chap 3: Boolean Expressions and if Statements

1. Consider the following code segment.

```
String str1 = new String("Advanced Placement");
String str2 = new String("Advanced Placement");
if (str1.equals(str2) && str1 == str2)
{
     System.out.println("A");
}
else if (str1.equals(str2) && str1 != str2)
{
     System.out.println("B");
}
else if (!str1.equals(str2) && str1 == str2)
{
     System.out.println("C");
}
else if (!str1.equals(str2) && str1 != str2)
{
     System.out.println("D");
}
```

What, if anything, is printed when the code segment is executed?

(A) A

(B) B

(C) C

(D) D

(E) Nothing is printed.

2. Consider the following method that is intended to determine if the double values d1 and d2 are close enough to be considered equal. For example, given a tolerance of 0.001, the values 54.32271 and 54.32294 would be considered equal.

```
/** @return true if d1 and d2 are within the specified tolerance,
 *          false otherwise
 */
public boolean almostEqual(double d1, double d2, double tolerance)
{
  /* missing code */
}
```

Which of the following should replace / * missing code * / so that almostEqual will work as intended?

chap 3: Boolean Expressions and if Statements

(A) return (d1 - d2) <= tolerance;
(B) return ((d1 + d2) / 2) <= tolerance;
(C) return (d1 - d2) >= tolerance;
(D) return ((d1 + d2) / 2) >= tolerance;
(E) return Math.abs(d1 - d2) <= tolerance;

3. Consider the following method, between, which is intended to return true if x is between lower and upper, inclusive, and false otherwise.

```
// precondition:  lower <= upper

// postcondition: returns true if x is between lower and upper,

//                inclusive; otherwise, returns false

public boolean between(int x, int lower, int upper)

{

  /* missing code */

}
```

Which of the following can be used to replace /* missing code */ so that between will work as intended?

(A) return (x <= lower) && (x >= upper);
(B) return (x <= lower) || (x >= upper);
(C) return lower <= x <= upper;
(D) return (x >= lower) && (x <= upper);
(E) return (x >= lower) || (x <= upper);

chap 3: Boolean Expressions and if Statements

4. Consider the following method, biggest, which is intended to return the greatest of three integers. It does not always work as intended.

```
public static int biggest(int a, int b, int c)
{
  if ((a > b) && (a > c))
  {
    return a;
  }
  else if ((b > a) && (b > c))
  {
    return b;
  }
  else
  {
    return c;
  }
}
```

Which of the following best describes the error in the method?

(A) biggest always returns the value of a.

(B) biggest may not work correctly when c has the greatest value.

(C) biggest may not work correctly when a and b have equal values.

(D) biggest may not work correctly when a and c have equal values.

(E) biggest may not work correctly when b and c have equal values.

chap 3: Boolean Expressions and if Statements

5. A teacher put three bonus questions on a test and awarded 5 extra points to anyone who answered all three bonus questions correctly and no extra points otherwise. Assume that the `boolean` variables `bonusOne`, `bonusTwo`, and `bonusThree` indicate whether a student has answered the particular question correctly.
Each variable was assigned `true` if the answer was correct and `false` if the answer was incorrect.

Which of the following code segments will properly update the variable `grade` based on a student's performance on the bonus questions?

I.
```
if (bonusOne && bonusTwo && bonusThree)
   grade += 5;
```

II.
```
if (bonusOne || bonusTwo || bonusThree)
   grade += 5;
```

III.
```
if (bonusOne)
   grade += 5;
if (bonusTwo)
   grade += 5;
if (bonusThree)
   grade += 5;
```

(A) I only
(B) II only
(C) III only
(D) I and III
(E) II and III

chap 3: Boolean Expressions and if Statements

6. Consider the following class definitions.

```
public class Person
{
     private String name;
     public String getName()
     {  return name;  }
}
public class Book
{
     private String author;
     private String title;
     private Person borrower;
     public Book(String a, String t)
     {
         author = a;
         title = t;
         borrower = null;
     }
     public void printDetails()
     {
         System.out.print("Author: " + author + " Title: " + title);
         if ( /* missing condition */ )
         {
            System.out.println(" Borrower: " + borrower.getName());
         }
     }
     public void setBorrower(Person b)
     {  borrower = b;  }
}
```

Which of the following can replace `/* missing condition */` so that the `printDetails` method CANNOT cause a run-time error?

I. `!borrower.equals(null)`
II. `borrower != null`
III. `borrower.getName() != null`

(A) I only
(B) II only
(C) III only
(D) I and II
(E) II and III

7. Assume that `a`, `b`, and `c` are `boolean` variables that have been properly declared and initialized. Which of the following `boolean` expressions is equivalent to `!(a && b) || c` ?

chap 3: Boolean Expressions and if Statements

(A) `a && b && c`
(B) `a || b || c`
(C) `!a && !b || c`
(D) `!a && !b && c`
(E) `!a || !b || c`

8. Assume that the boolean variables a, b, c, and d have been declared and initialized. Consider the following expression.

!(!(a && b) || (c || !d))

Which of the following is equivalent to the expression?

(A) (a && b) && (!c && d)
(B) (a || b) && (!c && d)
(C) (a && b) || (c || !d)
(D) (!a || !b) && (!c && d)
(E) !(a && b) && (c || !d)

9. Consider the following code segment, which is intended to simulate a random process. The code is intended to set the value of the variable `event` to exactly one of the values `1`, `2`, or `3`, depending on the probability of an event occurring. The value of `event` should be set to `1` if the probability is 70 percent or less. The value of `event` should be set to `2` if the probability is greater than 70 percent but no more than 80 percent. The value of `event` should be set to `3` if the probability is greater than 80 percent. The variable `randomNumber` is used to simulate the probability of the event occurring.

```
int event = 0;
if (randomNumber <= 0.70)
{
     event = 1;
}
if (randomNumber <= 0.80)
{
     event = 2;
}
else
{
     event = 3;
}
```

The code does not work as intended. Assume that the variable `randomNumber` has been properly declared and initialized. Which of the following initializations for `randomNumber` will demonstrate that the code segment will not work as intended?

chap 3: Boolean Expressions and if Statements

(A) `randomNumber = 0.70;`
(B) `randomNumber = 0.80;`
(C) `randomNumber = 0.85;`
(D) `randomNumber = 0.90;`
(E) `randomNumber = 1.00;`

10. Consider the following Boolean expressions.

I.

```
A && B
```

II.

```
!A && !B
```

Which of the following best describes the relationship between values produced by expression I and expression II?

(A) Expression I and expression II evaluate to different values for all values of `A` and `B`.
(B) Expression I and expression II evaluate to the same value for all values of `A` and `B`.
(C) Expression I and expression II evaluate to the same value only when `A` and `B` are the same.
(D) Expression I and expression II evaluate to the same value only when `A` and `B` differ.
(E) Expression I and expression II evaluate to the same value whenever `A` is `true`.

chap 3: Boolean Expressions and if Statements

11. Consider the following two code segments where the `int` variable `choice` has been properly declared and initialized.

Code Segment A

```
if (choice > 10)
{
     System.out.println("blue");
}
else if (choice < 5)
{
     System.out.println("red");
}
else
{
     System.out.println("yellow");
}
```

Code Segment B

```
if (choice > 10)
{
     System.out.println("blue");
}
if (choice < 5)
{
     System.out.println("red");
}
else
{
     System.out.println("yellow");
}
```

Assume that both code segments initialize `choice` to the same integer value. Which of the following best describes the conditions on the initial value of the variable `choice` that will cause the two code segments to produce different output?

(A) `choice < 5`

(B) `choice >= 5` and `choice <= 10`

(C) `choice > 10`

(D) `choice == 5` or `choice == 10`

(E) There is no value for `choice` that will cause the two code segments to produce different output.

chap 3: Boolean Expressions and if Statements

12. Consider the following code segments, which are each intended to convert grades from a 100-point scale to a 4.0-point scale and print the result. A grade of 90 or above should yield a 4.0, a grade of 80 to 89 should yield a 3.0, a grade of 70 to 79 should yield a 2.0, and any grade lower than 70 should yield a 0.0.

Assume that `grade` is an `int` variable that has been properly declared and initialized.

Code Segment I

```
double points = 0.0;
if (grade > 89)
{
     points += 4.0;
}
else if (grade > 79)
{
     points += 3.0;
}
else if (grade > 69)
{
     points += 2.0;
}
else
{
     points += 0.0;
}
System.out.println(points);
```

Code Segment II

```
double points = 0.0;
if (grade > 89)
{
     points += 4.0;
}
if (grade > 79)
{
     grade += 3.0;
}
if (grade > 69)
{
     points += 2.0;
}
if (grade < 70)
{
     points += 0.0;
}
System.out.println(points);
```

Which of the following statements correctly compares the values printed by the two methods?

chap 3: Boolean Expressions and if Statements

(A) The two code segments print the same value only when `grade` is below `80`.

(B) The two code segments print the same value only when `grade` is `90` or above or `grade` is below `80`.

(C) The two code segments print the same value only when `grade` is `90` or above.

(D) Both code segments print the same value for all possible values of `grade`.

(E) The two code segments print different values for all possible values of `grade`.

chap 3: Boolean Expressions and if Statements

13. Consider the following code segment in which the `int` variable `x` has been properly declared and initialized.

```
if (x % 2 == 1)
{
     System.out.println("YES");
}
else
{
     System.out.println("NO");
}
```

Assuming that `x` is initialized to the same positive integer value as the original, which of the following code segments will produce the same output as the original code segment?

I.

```
if (x % 2 == 1)
{
     System.out.println("YES");
}
if (x % 2 == 0)
{
     System.out.println("NO");
}
```

II.

```
if (x % 2 == 1)
{
     System.out.println("YES");
}
else if (x % 2 == 0)
{
     System.out.println("NO");
}
else
{
     System.out.println("NONE");
}
```

III.

```
boolean test = x % 2 == 0;
if (test)
{
     System.out.println("YES");
}
```

```
else
{
     System.out.println("NO");
}
```

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I, II, and III

14. Consider the following incomplete method, which is intended to return `true` if the value of `y` is between the values of the other two parameters and `false` otherwise.

```
/** Precondition: x, y, and z have 3 different values. */
public static boolean compareThree(int x, int y, int z)
{
     return /* missing condition */ ;
}
```

The following table shows the results of several calls to `compareThree`.

Call	Result
`compareThree(4, 5, 6)`	`true`
`compareThree(6, 5, 4)`	`true`
`compareThree(5, 4, 6)`	`false`
`compareThree(3, 4, 4)`	violates precondition

Which of the following can be used to replace `/* missing condition */` so that `compareThree` will work as intended when called with parameters that satisfy its precondition?

(A) `(x > y) && (x > z)`
(B) `(x > y) && (y > z)`
(C) `(x > y) || (y > z)`
(D) `(x > y) == (y > z)`
(E) `(x > y) != (y > z)`

15. Assume obj1 and obj2 are object references. Which of the following best describes when the expression obj1 == obj2 is true?

chap 3: Boolean Expressions and if Statements

(A) When obj1 and obj2 are defined within the same method
(B) When obj1 and obj2 are instances of the same class
(C) When obj1 and obj2 refer to objects that contain the same data
(D) When obj1 and obj2 refer to the same object
(E) When obj1 and obj2 are private class variables defined in the same class

16. Consider the following declarations.

```
int valueOne, valueTwo;
```

Assume that valueOne and valueTwo have been initialized. Which of the following evaluates to true if valueOne and valueTwo contain the same value?

(A) valueOne.equals((Object) valueTwo)
(B) valueOne == valueTwo
(C) valueOne.compareTo((Object) valueTwo) == 0
(D) valueOne.compareTo(valueTwo) == 0
(E) valueOne.equals(valueTwo)

17. Which of the following best describes the value of the Boolean expression shown below?

```
a && !(b || a)
```

(A) The value is always `true`.
(B) The value is always `false`.
(C) The value is `true` when `a` has the value `false`, and is `false` otherwise.
(D) The value is `true` when `b` has the value `false`, and is `false` otherwise.
(E) The value is `true` when either `a` or `b` has the value `true`, and is `false` otherwise.

18. Assume that x and y are boolean variables and have been properly initialized.

```
(x && y) && !(x || y)
```

Which of the following best describes the result of evaluating the expression above?

(A) true always
(B) false always
(C) true only when x is true and y is true
(D) true only when x and y have the same value
(E) true only when x and y have different values

chap 3: Boolean Expressions and if Statements

19. Assume that x and y have been declared and initialized with int values. Consider the following Java expression.

```
(y > 10000) || (x > 1000 && x < 1500)
```

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

(A) (y > 10000 | | x > 1000) && (y > 10000 | | x < 1500)
(B) (y > 10000 | | x > 1000) | | (y > 10000 | | x < 1500)
(C) (y > 10000) && (x > 1000 | | x < 1500)
(D) (y > 10000 && x > 1000) | | (y > 10000 && x < 1500)
(E) (y > 10000 && x > 1000) && (y > 10000 && x < 1500)

20. Assume that x and y are boolean variables and have been properly initialized.

```
(x || y) && x
```

Which of the following always evaluates to the same value as the expression above?

(A) x
(B) y
(C) x && y
(D) x | | y
(E) x != y

21. Assume that `x` and `y` are `boolean` variables and have been properly initialized.

```
(x && y) || !(x && y)
```

The result of evaluating the expression above is best described as

(A) always `true`
(B) always `false`
(C) `true` only when `x` is `true` and `y` is `true`
(D) `true` only when `x` and `y` have the same value
(E) `true` only when `x` and `y` have different values

chap 3: Boolean Expressions and if Statements

22. Consider the following code segment.

```
int x = /* some integer value */ ;

int y = /* some integer value */ ;


boolean result = (x < y);


result = ( (x >= y) && !result );
```

Which of the following best describes the conditions under which the value of `result` will be `true` after the code segment is executed?

(A) Only when `x < y`

(B) Only when `x >= y`

(C) Only when `x` and `y` are equal

(D) The value will always be `true`.

(E) The value will never be `true`.

23. Assume that `a`, `b`, and `c` are variables of type `int`. Consider the following three conditions.

I. `(a == b) && (a == c) && (b == c)`

II. `(a == b) || (a == c) || (b == c)`

III. `((a - b) * (a - c) * (b - c)) == 0`

Assume that subtraction and multiplication never overflow. Which of the conditions above is (are) always true if at least two of `a`, `b`, and `c` are equal?

(A) I only

(B) II only

(C) III only

(D) I and II

(E) II and III

24. Assume that a and b have been defined and initialized as int values. The expression

`! ( ! (a != b ) && (b > 7) )`

is equivalent to which of the following?

chap 3: Boolean Expressions and if Statements

(A) `(a != b) || (b < 7)`

(B) `(a != b) || (b <= 7)`

(C) `(a == b) || (b <= 7)`

(D) `(a != b) && (b <= 7)`

(E) `(a == b) && (b > 7)`

25. Consider the following method.

```
public void conditionalTest(int a, int b)
{
  if ((a > 0) && (b > 0))
  {
    if (a > b)
      System.out.println("A");
    else
      System.out.println("B");
  }
  else if ((b < 0) || (a < 0))
    System.out.println("C");
  else
    System.out.println("D");
}
```

What is printed as a result of the call conditionalTest(3, -2)?

chap 3: Boolean Expressions and if Statements

(A) A
(B) B
(C) C
(D) D
(E) Nothing is printed.

26. Consider the following statement. Assume that `a` and `b` are properly declared and initialized `boolean` variables.

```
boolean c = (a && b) || (!a && b);
```

Under which of the following conditions will `c` be assigned the value `false` ?

(A) Always
(B) Never
(C) When `a` and `b` have the same value
(D) When `a` has the value `false`
(E) When `b` has the value `false`

27. Consider the following code segment.

```
String alpha = new String("APCS");
String beta = new String("APCS");
String delta = alpha;
System.out.println(alpha.equals(beta));
System.out.println(alpha == beta);
System.out.println(alpha == delta);
```

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

(A)
```
false
false
false
```

(B)
```
false
false
true
```

(C)
```
true
false
false
```

(D)
```
true
false
true
```

(E)
```
true
true
true
```

chap 3: Boolean Expressions and if Statements

28. Assume that object references `one`, `two`, and `three` have been declared and instantiated to be of the same type. Assume also that `one == two` evaluates to `true` and that `two.equals(three)` evaluates to `false`.

Consider the following code segment.

```
if (one.equals(two))
{
     System.out.println("one dot equals two");
}
if (one.equals(three))
{
     System.out.println("one dot equals three");
}
if (two == three)
{
     System.out.println("two equals equals three");
}
```

What, if anything, is printed as a result of executing the code segment?

(A)
```
one dot equals two
```

(B)
```
one dot equals two
one dot equals three
```

(C)
```
one dot equals three
two equals equals three
```

(D)
```
one dot equals two
one dot equals three
two equals equals three
```

(E) Nothing is printed.

29. Consider the following code segment.

```
if (a < b || c != d)
{
     System.out.println("dog");
}
else
{
     System.out.println("cat");
}
```

Assume that the `int` variables `a`, `b`, `c`, and `d` have been properly declared and initialized. Which of the following code segments produces the same output as the given code segment for all values of `a`, `b`, `c`, and `d` ?

chap 3: Boolean Expressions and if Statements

(A)
```
if (a < b && c != d)
{
     System.out.println("dog");
}
else
{
     System.out.println("cat");
}
```

(B)
```
if (a < b && c != d)
{
     System.out.println("cat");
}
else
{
     System.out.println("dog");
}
```

(C)
```
if (a > b && c == d)
{
     System.out.println("cat");
}
else
{
     System.out.println("dog");
}
```

(D)
```
if (a >= b || c == d)
{
     System.out.println("cat");
}
else
{
     System.out.println("dog");
}
```

(E)
```
if (a >= b && c == d)
{
     System.out.println("cat");
}
else
{
     System.out.println("dog");
}
```

30. Assume that `a`, `b`, `c`, and `d` have been declared and initialized with `int` values.

```
!((a >= b) && !(c < d))
```

Which of the following is equivalent to the expression above?

chap 3: Boolean Expressions and if Statements

(A) `(a < b) || (c < d)`

(B) `(a < b) || (c >= d)`

(C) `(a < b) && (c < d)`

(D) `(a >= b) || (c < d)`

(E) `(a >= b) && (c < d)`

31. Consider the following method.

```
public String exercise(int input)
{
     if (input < 10)
     {
         return "alpha";
     }
     if (input < 5)
     {
         return "beta";
     }
     if (input < 1)
     {
         return "gamma";
     }
     return "delta";
}
```

Assume that the `int` variable `x` has been initialized in another method in the same class. Which of the following describes the conditions under which the method call `exercise(x)` will return `"gamma"` ?

(A) The method will never return `"gamma"`.

(B) The method will return `"gamma"` if `x` is less than `1`.

(C) The method will return `"gamma"` if `x` is between `1` and `4`, inclusive.

(D) The method will return `"gamma"` if `x` is between `5` and `9`, inclusive.

(E) The method will always return `"gamma"`.

32. Consider the following statement, which assigns a value to `b1`.

```
boolean b1 = true && (17 % 3 == 1);
```

Which of the following assigns the same value to `b2` as the value stored in `b1` ?

(A) `boolean b2 = false || (17 % 3 == 2);`

(B) `boolean b2 = false && (17 % 3 == 2);`

(C) `boolean b2 = true || (17 % 3 == 1);`

(D) `boolean b2 = (true || false) && true;`

(E) `boolean b2 = (true && false) || true;`

chap 3: Boolean Expressions and if Statements

33. The question refer to the code from the GridWorld case study.

Consider the following code segment.

```
Location loc1 = new Location(3, 3);

Location loc2 = new Location(3, 2);


if (loc1.equals(loc2.getAdjacentLocation(Location.EAST)))

  System.out.print("aaa");


if (loc1.getRow() == loc2.getRow())

  System.out.print("XXX");


if (loc1.getDirectionToward(loc2) == Location.EAST)

  System.out.print("555");
```

What will be printed as a result of executing the code segment?

(A) aaaXXX555
(B) aaaXXX
(C) XXX555
(D) 555
(E) aaa

chap 3: Boolean Expressions and if Statements

34. Consider the following code segment.

```
int num = /* initial value not shown */;
boolean b1 = true;
if (num > 0)
{
     if (num >= 100)
     {
         b1 = false;
     }
}
else
{
     if (num >= -100)
     {
         b1 = false;
     }
}
```

Which of the following statements assigns the same value to `b2` as the code segment assigns to `b1` for all values of `num` ?

(A) `boolean b2 = (num > -100) && (num < 100);`

(B) `boolean b2 = (num > -100) || (num < 100);`

(C) `boolean b2 = (num < -100) || (num > 100);`

(D) `boolean b2 = (num < -100) && (num > 0 || num < 100);`

(E) `boolean b2 = (num < -100) || (num > 0 && num < 100);`

35. Consider the following code segment.

```
int x = 3;
int y = -1;
if (x - 2 > y)
{
     x -= y;
}
if (y + 3 >= x)
{
     y += x;
}
System.out.print("x = " + x + " y = " + y);
```

What is printed as a result of the execution of the code segment?

chap 3: Boolean Expressions and if Statements

(A) `x = -1 y = -1`
(B) `x = 2 y = 1`
(C) `x = 3 y = 2`
(D) `x = 4 y = -1`
(E) `x = 4 y = 3`

chap 3: Boolean Expressions and if Statements

36. Consider the following incomplete method.

```
public int someProcess(int n)
{
  /* body of someProcess */
}
```

The following table shows several examples of input values and the results that should be produced by calling someProcess.

Input Value n	Value Returned by someProcess(n)
3	30
6	60
7	7
8	80
9	90
11	11
12	120
14	14
16	160

Which of the following code segments could be used to replace /* *body of someProcess* */ so that the method will produce the results shown in the table?

I.
```
if ((n % 3 == 0) && (n % 4 == 0))
  return n * 10;
else
  return n;
```

chap 3: Boolean Expressions and if Statements

II.
```
if ((n % 3 == 0) || (n % 4 == 0))
    return n * 10;

return n;
```

III.
```
if (n % 3 == 0)
    if (n % 4 == 0)
        return n * 10;

return n;
```

(A) I only
(B) II only
(C) III only
(D) I and III
(E) II and III

chap 3: Boolean Expressions and if Statements

37. Consider the following method.

```
public String inRangeMessage(int value)
{
  if (value < 0 || value > 100)
    return "Not in range";
  else
    return "In range";
}
```

Consider the following code segments that could be used to replace the body of `inRangeMessage`.

I.
```
if (value < 0)
{
  if (value > 100)
    return "Not in range";
  else
    return "In range";
}
else
  return "In range";
```

II.
```
if (value < 0)
  return "Not in range";
else if (value > 100)
  return "Not in range";
else
```

```
    return "In range";
```

III.
```
if (value >= 0)
    return "In range";
else if (value <= 100)
    return "In range";
else
    return "Not in range";
```

Which of the replacements will have the same behavior as the original version of inRangeMessage ?

(A) I only
(B) II only
(C) III only
(D) I and III
(E) II and III

38. The following method is intended to return `true` if and only if the parameter `val` is a multiple of `4` but is not a multiple of `100` unless it is also a multiple of `400`. The method does not always work correctly.

```
public boolean isLeapYear(int val)
{
     if ((val % 4) == 0)
     {
         return true;
     }
     else
     {
         return (val % 400) == 0;
     }
}
```

Which of the following method calls will return an incorrect response?

(A) `isLeapYear(1900)`
(B) `isLeapYear(1984)`
(C) `isLeapYear(2000)`
(D) `isLeapYear(2001)`
(E) `isLeapYear(2010)`

chap 3: Boolean Expressions and if Statements

39. At a certain high school students receive letter grades based on the following scale.

Integer Score	Letter Grade
93 or above	A
From 84 to 92 inclusive	B
From 75 to 83 inclusive	C
Below 75	F

Which of the following code segments will assign the correct string to grade for a given integer score ?

I.
```
if (score >= 93)
  grade = "A";
if (score >= 84 && score <= 92)
  grade = "B";
if (score >= 75 && score <= 83)
  grade = "C";
if (score < 75)
  grade = "F";
```

II.
```
if (score >= 93)
  grade = "A";
if (84 <= score <= 92)
  grade = "B";
if (75 <= score <= 83)
  grade = "C";
if (score < 75)
  grade = "F";
```

III.
```
if (score >= 93)
  grade = "A";
else if (score >= 84)
  grade = "B";
else if (score >= 75)
  grade = "C";
else
  grade = "F";
```

(A) II only
(B) III only
(C) I and II only
(D) I and III only
(E) I, II, and III

chap 3: Boolean Expressions and if Statements

40. Consider the following code segment.

```
if (false && true || false)
{
     if (false || true && false)
     {
         System.out.print("First");
     }
     else
     {
         System.out.print("Second");
     }
}
if (true || true && false)
{
     System.out.print("Third");
}
```

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

(A) `First`

(B) `Second`

(C) `Third`

(D) `FirstThird`

(E) `SecondThird`

chap 3: Boolean Expressions and if Statements

41. Consider the following code segment.

```
int start = 4;
int end = 5;
boolean keepGoing = true;
if (start < end && keepGoing)
{
     if (end > 0)
     {
         start += 2;
         end++;
     }
     else
     {
         end += 3;
     }
}
if (start < end)
{
     if (end == 0)
     {
         end += 2;
         start++;
     }
     else
     {
         end += 4;
     }
}
```

What is the value of `end` after the code segment is executed?

(A) 5

(B) 6

(C) 9

(D) 10

(E) 16

chap 3: Boolean Expressions and if Statements

42. Consider the following code segment.

```
int x = 7;
int y = 4;
boolean a = false;
boolean b = false;
if (x > y)
{
     if (x % y >= 3)
     {
         a = true;
         x -= y;
     }
     else
     {
         x += y;
     }
}
if (x < y)
{
     if (y % x >= 3)
     {
         b = true;
         x -= y;
     }
     else
     {
         x += y;
     }
}
```

What are the values of `a`, `b`, and `x` after the code segment has been executed?

(A) `a = true, b = true, x = -1`

(B) `a = true, b = false, x = 3`

(C) `a = true, b = false, x = 7`

(D) `a = false, b = true, x = 3`

(E) `a = false, b = false, x = 11`

chap 3: Boolean Expressions and if Statements

43. The price per box of ink pens advertised in an office supply catalog is based on the number of boxes ordered.The following table shows the pricing.

Number of Boxes	Price per Box
1 up to but not including 5	$5.00
5 up to but not including 10	$3.00
10 or more	$1.50

The following incomplete method is intended to return the total cost of an order based on the value of the parameter numBoxes.

```
/** Precondition: numBoxes > 0 */
public static double getCost(int numBoxes)
{
  double totalCost = 0.0;

  /* missing code */

  return totalCost;
}
```

Which of the following code segments can be used to replace /* *missing code* */ so that method getCost will work as intended?

I.
```
if (numBoxes >= 10)
{
  totalCost = numBoxes * 1.50;
}
if (numBoxes >= 5)
{
  totalCost = numBoxes * 3.00;
}
if (numBoxes > 0)
{
  totalCost = numBoxes * 5.00;
}
```

chap 3: Boolean Expressions and if Statements

II.
```
if (numBoxes >= 10)
{
  totalCost = numBoxes * 1.50;
}
else if (numBoxes >= 5)
{
  totalCost = numBoxes * 3.00;
}
else
{
  totalCost = numBoxes * 5.00;
}
```

III.
```
if (numBoxes > 0)
{
  totalCost = numBoxes * 5.00;
}
else if (numBoxes >= 5)
{
  totalCost = numBoxes * 3.00;
}
else if (numBoxes >= 10)
{
  totalCost = numBoxes * 1.50;
}
```

(A) I only
(B) II only
(C) III only
(D) I and II
(E) II and III

44. Consider the following code segment.

```
int a = 10;
int b = 5 * 2;
System.out.print(a == b);
```

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

(A) `5`
(B) `10`
(C) `10 == 10`
(D) `true`
(E) `false`

chap 3: Boolean Expressions and if Statements

45. Consider the following code segment. Assume `num` is a properly declared and initialized `int` variable.

```
if (num > 0)
{
     if (num % 2 == 0)
     {
         System.out.println("A");
     }
     else
     {
         System.out.println("B");
     }
}
```

Which of the following best describes the result of executing the code segment?

(A) When `num` is a negative odd integer, `"B"` is printed; otherwise, `"A"` is printed.

(B) When `num` is a negative even integer, `"B"` is printed; otherwise, nothing is printed.

(C) When `num` is a positive even integer, `"A"` is printed; otherwise, `"B"` is printed.

(D) When `num` is a positive even integer, `"A"` is printed; when `num` is a positive odd integer, `"B"` is printed; otherwise, nothing is printed.

(E) When `num` is a positive odd integer, `"A"` is printed; when `num` is a positive even integer, `"B"` is printed; otherwise, nothing is printed.

chap 3: Boolean Expressions and if Statements

46. Consider the following method.

```
public static void whatIsIt(int a, int b)
{
     if ((a < b) && (a > 0))
     {
         System.out.println("W");
     }
     else if (a == b)
     {
         if (b > 0)
         {
            System.out.println("X");
         }
         else if (b < 0)
         {
            System.out.println("Y");
         }

         {
            System.out.println("Z");
         }
     }
}
```

Which of the following method calls will cause `"W"` to be printed?

I. `whatIsIt(10, 10)`
II. `whatIsIt(-5, 5)`
III. `whatIsIt(7, 10)`

(A) I only

(B) II only

(C) III only

(D) I and III

(E) II and III

chap 3: Boolean Expressions and if Statements

47. Consider the following method.

```
public static void message(int a, int b, int c)
{
     if (a < 10)
     {
         if (b < 10)
         {
            System.out.print("X");
         }
         System.out.print("Y");
     }
     if (c < 10)
     {
         if (b > 10)
         {
            System.out.print("Y");
         }
         else
         {
            System.out.print("Z");
         }
     }
}
```

What is printed as a result of the call `message(5, 15, 5)` ?

(A) `XY`

(B) `XYZ`

(C) `Y`

(D) `YY`

(E) `Z`

chap 3: Boolean Expressions and if Statements

48. Consider the following method, which returns an `int` based on its parameter `x`.

```
public static int puzzle(int x)
{
     if (x > 20)
     {
         x -= 2;
     }
     else if (x % 2 == 0) // Line 7
     {
         x += 4;
     }
     return x;
}
```

Consider a modification to the method that eliminates the `else` from line 7 so that line 7 becomes

```
if (x % 2 == 0) // Modified line 7
```

For which of the following values of `x` would the return values of the original method and the modified method differ?

(A) 0
(B) 5
(C) 14
(D) 22
(E) 25

49. Assume that a and b are variables of type int. The expression

```
!(a < b) && !(a > b)
```

is equivalent to which of the following?

(A) true
(B) false
(C) a == b
(D) a != b
(E) !(a < b) && (a > b)

chap 3: Boolean Expressions and if Statements

50. A school that does not have air conditioning has published a policy to close school when the outside temperature reaches or exceeds 95°F. The following code segment is intended to print a message indicating whether or not the school is open, based on the temperature. Assume that the variable `degrees` has been properly declared and initialized with the outside temperature.

```
if (degrees > 95)
{
     System.out.println("School will be closed due to extreme heat");
}
else
{
     System.out.println("School is open");
}
```

Which of the following initializations for `degrees`, if any, will demonstrate that the code segment may not work as intended?

(A) `degrees = 90;`

(B) `degrees = 94;`

(C) `degrees = 95;`

(D) `degrees = 96;`

(E) The code will work as intended for all values of `degrees`.

51. Consider the following code segment.

```
int x = 7;
int y = 3;

if ((x < 10) && (y < 0))
  System.out.println("Value is: " + x * y);
else
  System.out.println("Value is: " + x / y);
```

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

(A) Value is: 21

(B) Value is: 2.3333333

(C) Value is: 2

(D) Value is: 0

(E) Value is: 1

chap 3: Boolean Expressions and if Statements

52. Consider the following code segment.

```
int x = 7;
if (x < 7)
{
     x = 2 * x;
}
if (x % 3 == 1)
{
     x = x + 2;
}
System.out.print(3 * x);
```

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

(A) 7

(B) 9

(C) 14

(D) 21

(E) 27

53. Consider the following code segment.

```
double regularPrice = 100;
boolean onClearance = true;
boolean hasCoupon = false;
double finalPrice = regularPrice;
if(onClearance)
{
     finalPrice -= finalPrice * 0.25;
}
if(hasCoupon)
{
     finalPrice -= 5.0;
}
System.out.println(finalPrice);
```

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

(A) 20.0

(B) 25.0

(C) 70.0

(D) 75.0

(E) 95.0

chap 3: Boolean Expressions and if Statements

54. Consider the following method.

```
public int someCode(int a, int b, int c)
{
  if ((a < b) && (b < c))
    return a;
  if ((a >= b) && (b >= c))
    return b;
  if ((a == b) || (a == c) || (b == c))
    return c;
}
```

Which of the following best describes why this method does not compile?

(A) The reserved word return cannot be used in the body of an if statement.

(B) It is possible to reach the end of the method without returning a value.

(C) The if statements must have else parts when they contain return statements.

(D) Methods cannot have multiple return statements.

(E) The third if statement is not reachable.

chap 3: Boolean Expressions and if Statements

55. Consider the following method.

```
public void test(int x)
{
  int y;

  if (x % 2 == 0)
    y = 3;
  else if (x > 9)
    y = 5;
  else
    y = 1;

  System.out.println("y = " + y);
}
```

Which of the following test data sets would test each possible output for the method?

(A) 8, 9, 12

(B) 7, 9, 11

(C) 8, 9, 11

(D) 8, 11, 13

(E) 7, 9, 10

56. Consider the following statement.

```
boolean x = (5 < 8) == (5 == 8);
```

What is the value of `x` after the statement has been executed?

(A) `3`

(B) `5`

(C) `8`

(D) `true`

(E) `false`

57. Consider the following Boolean expression in which the `int` variables `x` and `y` have been properly declared and initialized.

```
(x <= 10) == (y > 25)
```

Which of the following values for `x` and `y` will result in the expression evaluating to `true` ?

chap 3: Boolean Expressions and if Statements

(A) `x = 8` and `y = 25`

(B) `x = 10` and `y = 10`

(C) `x = 10` and `y = 30`

(D) `x = 15` and `y = 30`

(E) `x = 25` and `y = 30`

chap 3: Boolean Expressions and if Statements

58. Vehicles are classified based on their total interior volume. The `classify` method is intended to return a vehicle classification `String` value based on total interior volume, in cubic feet, as shown in the table below.

Vehicle size class	Total interior volume
Minicompact	Less than 85 cubic feet
Subcompact	85 to 99 cubic feet
Compact	100 to 109 cubic feet
Mid-Size	110 to 119 cubic feet
Large	120 cubic feet or more

The `classify` method, which does not work as intended, is shown below.

```
public static String classify(int volume)
{
     String carClass = "";
     if (volume >= 120)
     {
         carClass = "Large";
     }
     else if (volume < 120)
     {
         carClass = "Mid-Size";
     }
     else if (volume < 110)
     {
         carClass = "Compact";
     }
     else if (volume < 100)
     {
         carClass = "Subcompact";
     }
     else
     {
         carClass = "Minicompact";
     }
     return carClass;
}
```

The `classify` method works as intended for some but not all values of the parameter `volume`. For which of the following values of `volume` would the correct value be returned when the `classify` method is executed?

chap 3: Boolean Expressions and if Statements

(A) `80`

(B) `90`

(C) `105`

(D) `109`

(E) `115`

chap 3: Boolean Expressions and if Statements

59. The following categories are used by some researchers to categorize zip codes as urban, suburban, or rural based on population density.

- An urban zip code is a zip code with more than 3,000 people per square mile.
- A suburban zip code is a zip code with between 1,000 and 3,000 people, inclusive, per square mile.
- A rural zip code is a zip code with fewer than 1,000 people per square mile.

Consider the following method, which is intended to categorize a zip code as urban, suburban, or rural based on the population density of the area included in the zip code.

```
public static String getCategory(int density)
{
     /* missing code */
}
```

Which of the following code segments can replace `/* missing code */` so the `getCategory` method works as intended?

I.
```
String cat;
if (density > 3000)
{
cat = "urban";
}
else if (density > 999)
{
cat = "suburban";
}
else
{
cat = "rural";
}
return cat;
```

II.
```
String cat;
if (density > 3000)
{
cat = "urban";
}
if (density > 999)
{
cat = "suburban";
}
cat = "rural";
return cat;
```

III.
```
if (density > 3000)
{
   return "urban";
}
if (density > 999)
```

chap 3: Boolean Expressions and if Statements

```
    {
       return "suburban";
    }
    return "rural";
```

(A) I only

(B) III only

(C) I and II only

(D) I and III only

(E) I, II, and III