeeks.org/c-program-red-black-tree-insertion/)

```
int main(int argc, char** argv) {

    int sz = -1;
    printf("Enter size of array:\n");
    scanf("%d", &sz);
    int arr[sz];

    srand(time(NULL));
    for (int i = 0; i < sz; ++i)
    {
                arr[i] = rand() % (sz * 20);
    }

    clock_t begin = clock();
    quickSort(arr, 0, sz - 1);
    clock_t end = clock();

    printf("Time taken: %f seconds\n", ((double) (end - begin)) / CLOCKS_PER_SEC);

    return 0;
}
```