

2021



AP[®] Computer Science A

Scoring Guidelines

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No Penalty

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- Common mathematical symbols used for operators ($\times$, $\div$, $\leq$, $\geq$, $<>$, $\neq$)
- `[]` vs. `()` vs. `<>`
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Question 1: Methods and Control Structures

9 points

Canonical solution

(a)	<pre> 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(); } </pre>	5 points
(b)	<pre> 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; } </pre>	4 points

(a) scoreGuess

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

(b) `findBetterGuess`

Scoring Criteria		Decision Rules	
6	Calls <code>scoreGuess</code> to get scores for <code>guess1</code> and <code>guess2</code>	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 <code>this</code>	1 point
7	Compares the scores	Responses will not earn the point if they - only compare using <code>==</code> or <code>!=</code> - fail to use the result of the comparison in a conditional statement	1 point
8	Determines which of <code>guess1</code> and <code>guess2</code> is alphabetically greater	Responses can still earn the point even if they reverse the comparison Responses will not earn the point if they - reimplement <code>compareTo</code> incorrectly - use result of <code>compareTo</code> as if <code>boolean</code>	1 point
9	Returns the identified <code>guess1</code> or <code>guess2</code> (<i>algorithm</i>)	Responses can still earn the point even if they - call <code>scoreGuess</code> 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

```

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;
        }
    }
}

```

9 points

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

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

(a) `addMembers`

Scoring Criteria		Decision Rules	
1	Accesses all elements of <code>names</code> (<i>no bounds errors</i>)	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 <code>MemberInfo</code> object with name from array, provided year, and good standing		1 point
3	Adds <code>MemberInfo</code> objects to <code>memberList</code> (<i>in the context of a loop</i>)	Responses can earn the point even if they instantiate <code>MemberInfo</code> objects incorrectly	1 point
Total for part (a)			3 points

(b) `removeMembers`

Scoring Criteria		Decision Rules	
4	Declares and initializes an <code>ArrayList</code> of <code>MemberInfo</code> 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 <code>memberList</code> for potential removal (<i>no bounds errors</i>)	Responses will not earn the point if they - fail to use <code>get(i)</code> - fail to attempt to remove an element - skip an element - throw an exception due to removing	1 point
6	Calls <code>getGradYear</code> or <code>inGoodStanding</code>	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 <code>MemberInfo</code>	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 <code><</code> and <code><=</code> in the comparison	1 point
9	Removes appropriate members from <code>memberList</code> and adds appropriate members to the <code>ArrayList</code> to be returned	Responses can still earn the point even if they - call <code>getGradYear</code> or <code>inGoodStanding</code> incorrectly - access elements of <code>memberList</code> incorrectly - initialize the <code>ArrayList</code> incorrectly - fail to return the list that was built (<i>return is not assessed</i>) Responses will not earn the point if they - fail to declare an <code>ArrayList</code> to return - fail to distinguish the correct three cases, with the exception of confusing the <code><</code> and <code><=</code> in the comparison	1 point
		Total for part (b)	6 points

Question-specific penalties

None

Total for question 3 9 points

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Question 4: 2D Array

9 points

Canonical solution

- | | | |
|-----|--|----------|
| (a) | <pre>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; }</pre> | 3 points |
| (b) | <pre>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; }</pre> | 6 points |

(a) `isNonZero`

Scoring Criteria		Decision Rules	
1	Compares an item from <code>array2D</code> with <code>0</code>	Responses will not earn the point if they fail to attempt the comparison, even if they access an item from <code>array2D</code>	1 point
2	Accesses every item from row <code>r</code> of 2D array (<i>no bounds errors</i>)	Responses can still earn the point even if they return early from an otherwise correctly-bounded loop	1 point
3	Returns <code>true</code> 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

(b) `resize`

Scoring Criteria		Decision Rules	
4	Calls <code>numNonZeroRows</code> and <code>isNonZeroRow</code>	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 <code>ArrayResizer</code>	1 point
5	Identifies rows with no zeros (<i>in the context of an if</i>)	Responses can still earn the point even if they call <code>isNonZeroRow</code> 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 <code>array2D</code> (<i>no bounds errors</i>)	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

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