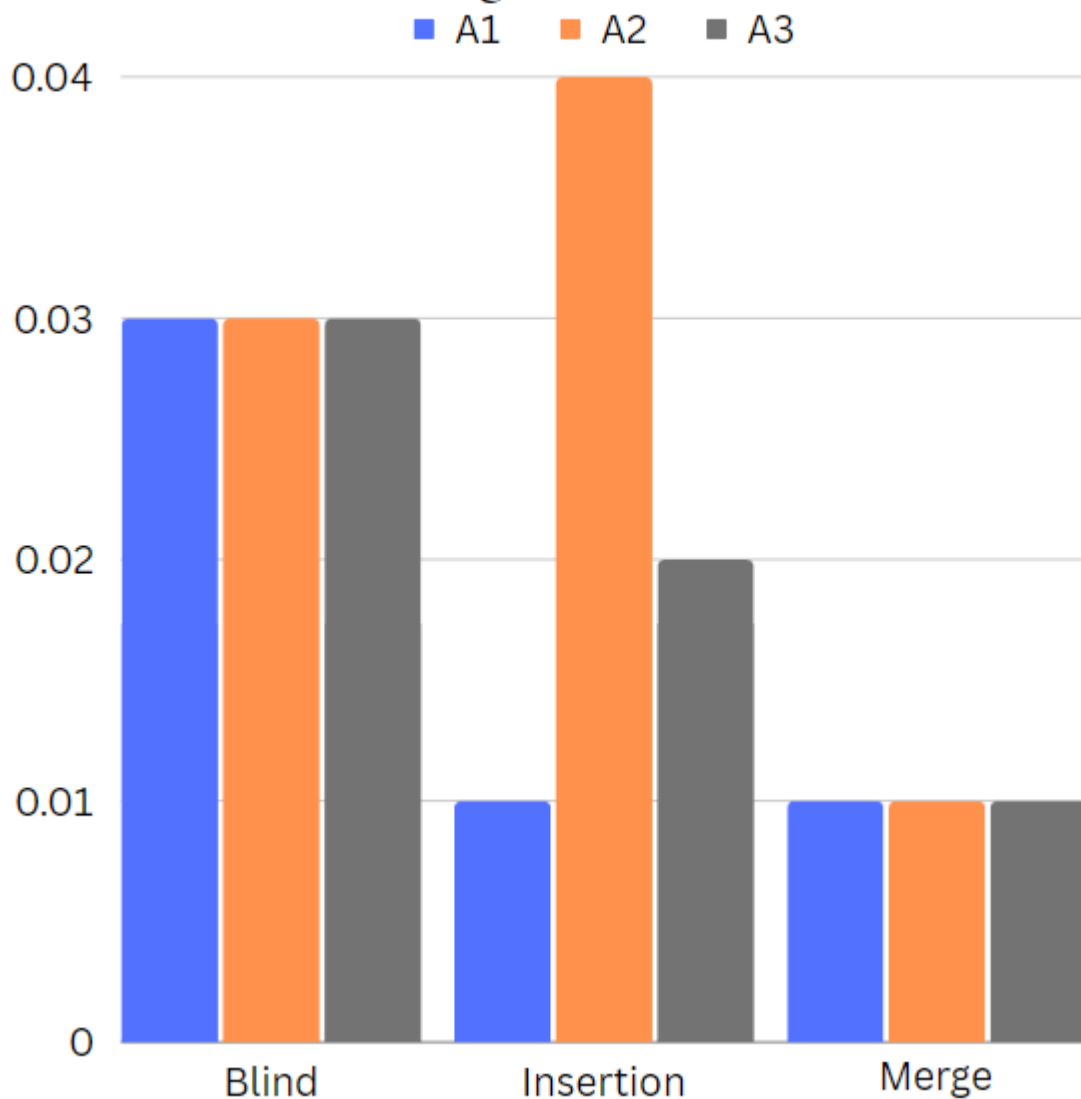To start on my reflection on this assignment, I want to explain how I finished it. I did this assignment by putting all the files together and calling all their methods from my created java file. I called all given algorithms on each of the three arrays I have created to see the runtime of them, and how they perform. I found it much easier to call each function separately than together. Now let's see what data we have collected and what it means. According to my data, the merge algorithm outperforms the 2 other algorithms on all 3 arrays. The insertion algorithm tied the merge algorithm only on array 1 (best case), however, on array 2 (worst case), it was the slowest out of the 3 algorithms. The blind algorithm was equally as bad on all 3 arrays. Now what does this tell us? This tells us that the merge sort is the fastest algorithm out of the 3 for all situations, with insertion sort coming in second for being better in 2 of the arrays than blind, and blind coming in last for being the slowest on 2/3 of the arrays. From insertion sort, we learn that arrays that are already going up in sorted order (best case) we will get a very fast runtime, but if the array is random or not going in ascending order already (worst case), then the runtime will take much longer. The blind algorithm took the same amount of time for each array and surprisingly did better than insertion sort for array 2. What I can learn from blind sort is that it is very consistent with its runtime on all arrays, but it is also not the best in terms of speed (runtime). What I take away from all of this and this assignment is that merge sort is the best out of the 3 for all cases, and very efficient. So, it makes sense to use merge sort when sorting arrays. Overall, I enjoyed this assignment since I saw how the differences in algorithms can make a big difference to runtime when sorting arrays.

(Scroll down for the Histogram and screenshots of output)

Running time comparison of three algorithms

■ A1   ■ A2   ■ A3

```java
        int result = Blind.CountInversions(firstArray);
        //int result = Blind.CountInversions(secondArray);
        //int result = Blind.CountInversions(thirdArray);


        //int result = Insertion.CountInversions(firstArray);
        //int result = Insertion.CountInversions(secondArray);
        //int result = Insertion.CountInversions(thirdArray);


        //int result = Merge.mergeSortAndCount(firstArray, 0, firstArray.length - 1);
        //int result = Merge.mergeSortAndCount(secondArray, 0, secondArray.length - 1);
        //int result = Merge.mergeSortAndCount(thirdArray, 0, thirdArray.length - 1);


        System.out.println(result);
        long endTime = System.currentTimeMillis();
        double timeml = (endTime-startTime)/100.0;
        System.out.printf(format:"Blind A1, Total Time%.4f\n", timeml);

    }
}
```

PROBLEMS 7   OUTPUT   DEBUG CONSOLE   TERMINAL   PORTS   Run: test

```
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PS C:\Users\harit\OneDrive\Documents\Desktop\Assignment 3>  & 'C:\Program Files\Java\jdk-17.0.1\bin\java.exe' '-XX:+ShowCodeDetailsInExceptionMessages' '-cp' 'C:
\Users\harit\AppData\Roaming\Code\User\workspaceStorage\4a735a9ad24657425b78fc8c634b1e00\redhat.java\jdt_ws\Assignment 3_2db5676b\bin' 'test'
0
Blind A1, Total Time0.0300
PS C:\Users\harit\OneDrive\Documents\Desktop\Assignment 3>
```

```java
27        //int result = Blind.CountInversions(firstArray);
28        int result = Blind.CountInversions(secondArray);
29        //int result = Blind.CountInversions(thirdArray);
30
31        //int result = Insertion.CountInversions(firstArray);
32        //int result = Insertion.CountInversions(secondArray);
33        //int result = Insertion.CountInversions(thirdArray);
34
35        //int result = Merge.mergeSortAndCount(firstArray, 0, firstArray.length - 1);
36        //int result = Merge.mergeSortAndCount(secondArray, 0, secondArray.length - 1);
37        //int result = Merge.mergeSortAndCount(thirdArray, 0, thirdArray.length - 1);
38
39        System.out.println(result);
40        long endTime = System.currentTimeMillis();
41        double timeml = (endTime-startTime)/100.0;
42        System.out.printf(format:"Blind A2, Total Time%.4f\n", timeml);
43
44    }
45 }
```

PROBLEMS 7   OUTPUT   DEBUG CONSOLE   TERMINAL   PORTS

```
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\Users\harit\AppData\Roaming\Code\User\workspaceStorage\4a735a9ad24657425b78fc8c634b1e00\redhat.java\jdt_ws\Assignment 3_2db5676b\bin' 'test'
499500
Blind A2, Total Time0.0300
PS C:\Users\harit\OneDrive\Documents\Desktop\Assignment 3>
```

```java
26
27          //int result = Blind.CountInversions(firstArray);
28          //int result = Blind.CountInversions(secondArray);
29      💡  int result = Blind.CountInversions(thirdArray);
30
31          //int result = Insertion.CountInversions(firstArray);
32          //int result = Insertion.CountInversions(secondArray);
33          //int result = Insertion.CountInversions(thirdArray);
34
35          //int result = Merge.mergeSortAndCount(firstArray, 0, firstArray.length - 1);
36          //int result = Merge.mergeSortAndCount(secondArray, 0, secondArray.length - 1);
37          //int result = Merge.mergeSortAndCount(thirdArray, 0, thirdArray.length - 1);
38
39          System.out.println(result);
40          long endTime = System.currentTimeMillis();
41          double timeml = (endTime-startTime)/100.0;
42          System.out.printf(format:"Blind A3, Total Time%.4f\n", timeml);
43
44      }
45  }
```

PROBLEMS 7   OUTPUT   DEBUG CONSOLE   TERMINAL   PORTS

```
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\Users\harit\AppData\Roaming\Code\User\workspaceStorage\4a735a9ad24657425b78fc8c634b1e00\redhat.java\jdt_ws\Assignment 3_2db5676b\bin' 'test'
248338
Blind A3, Total Time0.0300
PS C:\Users\harit\OneDrive\Documents\Desktop\Assignment 3>
```

```java
      //int result = Blind.CountInversions(firstArray);
      //int result = Blind.CountInversions(secondArray);
      //int result = Blind.CountInversions(thirdArray);


      int result = Insertion.CountInversions(firstArray);
      //int result = Insertion.CountInversions(secondArray);
      //int result = Insertion.CountInversions(thirdArray);


      //int result = Merge.mergeSortAndCount(firstArray, 0, firstArray.length - 1);
      //int result = Merge.mergeSortAndCount(secondArray, 0, secondArray.length - 1);
      //int result = Merge.mergeSortAndCount(thirdArray, 0, thirdArray.length - 1);

      System.out.println(result);
      long endTime = System.currentTimeMillis();
      double timeml = (endTime-startTime)/100.0;
      System.out.printf(format:"Insertion A1, Total Time%.4f\n", timeml);


    }
}
```

```java
26
27          //int result = Blind.CountInversions(firstArray);
28          //int result = Blind.CountInversions(secondArray);
29          //int result = Blind.CountInversions(thirdArray);
30
31          //int result = Insertion.CountInversions(firstArray);
32          int result = Insertion.CountInversions(secondArray);
33          //int result = Insertion.CountInversions(thirdArray);
34
35          //int result = Merge.mergeSortAndCount(firstArray, 0, firstArray.length - 1);
36          //int result = Merge.mergeSortAndCount(secondArray, 0, secondArray.length - 1);
37          //int result = Merge.mergeSortAndCount(thirdArray, 0, thirdArray.length - 1);
38
39          System.out.println(result);
40          long endTime = System.currentTimeMillis();
41          double timeml = (endTime-startTime)/100.0;
42          System.out.printf(format:"Insertion A2, Total Time%.4f\n", timeml);
43
44      }
45  }
```

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```
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\Users\harit\AppData\Roaming\Code\User\workspaceStorage\4a735a9ad24657425b78fc8c634b1e00\redhat.java\jdt_ws\Assignment 3_2db5676b\bin' 'test'
499500
Insertion A2, Total Time0.0400
PS C:\Users\harit\OneDrive\Documents\Desktop\Assignment 3>
```

```java
26
27          //int result = Blind.CountInversions(firstArray);
28          //int result = Blind.CountInversions(secondArray);
29          //int result = Blind.CountInversions(thirdArray);
30
31          //int result = Insertion.CountInversions(firstArray);
32          //int result = Insertion.CountInversions(secondArray);
33          int result = Insertion.CountInversions(thirdArray);
34
35          //int result = Merge.mergeSortAndCount(firstArray, 0, firstArray.length - 1);
36          //int result = Merge.mergeSortAndCount(secondArray, 0, secondArray.length - 1);
37          //int result = Merge.mergeSortAndCount(thirdArray, 0, thirdArray.length - 1);
38
39          System.out.println(result);
40          long endTime = System.currentTimeMillis();
41          double timeml = (endTime-startTime)/100.0;
42          System.out.printf(format:"Insertion A3, Total Time%.4f\n", timeml);
43
44      }
45 }
```

PROBLEMS 7   OUTPUT   DEBUG CONSOLE   TERMINAL   PORTS

```
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\Users\harit\AppData\Roaming\Code\User\workspaceStorage\4a735a9ad24657425b78fc8c634b1e00\redhat.java\jdt_ws\Assignment 3_2db5676b\bin' 'test'
249390
Insertion A3, Total Time0.0200
PS C:\Users\harit\OneDrive\Documents\Desktop\Assignment 3>
```

```java
26
27          //int result = Blind.CountInversions(firstArray);
28          //int result = Blind.CountInversions(secondArray);
29   💡     //int result = Blind.CountInversions(thirdArray);
30
31          //int result = Insertion.CountInversions(firstArray);
32          //int result = Insertion.CountInversions(secondArray);
33          //int result = Insertion.CountInversions(thirdArray);
34
35          int result = Merge.mergeSortAndCount(firstArray, l:0, firstArray.length - 1);
36          //int result = Merge.mergeSortAndCount(secondArray, 0, secondArray.length - 1);
37          //int result = Merge.mergeSortAndCount(thirdArray, 0, thirdArray.length - 1);
38
39          System.out.println(result);
40          long endTime = System.currentTimeMillis();
41          double timeml = (endTime-startTime)/100.0;
42          System.out.printf(format:"Merge A1, Total Time%.4f\n", timeml);
43
44      }
45  }
```

PROBLEMS **7**   OUTPUT   DEBUG CONSOLE   **TERMINAL**   PORTS   ⚙ Run: test + ∨ ⬚ 🗑 ⋯ ⌃

```
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PS C:\Users\harit\OneDrive\Documents\Desktop\Assignment 3>  & 'C:\Program Files\Java\jdk-17.0.1\bin\java.exe' '-XX:+ShowCodeDetailsInExceptionMessages' '-cp' 'C:
\Users\harit\AppData\Roaming\Code\User\workspaceStorage\4a735a9ad24657425b78fc8c634b1e00\redhat.java\jdt_ws\Assignment 3_2db5676b\bin' 'test'
0
Merge A1, Total Time0.0100
PS C:\Users\harit\OneDrive\Documents\Desktop\Assignment 3>
```

```java
26
27          //int result = Blind.CountInversions(firstArray);
28          //int result = Blind.CountInversions(secondArray);
29          //int result = Blind.CountInversions(thirdArray);
30
31          //int result = Insertion.CountInversions(firstArray);
32          //int result = Insertion.CountInversions(secondArray);
33          //int result = Insertion.CountInversions(thirdArray);
34
35          //int result = Merge.mergeSortAndCount(firstArray, 0, firstArray.length - 1);
36          int result = Merge.mergeSortAndCount(secondArray, l:0, secondArray.length - 1);
37          //int result = Merge.mergeSortAndCount(thirdArray, 0, thirdArray.length - 1);
38
39          System.out.println(result);
40          long endTime = System.currentTimeMillis();
41          double timeml = (endTime-startTime)/100.0;
42          System.out.printf(format:"Merge A2, Total Time%.4f\n", timeml);
43
44      }
45  }
```

```java
26
27        //int result = Blind.CountInversions(firstArray);
28        //int result = Blind.CountInversions(secondArray);
29        //int result = Blind.CountInversions(thirdArray);
30
31        //int result = Insertion.CountInversions(firstArray);
32        //int result = Insertion.CountInversions(secondArray);
33        //int result = Insertion.CountInversions(thirdArray);
34
35        //int result = Merge.mergeSortAndCount(firstArray, 0, firstArray.length - 1);
36        //int result = Merge.mergeSortAndCount(secondArray, 0, secondArray.length - 1);
37        int result = Merge.mergeSortAndCount(thirdArray, l:0, thirdArray.length - 1);
38
39        System.out.println(result);
40        long endTime = System.currentTimeMillis();
41        double timeml = (endTime-startTime)/100.0;
42        System.out.printf(format:"Merge A3, Total Time%.4f\n", timeml);
43
44    }
45 }
```