Exam Set 24E
AP Computer Science A

Name ____ Period__________

1. Refer to the code below,

```
public interface Sports {

      void method1( );
      void method2( );
      int method3(double d);
}

public class Baseball implements Sports {

      public Baseball( )  {      . . .    }
      public void method1( )  {    //some code…}
      public void method2( )  {    //some code…}
      public int method3(double c )  {    //some code…}
      public int statevar1;
}

public class Football implements Sports {

      public Football( )  {      . . .    }
      public void method1( )  {    //some code…}
      public void method2( )  {    //some code…}
      public int method3(double c )  {    //some code…}
      public int statevar1;
}

public class Tester {

     public static void main(String[] args)  {

           Sports x = new Baseball( );
           Sports y = new Football( );
           x.method2( );
           y.method2( );
           . . . more code . . .
      }
}
```

(a) Which methods, if any, in the Sports interface are abstract?

/1

(b) public class Hockey implements Sports {

//What methods, if any, must we implement here?

}

/1

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(c) Look at the classes Baseball and Football. Both implement method1. Do both implementations have to have identical code? If so, why?

/1

(d) In the “more code” section of Tester what would the following return?

```
(x instanceof Sports)
```

/1

(e) In the “more code” section of Tester what would the following return?

```
(y instanceof Football)
```

/1

(f) The property of two classes being able to have methods of the same name (but with possibly different implementations) is known as

/1

(g) Modify the following class so that it will simultaneously inherit the Red class and implement both the Eagle and Bobcat interfaces.

```
public class Austria {  . . .  }
```

/1

This question involves reasoning about 2-dimensional arrays of integers.

```
public class ArrayTester
{

/** Returns an array containing the elements of column c of arr2D in the
same order as
* they appear in arr2D.
* Precondition: c is a valid column index in arr2D.
* Postcondition: arr2D is unchanged.
*/
 public static int[] getColumn(int[][] arr2D, int c)
 {  /* to be implemented in part (a) */  }

 /** Returns true if and only if every value in arr1 appears in arr2.
* Precondition: arr1 and arr2 have the same length.
* Postcondition: arr1 and arr2 are unchanged.
*/
 public static boolean hasAllValues(int[] arr1, int[] arr2)
```

```
{ /* to be implemented in part (b) */  }

/** Returns true if arr contains any duplicate values;
* false otherwise.
*/
public static boolean containsDuplicates(int[] arr)
{ /* to be implemented in part (c) */  }


/** Returns true if square is a Latin square as described in part (b);
* false otherwise.
* Precondition: square has an equal number of rows and columns.
* square has at least one row.
*/
 public static boolean isLatin(int[][] square)
{ /* to be implemented in part (d) */  }
```

(a) Write a static method getColumn, which returns a one-dimensional array containing the elements of a single column in a two-dimensional array. The elements in the returned array should be in the same order as they appear in the given column.

The notation `arr2D[r][c]` represents the array element at row r and column c. The following code segment initializes an array and calls the getColumn method.

```
int[][] arr2D = {
                   { 0, 1, 2 },
                   { 3, 4, 5 },
                   { 6, 7, 8 },
                   { 9, 5, 3 }
                };

int[] result = ArrayTester.getColumn(arr2D, 1);
```

When the code segment has completed execution, the variable result will have the following contents.
result: {1, 4, 7, 5}

/4

(b) Write the static method hasAllValues which returns true if two arrays contain the same values. The values can appear in any order in either array.

/4

(c) Write the static method containsDuplicates which returns true if an array has any duplicate values.

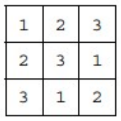
/4

(d) Write the static method isLatin, which returns true if a given two-dimensional square array is a Latin square, and otherwise, returns false. In the isLatin method apply the getColumn, hasAllValues, and containsDuplicates helper methods.

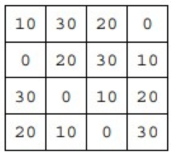
A two-dimensional square array of integers is a Latin square if the following conditions are true.

- The first row has no duplicate values.
- All values in the first row of the square appear in each row of the square.
- All values in the first row of the square appear in each column of the square.

Examples of Latin Squares

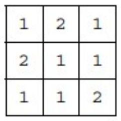


1	2	3
2	3	1
3	1	2



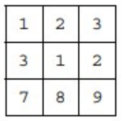
10	30	20	0
0	20	30	10
30	0	10	20
20	10	0	30

Examples that are NOT Latin Squares



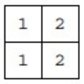
1	2	1
2	1	1
1	1	2

Not a Latin square because the first row contains duplicate values



1	2	3
3	1	2
7	8	9

Not a Latin square because the elements of the first row do not all appear in the third row



1	2
1	2

Not a Latin square because the elements of the first row do not all appear in either column

/5

Score __________/24