

## Assignment 1 - Q2

1. See zipped code
2. Steps placement

**Linear Search** - Steps counter is increased within the for loop, placed in the first line in the for loop, as one number in the array is checked if it matches the key. The steps counter increases as the following number in the array is checked if the first number does not match the key.

**Binary Search** - Steps counter is increased within the while loop, placed in the first line in the while loop. Each time the while loop traverses, half of the array is eliminated, which is what happens in one step.

**Recursive Binary Search** - Steps counter is increased at start of the recursive function, placed at the first line of the recursive function. The counter increases everytime the recursive function is called, which halves the array, which constitutes a step.

3. Experimental data

### **Array size = 100**

#### Trial 1

Linear Search Steps: 100

Binary Search Steps: 7

Recursive Binary Search Steps: 8

#### Trial 2

Linear Search Steps: 24

Binary Search Steps: 7

Recursive Binary Search Steps: 7

#### Trial 3

Linear Search Steps: 100

Binary Search Steps: 6

Recursive Binary Search Steps: 7

### **Array size = 1,000**

#### Trial 1

Linear Search Steps: 219

Binary Search Steps: 10

Recursive Binary Search Steps: 10

#### Trial 2

Linear Search Steps: 870

Binary Search Steps: 10  
Recursive Binary Search Steps: 10  
Trial 3  
Linear Search Steps: 568  
Binary Search Steps: 10  
Recursive Binary Search Steps: 10

**Array size = 10,000**

Trial 1  
Linear Search Steps: 6969  
Binary Search Steps: 12  
Recursive Binary Search Steps: 12  
Trial 2  
Linear Search Steps: 2866  
Binary Search Steps: 9  
Recursive Binary Search Steps: 9  
Trial 3  
Linear Search Steps: 8343  
Binary Search Steps: 10  
Recursive Binary Search Steps: 10

**Array size = 100,000**

Trial 1  
Linear Search Steps: 51637  
Binary Search Steps: 10  
Recursive Binary Search Steps: 10  
Trial 2  
Linear Search Steps: 29709  
Binary Search Steps: 10  
Recursive Binary Search Steps: 10  
Trial 3  
Linear Search Steps: 71681  
Binary Search Steps: 11  
Recursive Binary Search Steps: 11

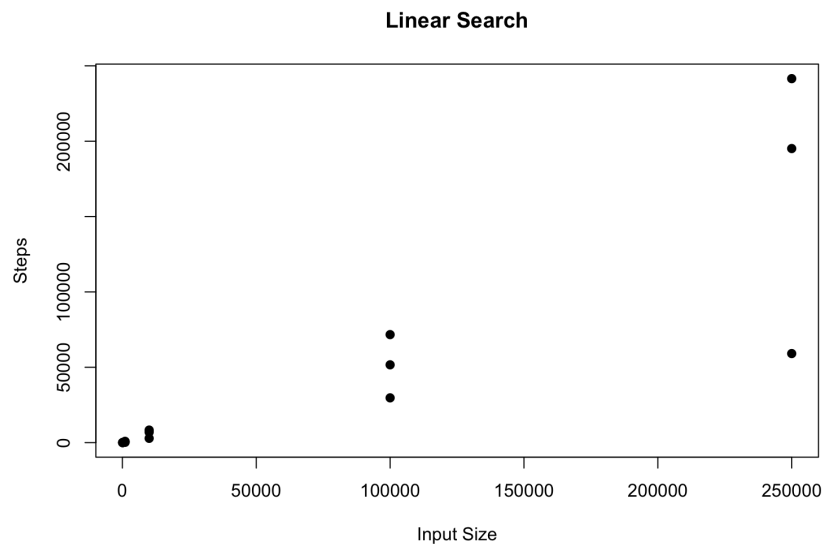
**Array size = 250,000**

Trial 1  
Linear Search Steps: 195127  
Binary Search Steps: 5  
Recursive Binary Search Steps: 5  
Trial 2  
Linear Search Steps: 241508  
Binary Search Steps: 9  
Recursive Binary Search Steps: 9  
Trial 3

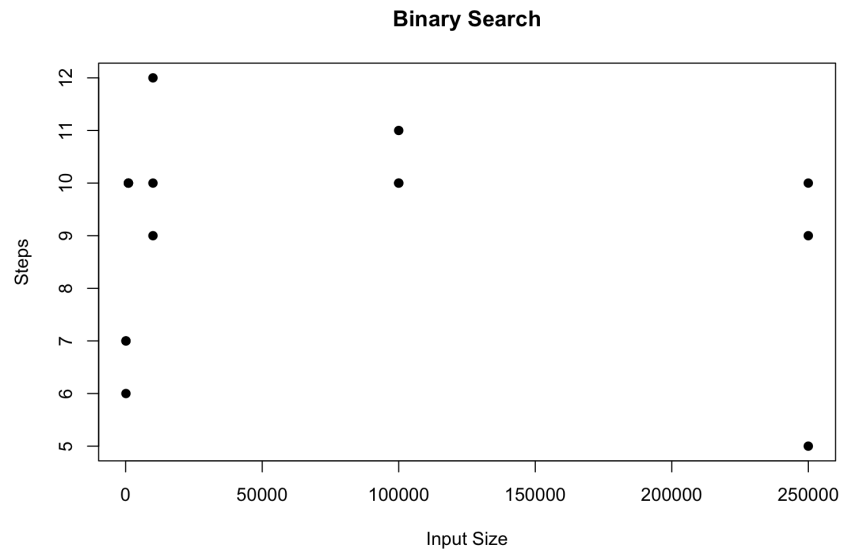
Linear Search Steps: 59098  
Binary Search Steps: 10  
Recursive Binary Search Steps: 10

#### 4. Plots for each algorithm

**Linear Search** - Algorithm searches for the key starting at the first number of the array. Generally, as input array size increases, the steps also linearly increases. Additionally, as input array size increases, there is greater variance in the steps.



**Binary Search** - Algorithms checks to see which half of the array the key is in and then eliminates the half of the array the key cannot be in. There is not a clear pattern between input array size and steps. No matter the input array size, the steps tend to be around 10 steps.



**Recursive Binary Search** - Algorithms checks to see which half of the array the key is in and then eliminates the half of the array the key cannot be in by calling its recursive function with the half of the array the key is in. There is not a clear pattern between input array size and steps. No matter the input array size, the steps tend to be around 10 steps.

