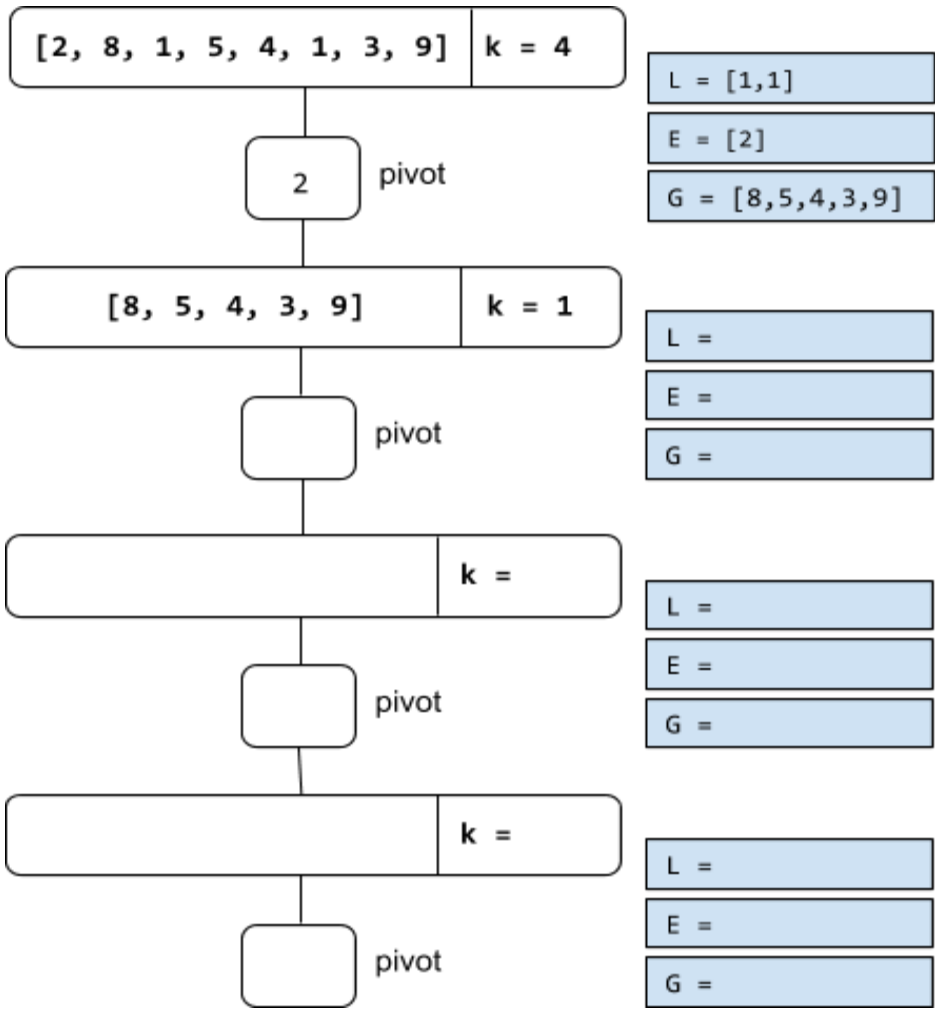
Names: _____
CS Logins: _____

Medians & Selection 3/5/17
Worksheet #10

1. **Try to hand-simulate `quickselect(list, k)` with the given inputs, and a random pivot (in this case we'll use the first element):**

```
myList = [2,8,1,5,4,1,3,9]
quickselect(myList, 4):
```



2. What is the worst case runtime of Hoare's Selection?

What case gives us this runtime?

```
quickselect(list, k):
    pivot = list[rand(0, list.size)]
    L=[] E=[] G=[]
    for x in list:
        if x < pivot: L.append(x)
        if x == pivot: E.append(x)
        if x > pivot: G.append(x)
   if k <= L.size:
        return quickselect(L, k)
   else if k <= (L.size + E.size):
        return pivot
   else:
        return quickselect(G, k – (L.size + E.size))
```

3. Provide the worst-case runtime for each line in Median of Medians Select:

(Hint: Remember that because our median is guaranteed to be between the 25th and 75th percentiles, we can be sure that in the worst case it will divide the input list into lists of size 3n/10 and 7n/10 on each call)

```
momSelect(list, k):

        if list.size == 5:
                sort5(list)                                          \\O(1) b/c list always size 5
                return kth element of list

        miniLists = divide list into n/5 lists of 5 medians = []     1: O(_____)

        for miniList in miniLists:                                   4: O(_____) (loop total)
                sort5(miniList)                                      2: O(____)
                medians.append(miniList[2])                          3: O(____)

        pivot = momSelect(medians, medians.size/2)                   5: T(_____)

        L=[] E=[] G=[]

        for x in list:                                               6: O(_____) (loop total)

                if x < pivot: L.append(x)
                if x == pivot: E.append(x)
                if x > pivot: G.append(x)
                                sl
        if k <= L.size:
                return momSelect(L, k)                               7: T(_____)

        else if k <= (L.size + E.size)
                return pivot

        else
                return momSelect(G, k – (L.size + E.size))           8: T(_____)
```

Now that we know the line by line runtime breakdown of momSelect, we can determine a general recurrence relation:

T(n) = 9: T( ) + 10: T( ) + 11: O( )