

AP Computer Science A Review Test 1

1. (B5) Assume that p , q , and r are boolean variables. Consider the following expression.

$$!((p \mid\mid q) \&\& (q \mid\mid !r))$$

Which of the following expressions is equivalent to the given expression?

- A. $(p \mid\mid q) \&\& (p \mid\mid !r) \&\& (q) \&\& (q \mid\mid !r)$
- B. $(!p \&\& !q) \mid\mid (!p \&\& r) \mid\mid (!q) \mid\mid (!q \&\& r)$
- C. $(!p \mid\mid !q) \&\& (!q \mid\mid r)$
- D. $(!p \&\& !q) \mid\mid (!q \&\& r)$
- E. $(p \&\& q) \mid\mid (q \&\& !r)$

2. (DS9) The simple game of Nim has a single pile of stones and two players who alternately remove at least one and up to half the stones in the pile, until one player removes the last stone. The player that removes the last stone loses. A Java implementation of this game includes a class `Pile`, an abstract class `Player` with different subclasses such as `HumanPlayer`, `DumbComputerPlayer`, `SmartComputerPlayer`, and a `GameController` class. The `GameController` is responsible for asking each player in turn to indicate how many stones that player wants to take, for checking that that number is legal, and, if it is legal to adjust the pile, if not to ask the same player again. The `Game Controller` continues to have the players alternate turns until the game ends when one player takes the last stone. The `GameController` constructor will initialize all its instance variables with appropriate parameters.

Which of the following is the best design for the `GameController` class?

- A. `GameController` has no instance variables. It has a method `makePlay` that takes a pile and a player as parameters and completes one play (taking of stones) by that player. Its main loop alternately calls the `makePlay` method for each player.
- B. `GameController` has a `Pile` instance variable. It has a method `makePlay` that takes a `Player` parameter and completes one play (taking of stones) by that player. Its main loop alternately calls the `makePlay` method for each player.
- C. `GameController` has a `Player` instance variable for each player. It has a method `makePlay` that takes a `Pile` parameter and completes one play (taking of stones) by a player. Its main loop alternately calls the `makePlay` method for each player.
- D. `GameController` has a `Player` instance variable for each player and a `Pile` instance variable. It has a method `makePlay` that takes a `Player` parameter and completes one play (taking of stones) by a player. Its main loop alternately calls the `makePlay` method for each player.
- E. `GameController` has a `HumanPlayer` instance variable, a `SmartComputerPlayer` instance variable and a `Pile` instance variable. It has a method `makePlay` that takes a `Player` parameter and completes one play (taking of stones) by a player. Its main loop alternately calls the `makePlay` method for each player.

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3. (A1) Consider the following data field and method.

```
private double[] list;

public int getIt(double value)
{
    int k = 0;

    while(k < list.length && list[k] != value)
        k++;

    if(k < list.length)
        return k;
    else
        return -1;
}
```

Which of the following best describes what is returned by this method?

- A. The number of times that `value` occurs in `list`, or -1 if all items in the list equal `value`.
- B. The number of items in `list` that are not equal to `value`, or -1 if `value` is not in list.
- C. The index of the first occurrence of `value` in `list`, or -1 if `value` is not in list
- D. The index of the last occurrence of `value` in `list`, or -1 if `value` is not in list
- E. The index of the first item in `list` that is not equal to `value`, or -1 if `value` is not in list

4.(B1) A class `Indicator` has a method `level` that returns an integer. Consider this method from a client class.

```
// precondition: low < high
// postcondition: return true if the current level of dial is between low and high
//                inclusive; otherwise return false
public boolean inRange(Indicator dial, int low, int high)
{
    // missing code
}
```

The method `inRange` is intended to return true when the value returned by the `dial.level` method is between `low` and `high` inclusive. Consider the following replacements for `// missing code`.

- I.

```
if(dial.level() < low)
    return false;
else if (dial.level() > high)
    return false;
else
    return true;
```
- II.

```
if((dial.level() < low) && (dial.level() > high))
    return false;
else
    return true;
```
- III.

```
return ((dial.level() >= low) && (dial.level() <= high));
```

Which of these replacements for `// missing code` would make `inRange` work as intended?

- A. I only
- B. II only
- C. I and II only
- D. I and III only
- E. I, II, and III

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5. (C1) Consider the following description.

A forest has trees. A white pine is a pine which is a tree.

Which of the following partial declarations would be the best choice for representing the relationships among these things?

- A.

```
public class Forest
    public class Tree extends Forest
    public class Pine extends Tree
    public class WhitePine extends Pine
```
- B.

```
public class WhitePine
    public class Pine extends WhitePine
    public class Tree extends Pine
    public class Forest extends Tree
```
- C.

```
public class WhitePine
    public class Pine extends WhitePine
    public class Tree extends Pine

    public class Forest
    {
        private ArrayList<Pine> myPines;
        private ArrayList<WhitePine> myWhitePines;
        . . .
    }
```
- D.

```
public class Tree
    public class Pine extends Tree
    public class WhitePine extends Pine

    public class Forest
    {
        private ArrayList<Tree> myTrees;
        . . .
    }
```
- E.

```
public class Forest

    public class Tree
    {
        private Forest myForest;
        . . .
    }
    public class Pine extends Tree
    public class WhitePine extends Pine
```

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6. (C6) Assume that the following partial declarations have been made, with default constructors for the classes.

```
public interface Controller  
  
public class Widget implements Controller  
  
public class Thingy extends Widget
```

Consider the following declarations.

- I. Widget myThing = new Thingy();
- II. Thingy myWidge = new Widget();
- III. Controller myControl = new Thingy();

Which of these declarations will compile correctly?

- A. I only
- B. I and II only
- C. I and III only
- D. II and III only
- E. I, II, and III

7. (R1) Consider the following method.

```
public int getSomething(int value)  
{  
    if(value < 2)  
        return 0;  
    else  
        return 1 + getSomething(value - 2);  
}
```

Assume $val > 0$. What is returned by the call `getSomething(val)`?

- A. $val - 2$
- B. $val \% 2$
- C. $(val-1) \% 2$
- D. $val / 2$
- E. $(val-1) / 2$

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8 (SL1) Consider the following declarations.

```
public class Something
{
    public String name()
    { /* code not shown */ }

    public int value()
    { /* code not shown */ }

    // instance variables, constructors, other methods not shown
}

Something[] list = new Something[10];
```

Assume that the elements of the array `list` have been initialized.

Which of the following gives a reference to the name of the second item in `list`?

- A. `list.name(1)`
- B. `list.name()[1]`
- C. `list[1].name()`
- D. `name.list[1]`
- E. `name(list[1])`

9. (CTA1) Consider the following code segment.

```
for(int num = 20; num >= 0; num--)
{
    if(num % 4 == 2)
        System.out.print(num + " ");
}
```

What is printed as a result of executing this code segment?

- A. 19 18 17 15 14 13 11 10 9 7 6 5 3 2 1
- B. 20 18 16 14 12 10 8 6 4 2 0
- C. 18 14 10 6 2
- D. 20 16 12 8 4 0
- E. 6

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10. (B3) A guidebook places hotel prices into four categories: category 1 (\$) means the price is \$50 or below; category 2 (\$\$) means the price is greater than \$50 but less than or equal \$80; category 3 (\$\$\$) means the price is greater than \$80 but less than or equal \$120; category 4 (\$\$\$\$) means the price is greater than \$120. The method `priceCategory` is intended to return a string with the number of '\$'s for the category of the parameter `price`.

```
public String priceCategory(double price)
{
    // missing code
}
```

Consider the following replacements for `// missing code`.

- I. String symbol;
 if(price <= 50.00)
 symbol = "\$";
 if(price <= 80.00)
 symbol = "\$\$";
 if(price <= 120.00)
 symbol = "\$\$\$";
 else
 symbol = "\$\$\$\$";
 return symbol;
- II. String symbol;
 if(price <= 50.00)
 symbol = "\$";
 if(50.00 < price <= 80.00)
 symbol = "\$\$";
 if(80.00 < price <= 120.00)
 symbol = "\$\$\$";
 else
 symbol = "\$\$\$\$";
 return symbol;
- III. if(price <= 50.00)
 return "\$";
 if(price <= 80.00)
 return "\$\$";
 if(price <= 120.00)
 return "\$\$\$";
 return "\$\$\$\$";

Which of these replacements for `// missing code` would make `priceCategory` work as intended?

- A. I only
- B. II only
- C. III only
- D. I and II
- E. I and III

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11. (C11) Consider the following declarations.

```
public class ColorBox
{
    public ColorBox()
    {
        System.out.print("black ");
    }

    public void showColor()
    {
        System.out.print("red ");
    }
}

public class BlueGreenBox extends ColorBox
{
    public BlueGreenBox()
    {
        System.out.print("blue ");
    }

    public void showColor()
    {
        super.showColor();
        System.out.print("green ");
    }
}
```

The following statements occur in a client method:

```
ColorBox box = new BlueGreenBox();
box.showColor();
```

What is printed when these two lines are executed?

- A. black red
- B. blue green
- C. blue red green
- D. blue black red green
- E. black blue red green

12. (DS3) The principle of *information hiding* suggests that in Java all variable data stored in an object should be in **private** data fields for the class defining the object, and accessed or changed only using appropriate public methods. Which of the following is the most accurate statement about this principle?

- A. When this principle is used, the representation of the data can be changed without any code in client programs needing to be changed.
- B. When this principle is used, the representation of the data can be changed without any code in the public methods of the defining class needing to be changed.
- C. This principle only applies to objects that have multiple methods for changing their internal data values; objects that have a single method for changing each data field should use public data fields.
- D. This principle only applies to objects that have multiple methods for accessing their internal data values; objects that have a single method for accessing each data field should use public data fields.
- E. This principle only applies to objects that have mutator methods that can change the values of one or more data fields. It does not apply to immutable objects.

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13. (CTA10) Consider the following static method

```
public static double getSomething(int val)
{
    val = 2 + val;
    val = val + 3*val;

    return val;
}
```

Which of the following could be used to replace the body of `getSomething` so that the modified version will return the same result as the original version for all values of the parameter `val`.

- A. `return 4*val + 2;`
- B. `return 4*val + 6;`
- C. `return 4*val + 8;`
- D. `return 7*val + 6;`
- E. `return 7*val + 8;`

14 (A21). Consider the incomplete method `headCount(int numFlips)`.

```
public int headCount(int numFlips)
{
    int count = 0;
    // missing code
    return count;
}
```

Method `headCount(int numFlips)` is intended to return the number of "heads" from `numFlips` flips of a fair coin (the probability of "heads" on one flip is $\frac{1}{2}$). Consider the following replacements for `// missing code`.

- I `while(count <= numFlips && Math.random() < 0.5)`
`count++;`
- II `for(int flip = 0; flip < numFlips; flip++)`
`{`
`if(Math.random() < 0.5)`
`count++;`
`}`
- III `for(int flip = 0; flip < numFlips; flip++)`
`{`
`if((int)(2 * Math.random()) == 1)`
`count++;`
`}`

Which if these replacements for `// missing code` will work as intended?

- A. I only
- B. II only
- C. I and II only
- D. II and III only
- E. I, II and III

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15. (R5) Consider the following method

```
public void doSomething(int value)
{
    if(0 < value && value < 10)
    {
        doSomething(value - 1);
        doSomething(value + 1);
        System.out.print(" " + value);
    }
}
```

Which of the following will be printed as a result of the call `doSomething(4)`?

- A. 4 3 2 1 5 6 7 8 9
- B. 4 3 5 2 6 1 7 8 9
- C. 9 8 7 6 5 1 2 3 4
- D. 9 8 7 1 6 2 5 3 4
- E. Nothing will be printed due to an infinite recursion

16. (SL3) Consider the following partial class declaration.

```
public class Student
{
    private String myName;
    private double myGPA;

    public String name()
    { return myName; }

    public double GPA()
    { return myGPA; }

    // returns the name and GPA in string format
    public String toString()
    {
        return // String expression
    }

    // constructors and other methods not shown
}
```

Consider the following replacements for `// string expression` in the `toString` method.

- I. `myName + " " + myGPA;`
- II. `Student.name() + " " + Student.GPA();`
- III. `name() + " " + GPA();`

Which of these replacements will make the method `toString` work as intended?

- A. I only
- B. I and II only
- C. I and III only
- D. II and III only
- E. I, II, and III

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17. (CTA3) The following code segment is intended to sum the first 10 positive odd integers.

```
sum = 0;
for(int k = 1; k <= 10; k++)
{
    sum += 2*k + 1;
}
```

Which of the following best describes the error, if any, in this code.

- A. The segment works as intended.
- B. The segment sums the first 9 odd integers
- C. The segment sums the first 20 odd integers
- D. The segment leaves out the first odd integer and includes the eleventh odd integer in the sum.
- E. The variable `sum` is incorrectly initialized. The segment would work as intended if `sum` were initialized to 1.

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Questions 18-19 refer to code from the GridWorld case study. A copy of the code is supplied in the appendix.

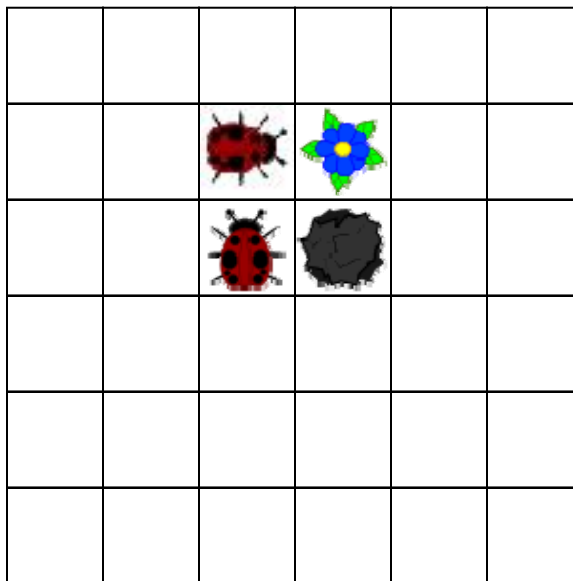
18. (GW1).

Assume that the `BugRunner` program is being executed. Assume the grid currently contains a single instance of `Bug` with a flower immediately in front of it. What happens when the step button is clicked?

- A. The bug does not change state
- B. The bug turns 45 degrees to the left
- C. The bug turns 45 degrees to the right
- D. The bug moves into the space occupied by the flower, removing the flower from the grid
- E. The bug turns into a rock

19. (GW9).

Suppose the grid has the following configuration after adding some objects.



Let `bug1` be the one at position (1, 2) (the upper bug) and `bug2` the one at position(2,2) (the lower bug). What will be the results of the calls to `canMove()` for bug 1 and bug 2?

- A. `bug1.canMove()` returns false; `bug2.canMove()` returns false
- B. `bug1.canMove()` returns true; `bug2.canMove()` returns false
- C. `bug1.canMove()` returns false; `bug2.canMove()` returns true
- D. `bug1.canMove()` returns 3; `bug2.canMove()` returns -1
- E. `bug1.canMove()` returns 0; `bug2.canMove()` returns 1

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20. (R7) Consider the following data field and method.

```
private int[] list;

public int getIt(int index, int target)
{
    if(index >= list.length)
        return -1;
    else if(target == list[index])
        return index;
    else
        return getIt(index + 1, target);
}
```

What will be returned by the call `getIt(0, 5)`?

- A. The value at index 5 in `list`, or -1 if `list.length < 5`.
- B. The value at index `list.length-1` in `list`, or -1 if `list.length < 5`.
- C. The index of the first occurrence of 5 in `list`, or -1 if 5 does not occur in `list`.
- D. The index of the last occurrence of 5 in `list`, or -1 if 5 does not occur in `list`.
- E. The call will cause an `ArrayIndexOutOfBoundsException`.

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21. (DS5) A class `CardDeck` will keep track of a deck of playing cards, a sequence of instances of the class `PlayingCard`. The chief responsibility for an instance of `CardDeck` is to deal, to remove and return one card at a time in random order, as if the card deck had been shuffled. Consider the following designs for the `CardDeck` class.

- I. When the `CardDeck` is created, store the instances of `PlayingCard` in an `ArrayList` in sorted order. When a card needs to be dealt, generate a random number and remove the `PlayingCard` at that index from the `ArrayList` and return it.
- II. When the `CardDeck` is created, store the instances of `PlayingCard` in an `ArrayList` in sorted order; then run an auxiliary method that randomizes the order of the `PlayingCards` in the `ArrayList`. When a card needs to be dealt, remove the last card from the `ArrayList` and return it.
- III. When the `CardDeck` is created, store the instances of `PlayingCard` in an array in sorted order; then run an auxiliary method that randomizes the order of the `PlayingCards` in the array. Initialize an instance variable `top` to equal the length of the array. When a card needs to be dealt, decrement `top` by one and return a reference to the card at index `top` in the array.

Which of these designs will satisfy the responsibility of the `CardDeck` class to deal a card as described above?

- A. I only
- B. II only
- C. I and II only
- D. I and III only
- E. I, II and III

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22. (C10) Consider the following declarations, where some lines have been numbered for reference.

```
public interface Controller
{
1   void doIt();
}

2   public abstract class Widget implements Controller
{
    private double myValue;

    public Widget()
    {
        myValue = 10;
    }

    public double value()
    {
        return myValue;
    }
}

public class Thingy extends Widget
{
    public void doIt()
    {
3       System.out.println( 3.0 * value());
    }
}

public class Client
{
    public void doSomething()
    {
4       Controller myControl = new Thingy();
        myControl.doIt();
    }
}
```

You attempt to compile and run these classes (with a class that correctly calls the `Client` `doSomething` method). Which of the following best describes the outcome?

- A. The code does not compile because in line 1 the `doIt` method is not declared public.
- B. The code does not compile because in line 2 the class `Widget` implements `Controller`, but it has no implementation of the method `doIt`.
- C. The code does not compile because the variable `myValue` cannot be accessed directly or indirectly within the class `Thingy`, as it is in line 3.
- D. The code does not compile because an instance of class `Thingy` is not type-compatible with `Controller`, as indicated in line 4.
- E. The code compiles and runs with the value 30.0 output when the call to `doSomething` is made.

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23. (A7) Consider the following data field and method.

```
private ArrayList<String> list;  
  
public void change()  
{  
    for(int k = 0; k < list.size() - 1; k++)  
    {  
        if(list.get(k).equals(list.get(k+1)))  
            list.remove(k+1);  
    }  
}
```

Assume that `list` is initialized as shown below.

list	alex	alex	brad	nils	nils	nils	pete	pete	pete	pete
------	------	------	------	------	------	------	------	------	------	------

Which of the following shows `list` after a call to method `change`?

A.

alex	brad	nils	pete
------	------	------	------

B.

alex	brad	nils	pete	pete
------	------	------	------	------

C.

alex	brad	nils	nils	pete	pete
------	------	------	------	------	------

D.

alex	brad	nils	nils	pete	pete	pete
------	------	------	------	------	------	------

E.

alex	alex	brad	nils	nils	nils	pete	pete	pete	pete
------	------	------	------	------	------	------	------	------	------

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24. (SL7) Consider the following partial class declaration.

```
public class Point2D
{
    private double myX;
    private double myY;

    public Point2D(double x, double y)
    {
        myX = x;
        myY = y;
    }

    public boolean equals(Object obj)
    {
        Point2D other = (Point2D)obj;

        return (myX == other.myX) && (myY == other.myY);
    }

    // other methods not shown
}
```

Consider the following method `isOrigin` from another class. Method `isOrigin` is intended to return `true` if and only if `point` has both coordinates equal to 0.0.

```
// returns true if the coordinates of point are both 0.0,
// otherwise returns false
public boolean isOrigin(Point2D point)
{
    Point2D origin = new Point2D(0.0, 0.0);
    return /* expression */;
}
```

Which of the following expressions substituted for `/* expression */` will make `isOrigin` work as intended?

- A. `origin.myX == point.myX && origin.myY == point.myY`
- B. `origin.myX.equals(point.myX) && origin.myY.equals(point.myY)`
- C. `origin == point`
- D. `origin.equals(point)`
- E. `Math.equals(origin, point)`

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25. (R9) Consider the following two methods that are declared within the same class.

```
public int supplement(int value)
{
    if(value < 50)
        return reduce(value + 10);
    else
        return reduce(value);
}

public int reduce(int value)
{
    if(value > 0)
        return supplement(value - 5);
    else
        return value;
}
```

What will be returned as a result of the call `supplement(40)`?

- A. 0
- B. -5
- C. 50
- D. 55
- E. Nothing will be returned due to an infinite recursion.

26. (CTA5) Consider the following code segment.

```
for(int num = 5; num > 0; num = num - 2)
{
    for(int star = 0; star < num; star++)
        System.out.print("*");
    System.out.println();
}
```

What will be printed when this code segment is executed?

- | | |
|--|--------------------------|
| A. *
**

***** | D. *****

* |
| B. *
**
***** | E. ****
** |
| C. *****

**
* | |

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27. (C3) Consider the following partial declarations.

```
public class Location
{
    public Location(int xCoord, int yCoord)
        . . .
}
public class Color
{
    public Color(int redVal, int greenVal, int blueVal)
        . . .
}
public class Widget
{
    private Location myLoc;

    public Widget(int x, int y)
    {
        myLoc = new Location(x, y);
    }
    . . .
}
public class Thingy extends Widget
{
    private Color myColor;

    public Thingy(int x, int y, Color col)
    {
        super(x, y);
        myColor = col;
    }
    . . .
}
```

Assume that the following statement appears in a client program.

```
Widget widg = new Thingy(100, 100, new Color(100, 100, 100));
```

Which of the following best describes the order on which the constructors will complete execution?

- A. Color, Location, Widget, Thingy
- B. Widget, Thingy, Location, Color
- C. Color, Widget, Location, Thingy
- D. Thingy, Color, Widget, Location
- E. Color, Thingy, Location, Widget

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28. (B8) Assume that an object referenced by the variable `gadget` has two boolean methods, `tooWide` and `tooLong`. Consider the following expression.

```
(gadget.tooWide() && !gadget.tooLong()) || gadget.tooLong()
```

Which of the following is equivalent to the expression above?

- A. `true`
- B. `false`
- C. `gadget.tooWide()`
- D. `gadget.tooWide() || gadget.tooLong()`
- E. `(!gadget.tooWide() || gadget.tooLong()) && !gadget.tooLong()`

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29. (A9) Consider the partial method definition.

```
// len > 3
public void printTriangle(int len)
{
    /* method body */
}
```

This method is intended to print a hollow triangle as diagrammed below, where the number of stars along each side is given by the parameter `len`, where `len > 3`. The result of the call `printTriangle(6)` would be this diagram.

```
*
**
* *
*  *
*   *
*****
```

Which of the following replacements for `/* method body */` would make the method `printTriangle` work as intended?

A.

```
for(row = 0; row < len; row++)
{
    for(k = 0; k < row+1; k++)
        System.out.print("*");
    System.out.println();
}
```

B.

```
System.out.println("*");
for(row = 0; row < len; row++)
{
    System.out.print("*");
    for(k = 0; k < row; k++)
        System.out.print(" ");
    System.out.println("*");
}
for(star = 0; star < len; star++)
    System.out.print("*");
```

C.

```
System.out.println("*");
for(row = 1; row < len-1; row++)
{
    System.out.print("*");
    for(k = 0; k < row; k++)
        System.out.print(" ");
    System.out.println("*");
}
for(star = 0; star < len; star++)
    System.out.print("*");
```

D.

```
System.out.println("*");
for(row = 1; row < len-1; row++)
{
    System.out.print("*");
    for(k = 0; k < row-1; k++)
        System.out.print(" ");
    System.out.println("*");
}
for(star = 0; star < len; star++)
    System.out.print("*");
```

E.

```
System.out.println("*");
for(row = 1; row < len-1; row++)
{
    System.out.print("*");
    for(k = 0; k < row-2; k++)
        System.out.print(" ");
    System.out.println("*");
}
for(star = 0; star < len; star++)
    System.out.print("*");
```

AP Computer Science A Review Test 1

30. (A11) Consider the following data field and method.

```
private int[] valList;  
  
public void changeList()  
{  
    int currentLoc = 0;  
    int nonZeroLoc = 0;  
  
    while(nonZeroLoc < valList.length && valList[nonZeroLoc] == 0)  
        nonZeroLoc++;  
  
    while(nonZeroLoc < valList.length)  
    {  
        valList[currentLoc] = valList[nonZeroLoc];  
        valList[nonZeroLoc] = 0;  
        currentLoc++;  
        nonZeroLoc++;  
  
        while(nonZeroLoc < valList.length && valList[nonZeroLoc] == 0)  
            nonZeroLoc++;  
    }  
}
```

Assume that `valList` is initially the following array.

4	0	0	3	2	0	6	5	0
---	---	---	---	---	---	---	---	---

Which of the following best represents `valList` after the call `changeList()`?

A.

4	0	0	3	2	0	6	5	0
---	---	---	---	---	---	---	---	---

B.

4	3	2	6	5	0	0	0	0
---	---	---	---	---	---	---	---	---

C.

0	3	2	6	5	0	0	0	0
---	---	---	---	---	---	---	---	---

D.

0	0	0	0	2	3	4	5	6
---	---	---	---	---	---	---	---	---

E. The call will result in an `ArrayIndexOutOfBoundsException`.