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AP[®]

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AP[®] Computer Science A

Scoring Guidelines

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- x) Local variables used but none declared
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No Penalty

- Extraneous code with no side-effect (e.g., valid precondition check, no-op)
- Spelling/case discrepancies where there is no ambiguity*
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- Common mathematical symbols used for operators (`×` `÷` `≤` `<>` `≠`)
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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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> calculate the score total incorrectly call <code>goalReached</code> incorrectly fail to distinguish all cases correctly Responses will not earn the point if they <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> return early 	1 point
6	Calls <code>play</code> and <code>getScore</code>	Responses will not earn the point if they <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> calculate the maximum score incorrectly Responses will not earn the point if they <ul style="list-style-type: none"> 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()
    {
        return super.getBookInfo() + "-" + edition;
    }
}
```

9 points

Textbook

Scoring Criteria		Decision Rules	
1	Declares class header (must not be private): <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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> exclude <code>public</code> 	1 point
6	<code>getEdition</code> returns value of instance variable	Responses will not earn the point if they <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> redeclare and use the instance variables of the superclass Responses will not earn the point if they <ul style="list-style-type: none"> include parameters 	1 point

9	Constructs information string	<p>Responses can still earn the point even if they</p> <ul style="list-style-type: none">• 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>) <p>Responses will not earn the point if they</p> <ul style="list-style-type: none">• omit the literal hyphen(s) in the constructed string• omit the edition in the constructed string• concatenate strings incorrectly	1 point
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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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> fail to initialize the accumulator for the sum Responses will not earn the point if they <ul style="list-style-type: none"> 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>)	<p>Responses can still earn the point even if they</p> <ul style="list-style-type: none"> fail to keep track of the index <p>Responses will not earn the point if they</p> <ul style="list-style-type: none"> 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 valid	<p>Responses can still earn the point even if they</p> <ul style="list-style-type: none"> call some of the <code>String</code> methods on objects other than <code>getComment</code> return values <p>Responses will not earn the point if they</p> <ul style="list-style-type: none"> 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	<p>Responses can still earn the point even if they</p> <ul style="list-style-type: none"> use incorrect logic in the comparison call <code>String</code> methods incorrectly <p>Responses will not earn the point if they</p> <ul style="list-style-type: none"> 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>)	<p>Responses can still earn the point even if they</p> <ul style="list-style-type: none"> call <code>String</code> methods incorrectly use <code>==</code> instead of <code>equals</code> <p>Responses will not earn the point if they</p> <ul style="list-style-type: none"> 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>)	<p>Responses can still earn the point even if they</p> <ul style="list-style-type: none"> 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
<hr/>	
Question-specific penalties	
None	
<hr/>	
	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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> assume or verify that <code>MAX >= 10</code> Responses will not earn the point if they <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> assume or verify that <code>MAX >= 10</code> 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 <ul style="list-style-type: none"> 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)	<p>Responses can still earn the point even if they</p> <ul style="list-style-type: none"> access an out-of-bounds row or column index adjacent to the edge of the grid, if the loop bounds include only valid indices <p>Responses will not earn the point if they</p> <ul style="list-style-type: none"> 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>	<p>Responses can still earn the point even if they</p> <ul style="list-style-type: none"> 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>)	<p>Responses can still earn the point even if they</p> <ul style="list-style-type: none"> fail to reset variables in the outer loop before proceeding to the next column <p>Responses will not earn the point if they</p> <ul style="list-style-type: none"> 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>)	<p>Responses can still earn the point even if they</p> <ul style="list-style-type: none"> detect increasing order for each row instead of each column incorrectly identify increasing columns in the inner loop <p>Responses will not earn the point if they</p> <ul style="list-style-type: none"> fail to initialize the counter 	1 point

		<ul style="list-style-type: none"> 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	1 point
		<ul style="list-style-type: none"> calculate the count incorrectly 	
		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;
        }
    }
}
```