```
import java.io.*;
import java.util.Random;

class ArraySorts{

	private int[] N;
	private int nElems;

	//--------------------------------------------------

	public ArraySorts(int max){
		N = new int[max];
		nElems = 0;
	}

	//--------------------------------------------------

	public void randomElements(int seed){
		Random r = new Random();

		r.setSeed(seed);

		for(int i=0; i<N.length; i++){
			N[i] = (int)(r.nextInt(100));
			nElems++;
		}
	}

	//--------------------------------------------------

	public void bubbleSort(){
		int out, in;
```

```
        for (out=0; out<nElems; out++){
                for (in = 0; in<nElems-1; in++){
                        if(N[in] > N[in+1]){
                                swap(in, in+1);
                        }
                }
        }
}

//--------------------------------------------------

public void selectionSort(){
        int out, in, min;

        for (out = 0; out<nElems-1; out++){
                min = out;
                for (in = out+1; in<nElems; in++){
                        if(N[in] < N[min]){
                                min = in;
                        }
                swap(out, min);
                }
        }
}

//--------------------------------------------------

public void insertionSort(){
        int out, in;

        for (out=1; out<nElems; out++){
```

```
                int temp = N[out];
                in = out;
                while (in>0 && N[in-1] >= temp){
                        N[in] = N[in-1];
                        --in;
                }
        N[in] = temp;
        }
    }

    //--------------------------------------------------

    private void swap (int one, int two){
        int temp = N[one];
        N[one] = N[two];
        N[two] = temp;
    }

} // end of ArraySorts

////////////////////////////////////////////////////////////////////////////////

class ArrayApp {
    public static void main(String args[]) throws IOException {

        //------------------------Utilities to Use File--------------------------------

        File file = new File("out.txt");
        FileWriter fw = new FileWriter(file, true);
        PrintWriter pw = new PrintWriter(fw);

        //-------------------------Test for Seed 1234----------------------------------
```

```
pw.println("Time Elapsed for Seed 1234");
System.out.println("Time Elapsed for Seed 1234");

//--------------BubbleSort-------------

ArraySorts arr1a;
pw.println("Bubble Sort: ");
System.out.println("Bubble Sort: ");

for (int i=10000; i<=100000; i+=2500){
        arr1a = new ArraySorts(i);

        arr1a.randomElements(1234);

        long startTime1a = System.currentTimeMillis();
        arr1a.bubbleSort();
        long elapsedTime1a = System.currentTimeMillis() - startTime1a;
        pw.println(i + " elements: " + elapsedTime1a);
        System.out.println(i + " elements: " + elapsedTime1a);
}

pw.println();
System.out.println();

//--------------SelectionSort-------------

ArraySorts arr1b;
pw.println("Selection Sort: ");
System.out.println("Selection Sort: ");

for (int i=10000; i<=100000; i+=2500){
```

```
        arr1b = new ArraySorts(i);

        arr1b.randomElements(1234);

        long startTime1b = System.currentTimeMillis();
        arr1b.selectionSort();
        long elapsedTime1b = System.currentTimeMillis() - startTime1b;
        pw.println(i + " elements: " + elapsedTime1b);
        System.out.println(i + " elements: " + elapsedTime1b);
}

pw.println();
System.out.println();

//--------------InsertionSort-------------

ArraySorts arr1c;
pw.println("Insertion Sort: ");
System.out.println("Insertion Sort: ");

for (int i=10000; i<=100000; i+=2500){
        arr1c = new ArraySorts(i);

        arr1c.randomElements(1234);

        long startTime1c = System.currentTimeMillis();
        arr1c.insertionSort();
        long elapsedTime1c = System.currentTimeMillis() - startTime1c;
        pw.println(i + " elements: " + elapsedTime1c);
        System.out.println(i + " elements: " + elapsedTime1c);
}
```

```
pw.println();
System.out.println();
pw.println();
System.out.println();

//-------------------------Test for Seed 666---------------------------------

pw.println("Time Elapsed for Seed 666");
System.out.println("Time Elapsed for Seed 666");

//--------------BubbleSort-------------

ArraySorts arr2a;
pw.println("Bubble Sort: ");
System.out.println("Bubble Sort: ");

for (int i=10000; i<=100000; i+=2500){
        arr2a = new ArraySorts(i);

        arr2a.randomElements(666);

        long startTime2a = System.currentTimeMillis();
        arr2a.bubbleSort();
        long elapsedTime2a = System.currentTimeMillis() - startTime2a;
        pw.println(i + " elements: " + elapsedTime2a);
        System.out.println(i + " elements: " + elapsedTime2a);
}

pw.println();
System.out.println();

//--------------SelectionSort-------------
```

```
ArraySorts arr2b;
pw.println("Selection Sort: ");
System.out.println("Selection Sort: ");

for (int i=10000; i<=100000; i+=2500){
	arr2b = new ArraySorts(i);

	arr2b.randomElements(666);

	long startTime2b = System.currentTimeMillis();
	arr2b.selectionSort();
	long elapsedTime2b = System.currentTimeMillis() - startTime2b;
	pw.println(i + " elements: " + elapsedTime2b);
	System.out.println(i + " elements: " + elapsedTime2b);
}

pw.println();
System.out.println();

//--------------InsertionSort-------------

ArraySorts arr2c;
pw.println("Insertion Sort: ");
System.out.println("Insertion Sort: ");

for (int i=10000; i<=100000; i+=2500){
	arr2c = new ArraySorts(i);

	arr2c.randomElements(666);

	long startTime2c = System.currentTimeMillis();
```

```
            arr2c.insertionSort();
            long elapsedTime2c = System.currentTimeMillis() - startTime2c;
            pw.println(i + " elements: " + elapsedTime2c);
            System.out.println(i + " elements: " + elapsedTime2c);
}

pw.println();
System.out.println();
pw.println();
System.out.println();

//-------------------------Test for Seed 42---------------------------------

pw.println("Time Elapsed for Seed 42");
System.out.println("Time Elapsed for Seed 42");

//--------------BubbleSort-------------

ArraySorts arr3a;
pw.println("Bubble Sort: ");
System.out.println("Bubble Sort: ");

for (int i=10000; i<=100000; i+=2500){
            arr3a = new ArraySorts(i);

            arr3a.randomElements(42);

            long startTime3a = System.currentTimeMillis();
            arr3a.bubbleSort();
            long elapsedTime3a = System.currentTimeMillis() - startTime3a;
            pw.println(i + " elements: " + elapsedTime3a);
            System.out.println(i + " elements: " + elapsedTime3a);
```

```
}

pw.println();
System.out.println();

//--------------SelectionSort-------------

ArraySorts arr3b;
pw.println("Selection Sort: ");
System.out.println("Selection Sort: ");

for (int i=10000; i<=100000; i+=2500){
        arr3b = new ArraySorts(i);

        arr3b.randomElements(42);

        long startTime3b = System.currentTimeMillis();
        arr3b.selectionSort();
        long elapsedTime3b = System.currentTimeMillis() - startTime3b;
        pw.println(i + " elements: " + elapsedTime3b);
        System.out.println(i + " elements: " + elapsedTime3b);
}

pw.println();
System.out.println();

//--------------InsertionSort-------------

ArraySorts arr3c;
pw.println("Insertion Sort: ");
System.out.println("Insertion Sort: ");
```

```
        for (int i=10000; i<=100000; i+=2500){
            arr3c = new ArraySorts(i);

            arr3c.randomElements(42);

            long startTime3c = System.currentTimeMillis();
            arr3c.insertionSort();
            long elapsedTime3c = System.currentTimeMillis() - startTime3c;
            pw.println(i + " elements: " + elapsedTime3c);
            System.out.println(i + " elements: " + elapsedTime3c);
        }

        pw.close();
    }
}
```