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**Program Structures & Algorithms**

**Fall 2021**

**Assignment No. 2**

* **Task**

1. Calculated benchmark timing for Insertion sort for differently sorted arrays (random, sorted, partially sorted, reverse ordered).
   1. Part-1: Implemented methods in Timer class
   2. Part-2: Implemented InsertionSort in InsertionSort class
   3. Part-3: Implemented main class in Benchmark\_Timer class where mean time for random, sorted, partially sorted, reversed array for various sizes will be calculated.

* **Relationship Conclusion**

Ordered < Partially Ordered < Randomly Ordered < Reverse Ordered.

1. **Output**

**A picture containing text

Description automatically generated**

1. **Graphical Representation**

**Chart

Description automatically generated**

* **Unit tests result:**

1. For BenchmarkTestText

   Description automatically generated
2. For TimerTest

Text

Description automatically generated

1. For InsertionSort

Graphical user interface, text

Description automatically generated

Code:

public static void main(String args[]) {  
  
 InsertionSort is = new InsertionSort();  
 Random random = new Random();  
 for (int k = 1; k <= 4; k++) {  
 int n = 1000;  
 for (int i = 0; i < 5; i++) {  
 Integer[] arr = new Integer[n];  
 for (int j = 0; j < n; j++) {  
 arr[j] = random.nextInt();  
 }  
  
 if(k==2){  
 Arrays.*sort*(arr);  
 System.*out*.print("Mean time for sorted array of size " + n + " is ");  
 }  
 else if(k==3){  
 Arrays.*sort*(arr, n/2, n);  
 System.*out*.print("Mean time for partially sorted array of size " + n + " is " );  
 }  
 else if(k==4){  
 Arrays.*sort*(arr, Collections.*reverseOrder*());  
 System.*out*.print("Mean time for a reverse ordered array of size " + n + " is " );  
 }  
 else{  
 System.*out*.print("Mean time for a randomly sorted array of size " + n + " is " );  
 }  
 int temp = n;  
 Timer timer = new Timer();  
 final double time = timer.repeat(50, () -> 5, t -> {  
 is.sort(arr, 0, temp);  
 return null;  
 });  
  
 System.*out*.println(time);  
  
 n = n \* 2;  
 }  
  
 }  
  
}