NGUYỄN MINH ĐỨC – ITITIU21045

2.

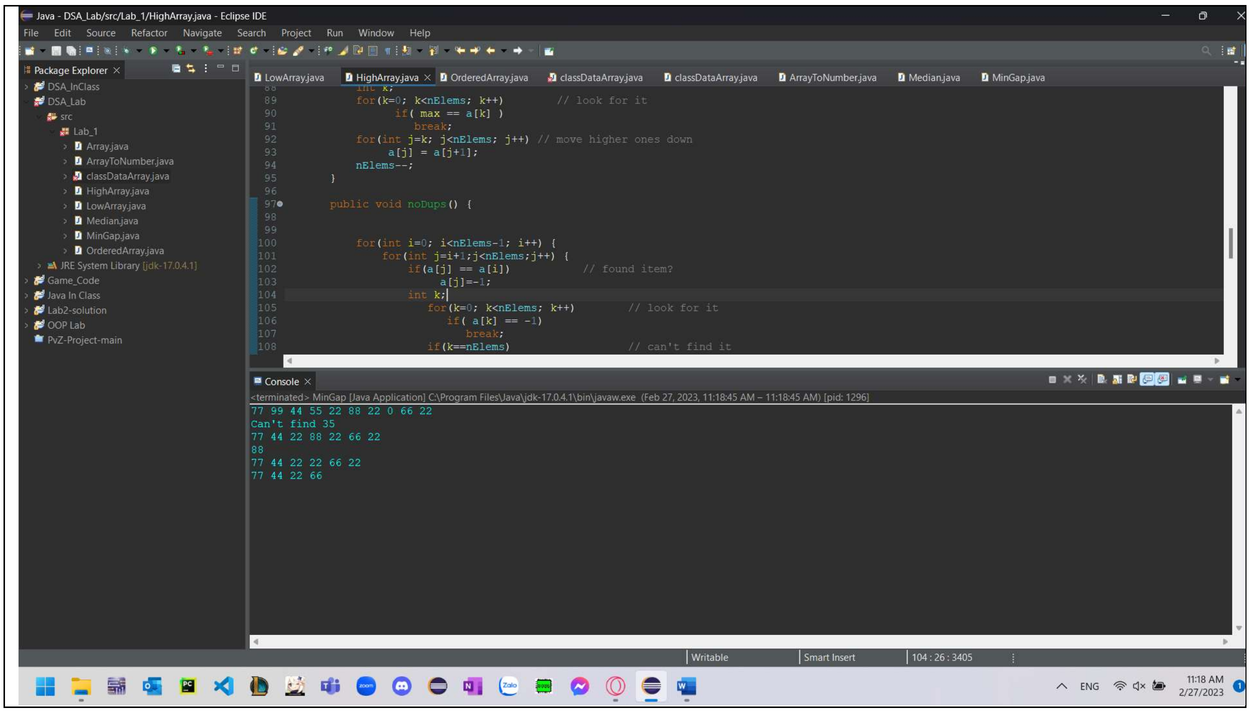
b, c, e.

```java
package Lab_1;

public class HighArray {

      // highArray.java
      // demonstrates array class with high-level interface
      // to run this program: C>java HighArrayApp
      ////////////////////////////////////////////////////////////////
         private long[] a;                 // ref to array a
         private int nElems;               // number of data items
         //-----------------------------------------------------------
         public HighArray(int max)         // constructor
            {
            a = new long[max];                 // create the array
            nElems = 0;                        // no items yet
            }
         //-----------------------------------------------------------
         public boolean find(long searchKey)
            {                              // find specified value
            int j;
            for(j=0; j<nElems; j++)            // for each element,
               if(a[j] == searchKey)           // found item?
                  break;                       // exit loop before end
            if(j == nElems)                    // gone to end?
               return false;                   // yes, can't find it
            else
               return true;                    // no, found it
            }  // end find()
         //-----------------------------------------------------------
         public void insert(long value)    // put element into array
            {
            a[nElems] = value;             // insert it
            nElems++;                      // increment size
            }
         //-----------------------------------------------------------
         public boolean delete(long value)
            {
            int j;
            for(j=0; j<nElems; j++)        // look for it
               if( value == a[j] )
                  break;
            if(j==nElems)                  // can't find it
               return false;
            else                           // found it
               {
               for(int k=j; k<nElems; k++) // move higher ones down
                  a[k] = a[k+1];
               nElems--;                   // decrement size
               return true;
               }
            }  // end delete()
         //-----------------------------------------------------------
         public void display()             // displays array contents
            {
            for(int j=0; j<nElems; j++)       // for each element,
               System.out.print(a[j] + " ");  // display it
            System.out.println("");
            }
         //-----------------------------------------------------------
         public long getMax() {
               long max = a[0];
               if (nElems==0) {
                     return -1;
               }
               else {
                     for(int i=1;i<nElems;i++) {
                           if(a[i]>max) {
                                 max = a[i];
                           }
                     }
               }
               return max;
         }

         public void removeMax() {
               long max = a[0];
               if (nElems==0) {
                     System.out.println("Can't implement the method");
               }
               else {
                     for(int i=1;i<nElems;i++) {
                           if(a[i]>max) {
                                 max = a[i];
                           }
                     }
               }

               int k;
               for(k=0; k<nElems; k++)        // look for it
                     if( max == a[k] )
                        break;
               for(int j=k; j<nElems; j++) // move higher ones down
                  a[j] = a[j+1];
             nElems--;
         }

         public void noDups() {


               for(int i=0; i<nElems-1; i++) {
                     for(int j=i+1;j<nElems;j++) {
                           if(a[j] == a[i])           // found item?
                              a[j]=-1;
                           int k;
                              for(k=0; k<nElems; k++)         // look for it
                                 if( a[k] == -1)
                                    break;
                              if(k==nElems)                   // can't find
it

                                 continue;
                              else                            // found it
                                 {
                                 for(int t=k; t<nElems; t++) // move higher
ones down

                                    a[t] = a[t+1];
                                 nElems--;
                     }
               }



         }
}  // end class HighArray
      ////////////////////////////////////////////////////////////////
```

NGUYỄN MINH ĐỨC – ITITIU21045

```java
      class HighArrayApp
         {
         public static void main(String[] args)
            {
            int maxSize = 100;              // array size
            HighArray arr;                  // reference to array
            arr = new HighArray(maxSize);  // create the array

            arr.insert(77);                 // insert 10 items
            arr.insert(99);
            arr.insert(44);
            arr.insert(55);
            arr.insert(22);
            arr.insert(88);
            arr.insert(22);
            arr.insert(00);
            arr.insert(66);
            arr.insert(22);

            arr.display();                  // display items

            int searchKey = 35;             // search for item
            if( arr.find(searchKey) )
               System.out.println("Found " + searchKey);
            else
               System.out.println("Can't find " + searchKey);

            arr.delete(00);                 // delete 3 items
            arr.delete(55);
            arr.delete(99);


            arr.display();                  // display items again
            System.out.println(arr.getMax());
            arr.removeMax();
            arr.display();
            arr.noDups();
            arr.display();
            }  // end main()
         }  // end class HighArrayApp
}
```

NGUYỄN MINH ĐỨC – ITITIU21045



```
        int k;
        for(k=0; k<nElems; k++)        // look for it
            if( max == a[k] )
               break;
        for(int j=k; j<nElems; j++) // move higher ones down
            a[j] = a[j+1];
        nElems--;
    }

    public void noDups() {


        for(int i=0; i<nElems-1; i++) {
            for(int j=i+1;j<nElems;j++) {
                if(a[j] == a[i])            // found item?
                    a[j]=-1;
                int k;
                  for(k=0; k<nElems; k++)        // look for it
                    if( a[k] == -1)
                       break;
                  if(k==nElems)                  // can't find it
```

```
<terminated> MinGap [Java Application] C:\Program Files\Java\jdk-17.0.4.1\bin\javaw.exe  (Feb 27, 2023, 11:18:45 AM – 11:18:45 AM) [pid: 1296]
77 99 44 55 22 88 22 0 66 22
Can't find 35
77 44 22 88 22 66 22
88
77 44 22 22 66 22
77 44 22 66
```

d.

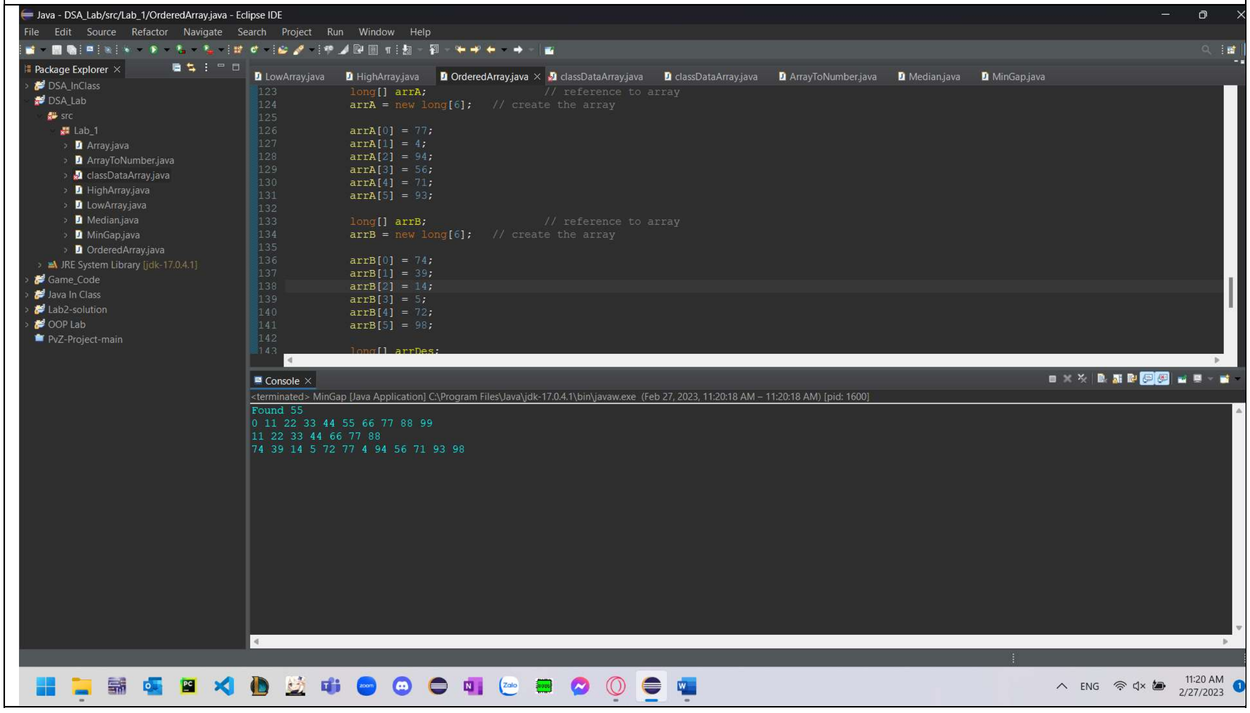
```
package Lab_1;

public class OrderedArray {

         private long[] a;                  // ref to array a
         private int nElems;                // number of data items
         //-----------------------------------------------------------
         public OrderedArray(int max)           // constructor
            {
            a = new long[max];              // create array
            nElems = 0;
            }
         //-----------------------------------------------------------
         public int size()
            { return nElems; }
         //-----------------------------------------------------------
         public int find(long searchKey)
            {
            int lowerBound = 0;
            int upperBound = nElems-1;
            int curIn;

            while(true)
               {
               curIn = (lowerBound + upperBound ) / 2;
               if(a[curIn]==searchKey)
                  return curIn;              // found it
               else if(lowerBound > upperBound)
                  return nElems;             // can't find it
               else                          // divide range
                  {
                  if(a[curIn] < searchKey)
                     lowerBound = curIn + 1; // it's in upper half
                  else
                     upperBound = curIn - 1; // it's in lower half
                  }  // end else divide range
               }  // end while
```

NGUYỄN MINH ĐỨC – ITITIU21045

```
      }  // end find()
   //------------------------------------------------------------
   public void insert(long value)    // put element into array
      {
      int j;
      for(j=0; j<nElems; j++)        // find where it goes
         if(a[j] > value)            // (linear search)
            break;
      for(int k=nElems; k>j; k--)    // move bigger ones up
         a[k] = a[k-1];
      a[j] = value;                  // insert it
      nElems++;                      // increment size
      }  // end insert()
   //------------------------------------------------------------
   public boolean delete(long value)
      {
      int j = find(value);
      if(j==nElems)                  // can't find it
         return false;
      else                           // found it
         {
         for(int k=j; k<nElems; k++) // move bigger ones down
            a[k] = a[k+1];
         nElems--;                   // decrement size
         return true;
         }
      }  // end delete()
   //------------------------------------------------------------
   public void display()             // displays array contents
      {
      for(int j=0; j<nElems; j++)       // for each element,
         System.out.print(a[j] + " ");  // display it
      System.out.println("");
      }
   //------------------------------------------------------------
   public void merge(long[] ArrayA, long[] ArrayB, long[] DesArray) {
               int i = 0, j = 0, k = 0;
               int n1 = ArrayA.length;
               int n2 = ArrayB.length;

               while(i<n1 && j<n2) {
                     if(ArrayA[i]<=ArrayB[j]) {
                           DesArray[k]=ArrayA[i];
                           i++;
                     }
                     else {
                           DesArray[k]=ArrayB[j];
                           j++;
                     }
                     k++;
               }

               while(i<n1) {
                     DesArray[k]=ArrayA[i];
                     i++;
                     k++;
               }

               while(j<n2) {
                     DesArray[k]=ArrayB[j];
                     j++;
                     k++;
               }
   }
```

```
}  // end class OrdArray
      ////////////////////////////////////////////////////////////////
      class OrderedApp
         {
         public static void main(String[] args)
            {
            int maxSize = 100;               // array size
            OrderedArray arr;                    // reference to array
            arr = new OrderedArray(maxSize);    // create the array

            arr.insert(77);                  // insert 10 items
            arr.insert(99);
            arr.insert(44);
            arr.insert(55);
            arr.insert(22);
            arr.insert(88);
            arr.insert(11);
            arr.insert(00);
            arr.insert(66);
            arr.insert(33);

            long[] arrA;                    // reference to array
            arrA = new long[6];   // create the array

            arrA[0] = 77;
            arrA[1] = 4;
            arrA[2] = 94;
            arrA[3] = 56;
            arrA[4] = 71;
            arrA[5] = 93;

            long[] arrB;                    // reference to array
            arrB = new long[6];   // create the array

            arrB[0] = 74;
            arrB[1] = 39;
            arrB[2] = 14;
            arrB[3] = 5;
            arrB[4] = 72;
            arrB[5] = 98;

            long[] arrDes;
            arrDes = new long[12];

            int searchKey = 55;              // search for item
            if( arr.find(searchKey) != arr.size() )
               System.out.println("Found " + searchKey);
            else
               System.out.println("Can't find " + searchKey);

            arr.display();                   // display items

            arr.delete(00);                  // delete 3 items
            arr.delete(55);
            arr.delete(99);

            arr.display();                   // display items again
            arr.merge(arrA, arrB, arrDes);
            for(int j=0; j<12; j++)         // for each element,
                  System.out.print(arrDes[j] + " ");  // display it
              System.out.println("");
            }  // end main()
}
```

NGUYỄN MINH ĐỨC – ITITIU21045



```
        long[] arrA;                    // reference to array
        arrA = new long[6];   // create the array

        arrA[0] = 77;
        arrA[1] = 4;
        arrA[2] = 94;
        arrA[3] = 56;
        arrA[4] = 71;
        arrA[5] = 93;

        long[] arrB;                    // reference to array
        arrB = new long[6];   // create the array

        arrB[0] = 74;
        arrB[1] = 39;
        arrB[2] = 14;
        arrB[3] = 5;
        arrB[4] = 72;
        arrB[5] = 98;

        long[] arrDes;
```

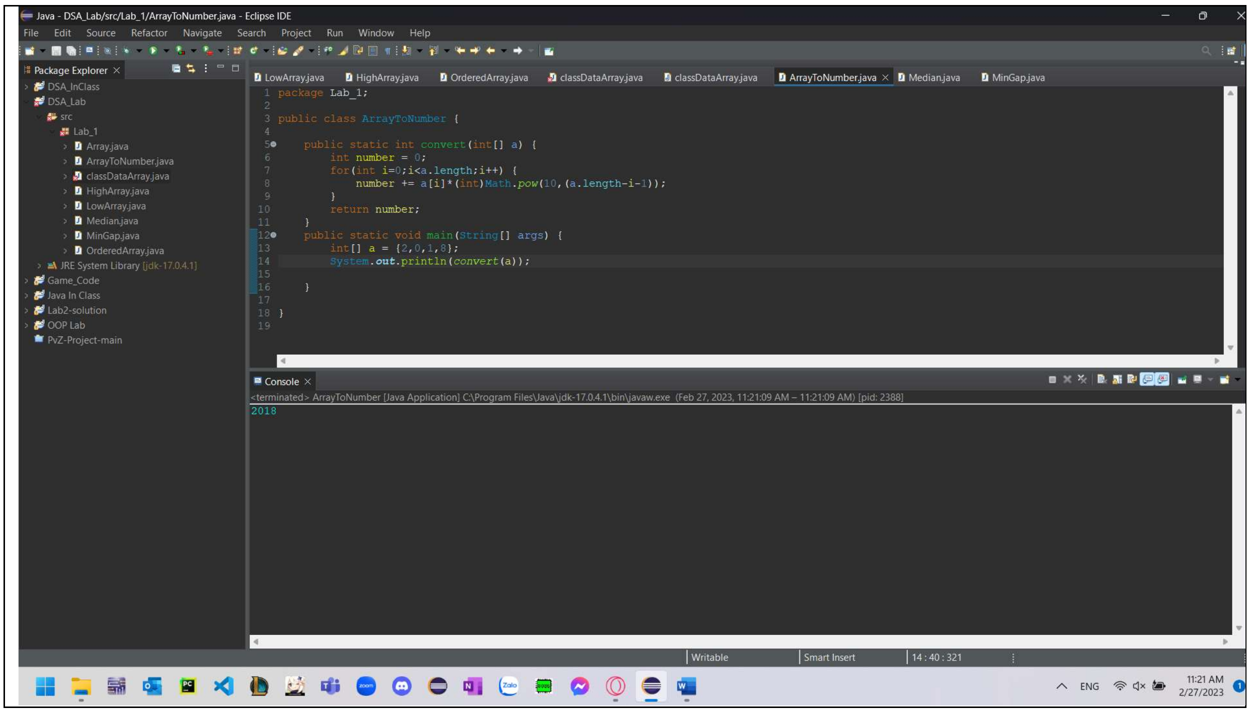
```
<terminated> MinGap [Java Application] C:\Program Files\Java\jdk-17.0.4.1\bin\javaw.exe  (Feb 27, 2023, 11:20:18 AM – 11:20:18 AM) [pid: 1600]
Found 55
0 11 22 33 44 55 66 77 88 99
11 22 33 44 66 77 88
74 39 14 5 72 77 4 94 56 71 93 98
```

3.

a.

```
package Lab_1;

public class ArrayToNumber {

	public static int convert(int[] a) {
		int number = 0;
		for(int i=0;i<a.length;i++) {
			number += a[i]*(int)Math.pow(10,(a.length-i-1));
		}
		return number;
	}
	public static void main(String[] args) {
		int[] a = {2,0,1,8};
		System.out.println(convert(a));

	}

}
```

NGUYỄN MINH ĐỨC – ITITIU21045



Java - DSA_Lab/src/Lab_1/ArrayToNumber.java - Eclipse IDE

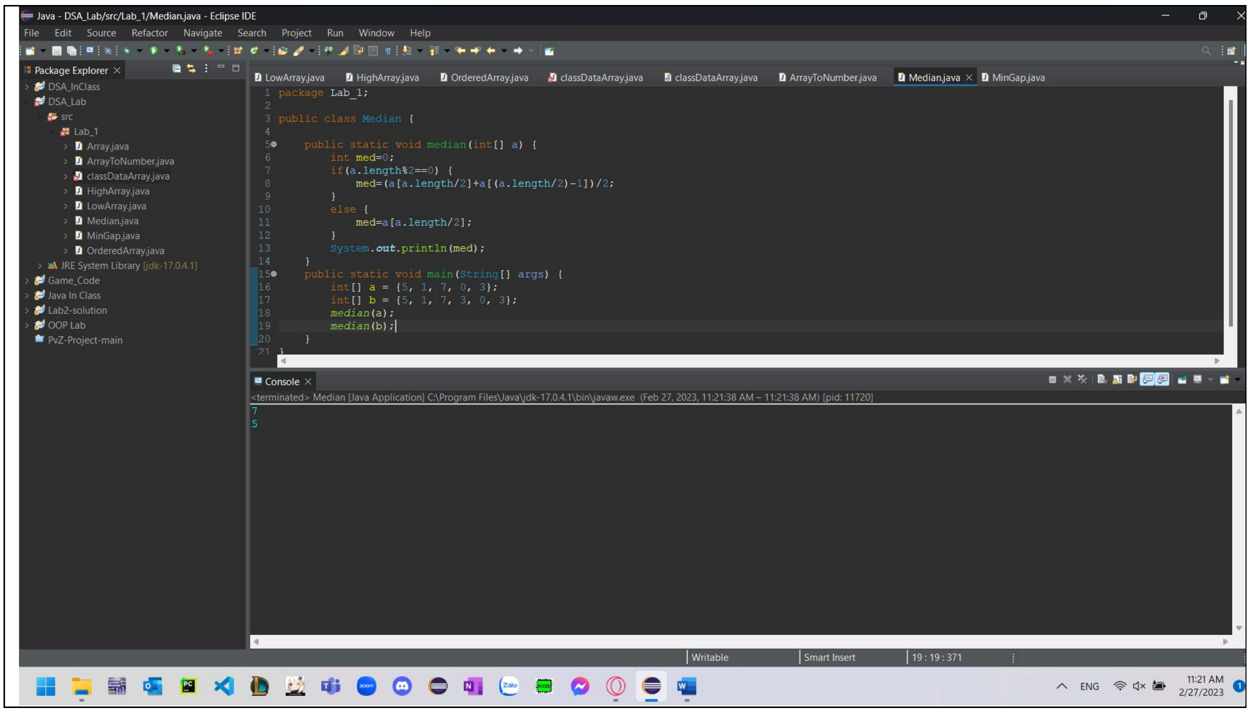
```java
package Lab_1;

public class ArrayToNumber {

	public static int convert(int[] a) {
		int number = 0;
		for(int i=0;i<a.length;i++) {
			number += a[i]*(int)Math.pow(10,(a.length-i-1));
		}
		return number;
	}
	public static void main(String[] args) {
		int[] a = {2,0,1,8};
		System.out.println(convert(a));

	}

}
```

```
<terminated> ArrayToNumber [Java Application] C:\Program Files\Java\jdk-17.0.4.1\bin\javaw.exe  (Feb 27, 2023, 11:21:09 AM – 11:21:09 AM) [pid: 2388]
2018
```

b.

```java
package Lab_1;

public class Median {

	public static void median(int[] a) {
		int med=0;
		if(a.length%2==0) {
			med=(a[a.length/2]+a[(a.length/2)-1])/2;
		}
		else {
			med=a[a.length/2];
		}
		System.out.println(med);
	}
	public static void main(String[] args) {
		int[] a = {5, 1, 7, 0, 3};
		int[] b = {5, 1, 7, 3, 0, 3};
		median(a);
		median(b);
	}
}
```

NGUYỄN MINH ĐỨC – ITITIU21045



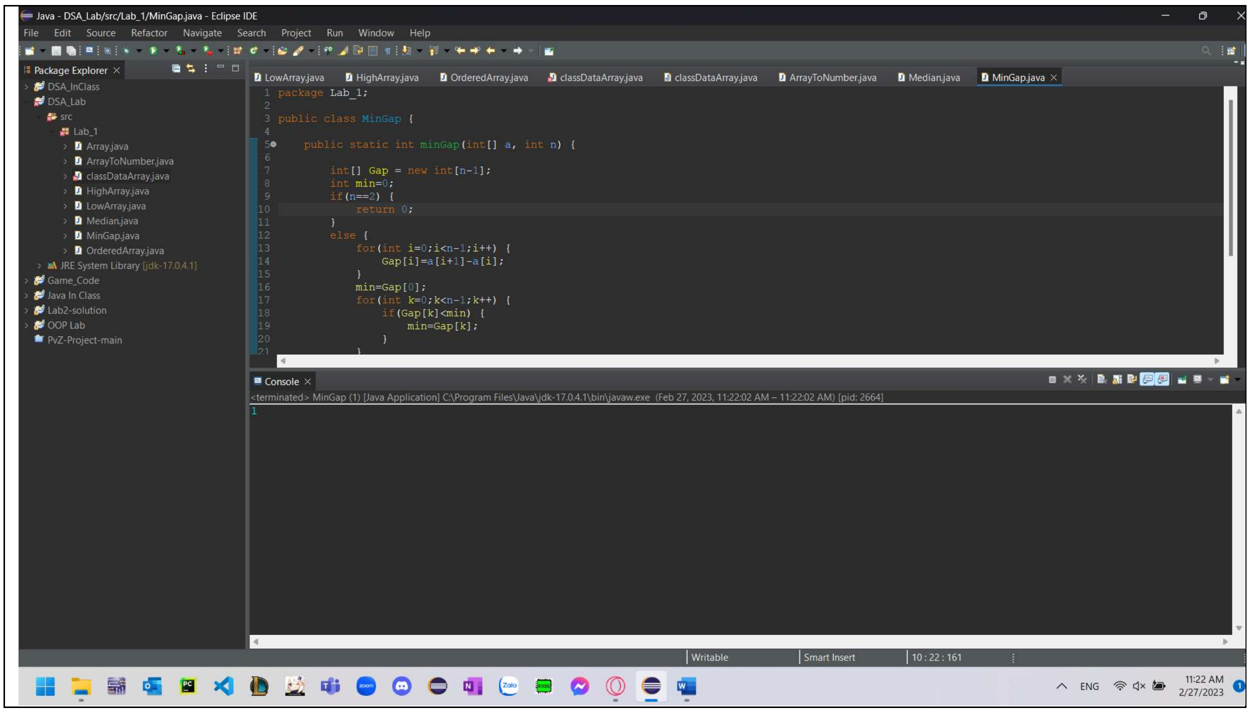
```java
package Lab_1;

public class Median {

	public static void median(int[] a) {
		int med=0;
		if(a.length%2==0) {
			med=(a[a.length/2]+a[(a.length/2)-1])/2;
		}
		else {
			med=a[a.length/2];
		}
		System.out.println(med);
	}
	public static void main(String[] args) {
		int[] a = {5, 1, 7, 0, 3};
		int[] b = {5, 1, 7, 3, 0, 3};
		median(a);
		median(b);
	}
}
```

```
<terminated> Median [Java Application] C:\Program Files\Java\jdk-17.0.4.1\bin\javaw.exe  (Feb 27, 2023, 11:21:38 AM – 11:21:38 AM) [pid: 11720]
7
5
```

c.

```java
package Lab_1;

public class MinGap {

	public static int minGap(int[] a, int n) {

		int[] Gap = new int[n-1];
		int min=0;
		if(n==2) {
			return 0;
		}
		else {
			for(int i=0;i<n-1;i++) {
				Gap[i]=a[i+1]-a[i];
			}
			min=Gap[0];
			for(int k=0;k<n-1;k++) {
				if(Gap[k]<min) {
					min=Gap[k];
				}
			}
		}
		return min;
	}
	public static void main(String[] args) {
		int[] a = {1, 3, 6, 7, 12};
		int n = a.length;
		System.out.println(minGap(a,n));
	}

}
```

NGUYỄN MINH ĐỨC – ITITIU21045



```java
package Lab_1;

public class MinGap {

    public static int minGap(int[] a, int n) {

        int[] Gap = new int[n-1];
        int min=0;
        if(n==2) {
            return 0;
        }
        else {
            for(int i=0;i<n-1;i++) {
                Gap[i]=a[i+1]-a[i];
            }
            min=Gap[0];
            for(int k=0;k<n-1;k++) {
                if(Gap[k]<min) {
                    min=Gap[k];
                }
            }
```

```
<terminated> MinGap (1) [Java Application] C:\Program Files\Java\jdk-17.0.4.1\bin\javaw.exe  (Feb 27, 2023, 11:22:02 AM – 11:22:02 AM) [pid: 2664]
1
```