2021

AP® Computer Science A

Scoring Guidelines

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Question 1: Methods and Control Structures — 9 points

Canonical solution

(a) — **5 points**

```
public int scoreGuess(String guess)
{
   int count = 0;

   for (int i = 0; i <= secret.length() - guess.length(); i++)
   {
      if (secret.substring(i, i + guess.length()).equals(guess))
      {
         count++;
      }
   }

   return count * guess.length() * guess.length();
}
```

(b) — **4 points**

```
public String findBetterGuess(String guess1, String guess2)
{
   if (scoreGuess(guess1) > scoreGuess(guess2))
   {
      return guess1;
   }
   if (scoreGuess(guess2) > scoreGuess(guess1))
   {
      return guess2;
   }
   if (guess1.compareTo(guess2) > 0)
   {
      return guess1;
   }
   return guess2;
}
```

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(a) `scoreGuess`

	Scoring Criteria	Decision Rules	
1	Compares `guess` to a substring of `secret`	Responses **can** still earn the point even if they only call `secret.indexOf(guess)` Responses **will not** earn the point if they use `==` instead of `equals`	**1 point**
2	Uses a substring of `secret` with correct length for comparison with `guess`	Responses **can** still earn the point even if they • only call `secret.indexOf(guess)` • use `==` instead of `equals`	**1 point**
3	Loops through all necessary substrings of `secret` (*no bounds errors*)	Responses **will not** earn the point if they skip overlapping occurrences	**1 point**
4	Counts number of identified occurrences of `guess` within `secret` (*in the context of a condition involving both* `secret` *and* `guess`)	Responses **can** still earn the point even if they • initialize count incorrectly or not at all • identify occurrences incorrectly	**1 point**
5	Calculates and returns correct final score (*algorithm*)	Responses **will not** earn the point if they • initialize count incorrectly or not at all • fail to use a loop • fail to compare `guess` to multiple substrings of `secret` • count the same matching substring more than once • use a changed or incorrect `guess` length when computing the score	**1 point**
		Total for part (a)	**5 points**

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(b) `findBetterGuess`

	Scoring Criteria	Decision Rules	
6	Calls `scoreGuess` to get scores for `guess1` and `guess2`	Responses **will not** earn the point if they • fail to include parameters in the method calls • call the method on an object or class other than `this`	**1 point**
7	Compares the scores	Responses **will not** earn the point if they • only compare using `==` or `!=` • fail to use the result of the comparison in a conditional statement	**1 point**
8	Determines which of `guess1` and `guess2` is alphabetically greater	Responses **can** still earn the point even if they reverse the comparison Responses **will not** earn the point if they • reimplement `compareTo` incorrectly • use result of `compareTo` as if `boolean`	**1 point**
9	Returns the identified `guess1` or `guess2` (*algorithm*)	Responses **can** still earn the point even if they • call `scoreGuess` incorrectly • compare strings incorrectly Responses **will not** earn the point if they • reverse a comparison • omit either comparison • fail to return a guess in some case	**1 point**
		Total for part (b)	**4 points**
	Question-specific penalties		
	None		
		Total for question 1	**9 points**

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Question 2: Class Design — 9 points

Canonical solution

9 points

```
public class CombinedTable
{
   private SingleTable table1;
   private SingleTable table2;

   public CombinedTable(SingleTable tab1, SingleTable tab2)
   {
      table1 = tab1;
      table2 = tab2;
   }

   public boolean canSeat(int n)
   {
      if (table1.getNumSeats() + table2.getNumSeats() - 2 >= n)
      {
         return true;
      }
      else
      {
         return false;
      }
   }

   public double getDesirability()
   {
      if (table1.getHeight() == table2.getHeight())
      {
         return (table1.getViewQuality() +
                 table2.getViewQuality()) / 2;
      }
      else
      {
         return ((table1.getViewQuality() +
                  table2.getViewQuality()) / 2) - 10;
      }
   }
}
```

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`CombinedTable`

	Scoring Criteria	Decision Rules	

1	Declares class header:
	`class CombinedTable`
	and constructor header:
	`CombinedTable(SingleTable ___, SingleTable ___)`
	(*must not be* `private`)
		Responses **can** still earn the point even if they declare the class header as `class CombinedTable extends SingleTable`	**1 point**

2	Declares appropriate `private` instance variables including at least two `SingleTable` references	Responses **can** still earn the point even if they declare an additional instance variable to cache the number of seats at the combined table Responses **will not** earn the point if they • declare and initialize local variables in the constructor instead of instance variables • declare additional instance variable(s) that cache the desirability rating • omit keyword `private` • declare variables outside the class	**1 point**
3	Constructor initializes instance variables using parameters	Responses **can** still earn the point even if they declare and initialize local variables in the constructor instead of instance variables	**1 point**
4	Declares header: `public boolean canSeat(int ___)`		**1 point**
5	Calls `getNumSeats` on a `SingleTable` object	Responses **can** still earn the point even if they call `getNumSeats` on constructor parameters or local variables of type `SingleTable` in the constructor Responses **will not** earn the point if they call the `SingleTable` accessor method on something other than a `SingleTable` object	**1 point**
6	`canSeat(n)` returns `true` if and only if sum of seats of two tables `- 2 >= n`	Responses **can** still earn the point even if they call `getNumSeats` incorrectly	**1 point**
7	Declares header: `public double getDesirability()`		**1 point**
8	Calls `getHeight` and `getViewQuality` on `SingleTable` objects	Responses **can** still earn the point even if they call `getHeight` or `getViewQuality` on constructor parameters or local variables of type `SingleTable` in the constructor	**1 point**

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		Responses **will not** earn the point if they call the `SingleTable` accessor methods on something other than a `SingleTable` object	
9	`getDesirability` computes average of constituent tables' view desirabilities	Responses **can** still earn the point even if they • call `getHeight` or `getViewQuality` on constructor parameters or local variables of type `SingleTable` in the constructor • fail to return the computed average (*return is not assessed*) Responses **will not** earn the point if they • fail to have an `if` statement and a correct calculation • choose the incorrect value (average vs. average – 10) based on evaluation of the `if` statement condition	**1 point**

Question-specific penalties
None

Total for question 2 9 points

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Question 3: Array / ArrayList — 9 points

Canonical solution

(a) — **3 points**

```
public void addMembers(String[] names, int gradYear)
{
   for (String n : names)
   {
      MemberInfo newM = new MemberInfo(n, gradYear, true);
      memberList.add(newM);
   }
}
```

(b) — **6 points**

```
public ArrayList<MemberInfo> removeMembers(int year)
{
   ArrayList<MemberInfo> removed = new ArrayList<MemberInfo>();

   for (int i = memberList.size() - 1; i >= 0; i--)
   {
      if (memberList.get(i).getGradYear() <= year)
      {
         if (memberList.get(i).inGoodStanding())
         {
            removed.add(memberList.get(i));
         }
         memberList.remove(i);
      }
   }
   return removed;
}
```

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(a) `addMembers`

	Scoring Criteria	Decision Rules	
1	Accesses all elements of `names` (*no bounds errors*)	Responses **will not** earn the point if they fail to access elements of the array, even if loop bounds are correct	**1 point**
2	Instantiates a `MemberInfo` object with name from array, provided year, and good standing		**1 point**
3	Adds `MemberInfo` objects to `memberList` (*in the context of a loop*)	Responses **can** earn the point even if they instantiate `MemberInfo` objects incorrectly	**1 point**
		Total for part (a)	**3 points**

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(b) `removeMembers`

	Scoring Criteria	Decision Rules	
4	Declares and initializes an `ArrayList` of `MemberInfo` objects	Responses **will not** earn the point if they initialize the variable with a reference to the instance variable	**1 point**
5	Accesses all elements of `memberList` for potential removal (*no bounds errors*)	Responses **will not** earn the point if they • fail to use `get(i)` • fail to attempt to remove an element • skip an element • throw an exception due to removing	**1 point**
6	Calls `getGradYear` or `inGoodStanding`	Responses **can** still earn the point even if they call only one of the methods Responses **will not** earn the point if they • ever include parameters in either method call • ever call either method on an object other than `MemberInfo`	**1 point**
7	Distinguishes any three cases, based on graduation status and standing	Responses **will not** earn the point if they fail to behave differently in all three cases	**1 point**
8	Identifies graduating members	Responses **can** still earn the point even if they • fail to distinguish three cases • fail to access standing at all • access the graduating year incorrectly Responses **will not** earn the point if they confuse `<` and `<=` in the comparison	**1 point**
9	Removes appropriate members from `memberList` and adds appropriate members to the `ArrayList` to be returned	Responses **can** still earn the point even if they • call `getGradYear` or `inGoodStanding` incorrectly • access elements of `memberList` incorrectly • initialize the `ArrayList` incorrectly • fail to return the list that was built (*return is not assessed*) Responses **will not** earn the point if they • fail to declare an `ArrayList` to return • fail to distinguish the correct three cases, with the exception of confusing the `<` and `<=` in the comparison	**1 point**
		Total for part (b)	**6 points**

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Question-specific penalties
None

Total for question 3 9 points

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Question 4: 2D Array — 9 points

Canonical solution

(a) — **3 points**

```
public static boolean isNonZeroRow(int[][] array2D, int r)
{
   for (int col = 0; col < array2D[0].length; col++)
   {
      if (array2D[r][col] == 0)
      {
         return false;
      }
   }
   return true;
}
```

(b) — **6 points**

```
public static int[][] resize(int[][] array2D)
{
   int numRows = array2D.length;
   int numCols = array2D[0].length;

   int[][] result = new int[numNonZeroRows(array2D)][numCols];
   int newRowIndex = 0;

   for (int r = 0; r < numRows; r++)
   {
      if (isNonZeroRow(array2D, r))
      {
         for (int c = 0; c < numCols; c++)
         {
            result[newRowIndex][c] = array2D[r][c];
         }
         newRowIndex++;
      }
   }
   return result;
}
```

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(a) `isNonZero`

	Scoring Criteria	Decision Rules	
1	Compares an item from `array2D` with `0`	Responses **will not** earn the point if they fail to attempt the comparison, even if they access an item from `array2D`	**1 point**
2	Accesses every item from row `r` of 2D array (*no bounds errors*)	Responses **can** still earn the point even if they return early from an otherwise correctly-bounded loop	**1 point**
3	Returns `true` if and only if row contains no zeros	Responses **can** still earn the point even if they process a column of the 2D array rather than a row Responses **will not** earn the point if they fail to return a value in some cases	**1 point**
		Total for part (a)	**3 points**

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(b) `resize`

	Scoring Criteria	Decision Rules	
4	Calls `numNonZeroRows` and `isNonZeroRow`	Responses **can** still earn the point even if they fail to use or store the return value Responses **will not** earn the point if they • include incorrect number or type of parameters • call methods on an object or class other than `ArrayResizer`	**1 point**
5	Identifies rows with no zeros (*in the context of an* `if`)	Responses **can** still earn the point even if they call `isNonZeroRow` incorrectly, if the row being tested is clearly identified (index or reference)	**1 point**
6	Declares and creates a new 2D array of the correct size	Response **will not** earn the point if they transpose the dimensions of the created array	**1 point**
7	Maintains an index in the new array	Responses **will not** earn the point if they • fail to declare, initialize, and update a different index • maintain the index in a way that overwrites, skips, or duplicates rows	**1 point**
8	Traverses all necessary elements of `array2D` (*no bounds errors*)	Responses **can** still earn the point even if they • cause a bounds error by declaring and creating a new 2D array of an incorrect size • fail to maintain an index in the new array correctly, resulting in a bounds error • fail to access individual elements in a nested loop, if they access each row as an entire row Responses **will not** earn the point if they transpose coordinates, leading to a bounds error and/or copying columns	**1 point**
9	Copies all and only rows identified as having no zero elements into the new array	Responses **can** still earn the point even if they • copy a reference • identify rows incorrectly, if the logical sense can be determined and is correct • copy columns instead of rows, consistent with the dimensions of the created 2D array	**1 point**

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		Responses **will not** earn the point if they • remove or overwrite data from `array2D` (instead of or in addition to copying it to the new array) • reverse the logical sense of which rows to copy	
		Total for part (b)	**6 points**
	Question-specific penalties		
	-1 (u) Use `array2D[].length` to refer to the number of columns in a row of the 2D array		
		Total for question 4	**9 points**

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