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AP[®]

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AP[®] Computer Science A

Scoring Guidelines

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Question 1: Methods and Control Structures**9 points****Canonical solution**

(a)

```
public int getScore()
{
    int score = 0;

    if (levelOne.goalReached())
    {
        score = levelOne.getPoints();

        if (levelTwo.goalReached())
        {
            score += levelTwo.getPoints();

            if (levelThree.goalReached())
            {
                score += levelThree.getPoints();
            }
        }
    }

    if (isBonus())
    {
        score *= 3;
    }

    return score;
}
```

4 points

(b)

```
public int playManyTimes(int num)
{
    int max = 0;

    for (int i = 0; i < num; i++)
    {
        play();
        int score = getScore();
        if (score > max)
        {
            max = score;
        }
    }

    return max;
}
```

5 points

(a) `getScore`

Scoring Criteria		Decision Rules	
1	Calls <code>getPoints</code> , <code>goalReached</code> , and <code>isBonus</code>	Responses will not earn the point if they - fail to call <code>getPoints</code> or <code>goalReached</code> on a <code>Level</code> object - call <code>isBonus</code> on an object other than <code>this</code> (use of <code>this</code> is optional) - include parameters	1 point
2	Determines if points are earned based on <code>goalReached</code> return values	Responses can still earn the point even if they - calculate the score total incorrectly - call <code>goalReached</code> incorrectly - fail to distinguish all cases correctly Responses will not earn the point if they - fail to use a nested <code>if</code> statement or equivalent	1 point
3	Guards update of score for bonus game based on <code>isBonus</code> return value	Responses can still earn the point even if they - triple the calculated score incorrectly - update the score with something other than tripling - call <code>isBonus</code> incorrectly Responses will not earn the point if they - use the <code>isBonus</code> return value incorrectly	1 point
4	Initializes and accumulates appropriate score (<i>algorithm</i>)	Responses can still earn the point even if they - call methods incorrectly, as long as method calls are attempted - fail to return the score (<i>return is not assessed</i>) Responses will not earn the point if they - calculate the score total incorrectly - triple the calculated score incorrectly	1 point
Total for part (a)			4 points

(b) `playManyTimes`

Scoring Criteria		Decision Rules	
5	Loops <code>num</code> times	Responses can still earn the point even if they • return early	1 point
6	Calls <code>play</code> and <code>getScore</code>	Responses will not earn the point if they • call either method on an object other than <code>this</code> (use of <code>this</code> is optional) • include parameters	1 point
7	Compares a score to an identified max or to another score	Responses can still earn the point even if they • make the comparison outside the loop • call <code>getScore</code> incorrectly • fail to call <code>play</code> between calls to <code>getScore</code>	1 point
8	Identifies the maximum score (<i>algorithm</i>)	Responses will not earn the point if they • fail to initialize the result variable • compare a score to an identified max or to another score outside the loop • fail to call <code>play</code> exactly once each time through the loop	1 point
9	Returns identified maximum score	Responses can still earn the point even if they • calculate the maximum score incorrectly Responses will not earn the point if they • assign a value to the identified maximum score without any loop or logic to find the maximum	1 point
Total for part (b)			5 points
Question-specific penalties			
None			
Total for question 1			9 points

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Question 2: Class**9 points****Canonical solution**

```
public class Textbook extends Book
{
    private int edition;

    public Textbook(String tbTitle, double tbPrice,
                    int tbEdition)
    {
        super(tbTitle, tbPrice);
        edition = tbEdition;
    }

    public int getEdition()
    {
        return edition;
    }

    public boolean canSubstituteFor(Textbook other)
    {
        return other.getTitle().equals(getTitle()) &&
            edition >= other.getEdition();
    }

    public String getBookInfo()
    {
    }
}
```

9 points

Textbook

Scoring Criteria		Decision Rules	
1	Declares class header (must not be <code>private</code>): <code>class Textbook extends Book</code>		1 point
2	Declares constructor header: <code>public Textbook(String ____, double ____, int ____)</code>		1 point
3	Constructor calls <code>super</code> as the first line with the appropriate parameters		1 point
4	Declares appropriate <code>private</code> instance variable and uses appropriate parameter to initialize it	Responses will not earn the point if they - omit the keyword <code>private</code> - declare the variable outside the class, or in the class within a method or constructor - redeclare and use the instance variables of the superclass	1 point
5	Declares at least one required method and all declared headers are correct: <code>public boolean canSubstituteFor(Textbook ____) public int getEdition() public String getBookInfo()</code>	Responses will not earn the point if they exclude <code>public</code>	1 point
6	<code>getEdition</code> returns value of instance variable	Responses will not earn the point if they fail to create an instance variable for the edition	1 point
7	<code>canSubstituteFor</code> determines whether <code>true</code> or <code>false</code> should be returned based on comparison of book titles and editions (<i>algorithm</i>)	Responses can still earn the point even if they - fail to return (<i>return is not assessed for this method</i>) - access the edition without calling <code>getEdition</code> - redeclare and use the <code>title</code> variable of the superclass instead of calling <code>getTitle</code> Responses will not earn the point if they - fail to use <code>equals</code> - call <code>getTitle</code> incorrectly in either case	1 point
8	<code>getBookInfo</code> calls <code>super.getBookInfo</code>	Responses can still earn the point even if they - redeclare and use the instance variables of the superclass Responses will not earn the point if they - include parameters	1 point

9	Constructs information string	Responses can still earn the point even if they • call <code>super.getBookInfo</code> incorrectly • fail to call <code>super.getBookInfo</code> and access <code>title</code> and <code>price</code> directly • fail to return (<i>return is not assessed for this method</i>) Responses will not earn the point if they • omit the literal hyphen(s) in the constructed string • omit the edition in the constructed string • concatenate strings incorrectly	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) `public double getAverageRating()` **3 points**
- ```
{
 int sum = 0;

 for (Review r : allReviews)
 {
 sum += r.getRating();
 }

 return (double) sum / allReviews.length;
}
```
- (b) `public ArrayList<String> collectComments()` **6 points**
- ```
{
    ArrayList<String> commentList = new ArrayList<String>();

    for (int i = 0; i < allReviews.length; i++)
    {
        String comment = allReviews[i].getComment();
        if (comment.indexOf("!") >= 0)
        {
            String last =
                comment.substring(comment.length() - 1);
            if (!last.equals("!") && !last.equals("."))
            {
                comment += ".";
            }
            commentList.add(i + "-" + comment);
        }
    }
    return commentList;
}
```

(a) `getAverageRating`

Scoring Criteria		Decision Rules	
1	Initializes and accumulates sum	Response can still earn the point even if they - fail to use a loop to accumulate - fail to call <code>getRating</code> or call <code>getRating</code> incorrectly	1 point
2	Accesses every element of <code>allReviews</code> (<i>no bounds errors</i>)	Responses will not earn the point if they access the elements of <code>allReviews</code> incorrectly	1 point
3	Computes and returns <code>double</code> average rating based on <code>getRating</code> return values (<i>algorithm</i>)	Response can still earn the point even if they - fail to initialize the accumulator for the sum Responses will not earn the point if they - fail to accumulate the sum of all ratings - use integer division to compute average - include parameters on call to <code>getRating</code> - fail to call <code>getRating</code> on all elements of <code>allReviews</code>	1 point
Total for part (a)			3 points

(b) `collectComments`

Scoring Criteria		Decision Rules	
4	Instantiates an <code>ArrayList</code> capable of holding <code>String</code> objects		1 point
5	Accesses every element of <code>allReviews</code> (<i>no bounds errors</i>)	Responses can still earn the point even if they - fail to keep track of the index Responses will not earn the point if they - access the elements of <code>allReviews</code> incorrectly	1 point
6	Calls <code>getComment</code> on an element of <code>allReviews</code> , calls at least one <code>String</code> method appropriately on the <code>getComment</code> return value, and all <code>String</code> method calls are syntactically	Responses can still earn the point even if they - call some of the <code>String</code> methods on objects other than <code>getComment</code> return values Responses will not earn the point if they - include a parameter when calling <code>getComment</code> - call any <code>String</code> methods incorrectly - call any <code>String</code> methods on objects other than <code>String</code> values	1 point
7	Compares the final character of the comment to both a period and an exclamation point	Responses can still earn the point even if they - use incorrect logic in the comparison - call <code>String</code> methods incorrectly Responses will not earn the point if they - use <code>==</code> instead of <code>equals</code> when comparing <code>String</code> objects	1 point
8	Assembles string appropriately based on result of comparison of last character with period and exclamation point (<i>algorithm</i>)	Responses can still earn the point even if they - call <code>String</code> methods incorrectly - use <code>==</code> instead of <code>equals</code> Responses will not earn the point if they - fail to keep track of the element index - use incorrect logic in the comparison	1 point
9	Adds all and only appropriate constructed strings to the <code>ArrayList</code> (<i>algorithm</i>)	Responses can still earn the point even if they - initialize the <code>ArrayList</code> incorrectly - fail to return the constructed <code>ArrayList</code> (<i>return is not assessed</i>) - assemble the review string incorrectly - access the elements of <code>allReviews</code> incorrectly	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)

```
public void repopulate()
{
    for (int row = 0; row < grid.length; row++)
    {
        for (int col = 0; col < grid[0].length; col++)
        {
            int rval = (int)(Math.random() * MAX) + 1;
            while (rval % 10 != 0 || rval % 100 == 0)
            {
                rval = (int)(Math.random() * MAX) + 1;
            }
            grid[row][col] = rval;
        }
    }
}
```

4 points

(b)

```
public int countIncreasingCols()
{
    int count = 0;

    for (int col = 0; col < grid[0].length; col++)
    {
        boolean ordered = true;

        for (int row = 1; row < grid.length; row++)
        {
            if (grid[row][col] < grid[row-1][col])
            {
                ordered = false;
            }
        }

        if (ordered)
        {
            count++;
        }
    }

    return count;
}
```

5 points

(a) `repopulate`

Scoring Criteria		Decision Rules	
1	Traverses <code>grid</code> (<i>no bounds errors</i>)	Responses will not earn the point if they - fail to access an element of <code>grid</code> - access the elements of <code>grid</code> incorrectly - use enhanced <code>for</code> loops without using a <code>grid</code> element inside the loop	1 point
2	Generates a random integer in a range based on <code>MAX</code>	Responses can still earn the point even if they - assume or verify that <code>MAX</code> ≥ 10 Responses will not earn the point if they - fail to cast to an <code>int</code>	1 point
3	Ensures that all produced values are divisible by 10 but not by 100	Responses can still earn the point even if they fail to use a loop	1 point
4	Assigns appropriate values to all elements of <code>grid</code> (<i>algorithm</i>)	Responses can still earn the point even if they - assume or verify that <code>MAX</code> ≥ 10 - produce some values that are not divisible by 10 or divisible by 100, if the range and distribution are otherwise correct Responses will not earn the point if they - use enhanced <code>for</code> loops and fail to maintain indices - produce values that are not equally distributed - produce values outside the specified range - exclude values that should be considered valid (other than errors in 10/100 handling)	1 point
Total for part (a)			4 points

(b) `countIncreasingCols`

Scoring Criteria		Decision Rules	
5	Traverses <code>grid</code> in column major order (no loop header bounds errors)	Responses can still earn the point even if they - access an out-of-bounds row or column index adjacent to the edge of the grid, if the loop bounds include only valid indices Responses will not earn the point if they - fail to access an element of <code>grid</code> - access the elements of <code>grid</code> incorrectly	1 point
6	Compares two elements in the same column of <code>grid</code>	Responses can still earn the point even if they - access elements of <code>grid</code> incorrectly - access elements in nonadjacent rows - compare elements with <code>==</code> - compare two elements in the same row instead of the same column	1 point
7	Determines whether a single column is in increasing order (<i>algorithm</i>)	Responses can still earn the point even if they - fail to reset variables in the outer loop before proceeding to the next column Responses will not earn the point if they - fail to access all pairs of adjacent elements in a single column - cause a bounds error by attempting to compare the first element of a column with a previous element or the last element of a column with a subsequent element - incorrectly identify a column with at least one pair of adjacent elements in decreasing order as increasing	1 point
8	Counts all columns that are identified as increasing (<i>algorithm</i>)	Responses can still earn the point even if they - detect increasing order for each row instead of each column - incorrectly identify increasing columns in the inner loop Responses will not earn the point if they - fail to initialize the counter	1 point

		fail to reset variables in the outer loop causing subsequent runs of the inner loop to misidentify columns	
9	Returns calculated count of increasing columns	Responses can still earn the point even if they calculate the count incorrectly	1 point
Total for part (b)			5 points
Question-specific penalties			
None			
Total for question 4			9 points

Alternate Canonical for Part (a)

```
public void repopulate()
{
    for (int row = 0; row < grid.length; row++)
    {
        for (int col = 0; col < grid[0].length; col++)
        {
            int rval = ((int)(Math.random() * (MAX / 10)) + 1) * 10;
            while (rval % 100 == 0)
            {
                rval = ((int)(Math.random() * (MAX / 10)) + 1) * 10;
            }
            grid[row][col] = rval;
        }
    }
}
```