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1. Consider the following method.

```
/** Removes all occurrences of nameToRemove from nameList.
* @param nameList a list of names
* @param nameToRemove a name to be removed from nameList
*/
public void removeName(List<String> nameList, String nameToRemove)
{
/* missing implementation */
}
```

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

I.
```
for (String name : nameList)
{
    if (name.equals(nameToRemove))
        name.remove();
}
```

II.
```
for (int k = 0; k < nameList.size(); k++)
{
    if (nameList.get(k).equals(nameToRemove))
        nameList.remove(k);
```

```
}
```

III.
```
for (int k = nameList.size() - 1; k >= 0; k--)
{
if (nameList.get(k).equals(nameToRemove))
    nameList.remove(k);
}
```

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

Consider the following correct implementation of the insertion sort algorithm. The `insertionSort` method correctly sorts the elements of `ArrayList data` into increasing order.

```
public static void insertionSort(ArrayList<Integer> data)
{
     for (int j = 1; j < data.size(); j++)
     {
         int v = data.get(j);
         int k = j;

         {
            data.set(k, data.get(k - 1)); /* Statement 1 */
            k--;
         }
         data.set(k, v); /* Statement 2 */
         /* End of outer loop */
     }
}
```

2. Assume that `insertionSort` has been called with an `ArrayList` parameter that has been initialized with the following `Integer` objects.

```
[5, 2, 4, 1, 3, 6]
```

What will the contents of `data` be after three passes of the outside loop (i.e., when `j == 3` at the point indicated by `/* End of outer loop */`) ?

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(A) `[1, 2, 3, 4, 5, 6]`

(B) `[1, 2, 3, 5, 4, 6]`

(C) `[1, 2, 4, 5, 3, 6]`

(D) `[2, 4, 5, 1, 3, 6]`

(E) `[5, 2, 1, 3, 4, 6]`

3. Assume that `insertionSort` is called with an `ArrayList` parameter that has been initialized with the following `Integer` objects.

`[1, 2, 3, 4, 5, 6]`

How many times will the statements indicated by `/* Statement 1 */` and `/* Statement 2 */` execute?

(A)

Statement 1	*Statement 2*
0	0

(B)

Statement 1	*Statement 2*
0	5

(C)

Statement 1	*Statement 2*
0	6

(D)

Statement 1	*Statement 2*
5	5

(E)

Statement 1	*Statement 2*
6	6

4. Consider the following two data structures for storing several million words.

I. An array of words, not in any particular order

II. An array of words, sorted in alphabetical order

Which of the following statements most accurately describes the time needed for operations on these data structures?

(A) Inserting a word is faster in II than in I.
(B) Finding a given word is faster in I than in II.
(C) Finding a given word is faster in II than in I.
(D) Finding the longest word is faster in II than in I.
(E) Finding the first word in alphabetical order is faster in I than in II.

5. Consider the following method.

```
public int addFun(int n)

{

  if (n <= 0)

return 0;

  if (n == 1)

return 2;

  return addFun(n - 1) + addFun(n - 2);

}
```

What value is returned as a result of the call addFun(6) ?

(A) 10
(B) 12
(C) 16
(D) 26
(E) 32

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6. Consider the following Book and AudioBook classes.

```
public class Book
{
  private int numPages;
  private String bookTitle;

  public Book(int pages, String title)
  {
    numPages = pages;
    bookTitle = title;
  }

  public String toString()
  {
    return bookTitle + " " + numPages;
  }

  public int length()
  {
    return numPages;
  }
}


public class AudioBook extends Book
{
  private int numMinutes;

  public AudioBook(int minutes, int pages, String title)
  {
    super(pages, title);
    numMinutes = minutes;
  }

  public int length()
  {
    return numMinutes;
  }

  public double pagesPerMinute()
  {
    return ((double) super.length()) / numMinutes;
  }
}
```

Consider the following code segment that appears in a class other than Book or AudioBook.

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```
Line 1:  Book[] books = new Book[2];
Line 2:  books[0] = new AudioBook(100, 300, "The Jungle");
Line 3:  books[1] = new Book(400, "Captains Courageous");
Line 4:  System.out.println(books[0].pagesPerMinute());
Line 5:  System.out.println(books[0].toString());
Line 6:  System.out.println(books[0].length());
Line 7:  System.out.println(books[1].toString());
```

Which of the following best explains why the code segment will not compile?

(A) Line 2 will not compile because variables of type Book may not refer to variables of type AudioBook.

(B) Line 4 will not compile because variables of type Book may only call methods in the Book class.

(C) Line 5 will not compile because the AudioBook class does not have a method named toString declared or implemented.

(D) Line 6 will not compile because the statement is ambiguous. The compiler cannot determine which length method should be called.

(E) Line 7 will not compile because the element at index 1 in the array named books may not have been initialized.

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7. Consider the following class declarations.

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```
public class A
{
private int x;
public A()
{ x = 0; }
public A(int y)
{ x = y; }
// There may be instance variables, constructors, and methods that are not shown.
}

public class B extends A
{
private int y;
public B()
{
/* missing code */
}
// There may be instance variables, constructors, and methods that are not shown.
}
```

Which of the following can be used to replace /* *missing code* */ so that the statement

B temp = new B();

will construct an object of type B and initialize both x and y with 0 ?

I. y = 0

II. super (0);

y = 0;

III. x = 0;

y = 0;

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

8. Consider the following classes.

```
public class Base

{

public Base()

{

System.out.print("Base" + " ");

}

}

public class Derived extends Base

{

public Derived()

{

System.out.print("Derived" + " ");

}

}
```

Assume that the following statement appears in another class.

```
Derived d1 = new Derived();
```

What is printed as a result of executing the statement?

(A) Nothing is printed because the statement is a variable declaration.
(B) Base
(C) Derived
(D) Base Derived
(E) Derived Base

9. Consider the following code segment.

```
int[] oldArray = {1, 2, 3, 4, 5, 6, 7, 8, 9};

int[][] newArray = new int[3][3];

int row = 0; int col = 0;

for (int index = 0; index < oldArray.length; index++)

{

newArray[row][col] = oldArray[index]; row++;

if ((row % 3) == 0)

{

col++;

row = 0;

}

}

System.out.println(newArray[0][2]);
```

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

(A) 3
(B) 4
(C) 5
(D) 7
(E) 8

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The following questions refer to the following classes:

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```
public class First
{
    public String name()
    {
        return "First";
    }
}

public class Second extends First
{
    public void whoRules()
    {
        System.out.print(super.name() + " rules");
        System.out.println(" but " + name() + " is even better");
    }
    public String name()
    {
        return "Second";
    }
}
```

```
public class Third extends Second
{
    public String name()
    {
        return "Third";
    }
}
```

10. Consider the following code segment.

```
Second varSecond = new Second();

Third varThird = new Third();


varSecond.whoRules();

varThird.whoRules();
```

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

(A) First rules but Second is even better
First rules but Second is even better

(B) First rules but Second is even better
First rules but Third is even better

(C) First rules but Second is even better
Second rules but Second is even better

(D) First rules but Second is even better
Second rules but Third is even better

(E) Second rules but Second is even better
Second rules but Second is even better

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11. Consider the following code segment.

```
/* SomeType1 */ varA = new Second();
/* SomeType2 */ varB = new Third();


varA.whoRules();
varB.whoRules();
```

Which of the following could be used to replace /* ***SomeType1*** */ and /* ***SomeType2*** */ so that the code segment will compile without error?

	/* ***SomeType1*** */	/* ***SomeType2*** */
I.	First	Third
II.	Second	Second
III.	Third	Third

(A) I only

(B) II only

(C) III only

(D) I and II

(E) II and III

12. Consider the following code segment.

```
int[] oldArray = {1, 2, 3, 4, 5, 6, 7, 8, 9};
int[][] newArray = new int[3][3];

int row = 0;
int col = 0;
for (int value : oldArray)
{
  newArray[row][col] = value;
  row++;
  if ((row % 3) == 0)
  {
    col++;
    row = 0;
  }
}

System.out.println(newArray[0][2]);
```

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

(A) 3

(B) 4

(C) 5

(D) 7

(E) 8

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13. Consider the following instance variable and method.

```
private List<String> animals;

public void manipulate()
{
  for (int k = animals.size() - 1; k > 0; k--)
  {
    if (animals.get(k).substring(0, 1).equals("b"))
    {
      animals.add(animals.size() - k, animals.remove(k));
    }
  }
}
```

Assume that animals has been instantiated and initialized with the following contents.

```
["bear", "zebra", "bass", "cat", "koala", "baboon"]
```

What will the contents of animals be as a result of calling manipulate?

(A) ["baboon", "zebra", "bass", "cat", "bear", "koala"]

(B) ["bear", "zebra", "bass", "cat", "koala", "baboon"]

(C) ["baboon", "bear", "zebra", "bass", "cat", "koala"]

(D) ["bear", "baboon", "zebra", "bass", "cat", "koala"]

(E) ["zebra", "cat", "koala", "baboon", "bass", "bear"]

14. Consider the following method.

```
// Precondition: b > 0

public int surprise(int b)

{

if ((b % 2) == 0)

{

if (b < 10)

return b;

else

return ((b % 10) + surprise(b / 10));

}

else

{

if (b < 10)

return 0;

else

return surprise(b / 10);

}

}
```

Which of the following expressions will evaluate to true ?

I. surprise(146781) == 0

II. surprise(7754) == 4

III. surprise(58216) == 16

(A) I only

(B) II only

(C) III only

(D) II and III only

(E) I, II, and III

15. Consider the following method.

```
public String recScramble(String str, int[] positions, int k)
{
if (str == null || str.length() == 0)
return "";

if (str.length() == 1)
return str;
int pos = positions[k];
String nStr = str.substring(pos, pos + 1);
str = str.substring(0, pos) + str.substring(pos + 1);
return nStr + recScramble(str, positions, k + 1);
}
```

Consider the following code segment.

```
int[] indexes = {2, 1, 1};
System.out.println(recScramble("epic", indexes, 0));
```

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

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(A) cepi
(B) epci
(C) iecp
(D) iepc
(E) ipce

16. Consider the following method.

```
public static void showMe(int arg)
{
  if (arg < 10)
  {
    showMe(arg + 1);
  }
  else
  {
    System.out.print(arg + " ");
  }
}
```

What will be printed as a result of the call showMe(0) ?

(A) 10
(B) 11
(C) 0 1 2 3 4 5 6 7 8 9
(D) 9 8 7 6 5 4 3 2 1 0
(E) 0 1 2 3 4 5 6 7 8 9 10

17. Consider the following method, which is intended to return the element of a 2-dimensional array that is closest in value to a specified number, val.

```
/** @return the element of 2-dimensional array mat whose value is closest to val */
public double findClosest(double[][] mat, double val)
{
  double answer = mat[0][0];
  double minDiff = Math.abs(answer - val);
  for (double[] row : mat)
  {
    for (double num : row)
    {
      if ( /* missing code */ )
      {
        answer = num;
        minDiff = Math.abs(num - val);
      }
    }
  }
  return answer;
}
```

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

(A) val - row [num] < minDiff

(B) Math.abs (num - minDiff) < minDiff

(C) val - num < 0.0

(D) Math.abs (num - val) < minDiff

(E) Math.abs (row [num] - val) < minDiff

18. Consider the following method.

```
/** Precondition: 0 < numVals <= nums.length */
public static int mystery(int[] nums, int v, int numVals)
{
  int k = 0;

  if (v == nums[numVals - 1])
  {
    k = 1;
  }

  if (numVals == 1)
  {
    return k;
  }
  else
  {
    return k + mystery(nums, v, numVals - 1);
  }
}
```

Which of the following best describes what the call mystery(numbers, val, numbers.length) does? You may assume that variables numbers and val have been declared and initialized.

(A) Returns 1 if the last element in numbers is equal to val; otherwise, returns 0

(B) Returns the index of the last element in numbers that is equal to val

(C) Returns the number of elements in numbers that are equal to val

(D) Returns the number of elements in numbers that are not equal to val

(E) Returns the maximum number of adjacent elements that are not equal to val

19. Consider the following recursive method.

```
public static void whatsItDo(String str)
{
  int len = str.length();
  if (len > 1)
  {
    String temp = str.substring(0, len - 1);
    whatsItDo(temp);
    System.out.println(temp);
  }
}
```

What is printed as a result of the call whatsItDo ("WATCH") ?

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(A)
WATC
WAT
WA
W

(B)
WATCH
WATC
WAT
WA

(C)
W
WA
WAT
WATC

(D)
W
WA
WAT
WATC
WATCH

(E)
WATCH
WATC
WAT
WA
W
WA
WAT
WATC
WATCH

20. Consider the following recursive method.

```
public static void whatsItDo(String str)
{
  int len = str.length();
  if (len > 1)
  {
    String temp = str.substring(0, len - 1);
    System.out.println(temp);
    whatsItDo(temp);
  }
}
```

What is printed as a result of the call whatsItDo("WATCH") ?

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(A) H

(B) WATC

(C) ATCH
ATC
AT
A

(D) WATC
WAT
WA
W

(E) WATCH
WATC
WAT
WA

21. Consider the following recursive method.

```
/** Precondition: num ≥ 0 */
public static int what(int num)
{
  if (num < 10)
  {
    return 1;
  }
  else
  {
    return 1 + what(num / 10);
  }
}
```

Assume that int val has been declared and initialized with a value that satisfies the precondition of the method. Which of the following best describes the value returned by the call what(val) ?

(A) The number of digits in the decimal representation of val is returned.

(B) The sum of the digits in the decimal representation of val is returned.

(C) Nothing is returned. A run-time error occurs because of infinite recursion.

(D) The value 1 is returned.

(E) The value val/10 is returned.

22. Consider the following recursive method.

```
public int recur(int n)
{
  if (n <= 10)
    return n * 2;
  else
    return recur(recur(n / 3));
}
```

What value is returned as a result of the call recur(27)?

(A) 8

(B) 9

(C) 12

(D) 16

(E) 18

Directions: Select the choice that best fits each statement. The following question(s) refer to the following information

Consider the following instance variable and methods. You may assume that data has been initialized with length > 0. The methods are intended to return the index of an array element equal to target, or -1 if no such element exists.

```
private int[] data;

public int seqSearchRec(int target)
{
  return seqSearchRecHelper(target, data.length - 1);
}


private int seqSearchRecHelper(int target, int last)
{
  // Line 1

  if (data[last] == target)
    return last;
  else
    return seqSearchRecHelper(target, last - 1);
}
```

23. For which of the following test cases will the call seqSearchRec(5) always result in an error?

I. data contains only one element.

II. data does not contain the value 5.

III. data contains the value 5 multiple times.

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

24. Which of the following should be used to replace // Line 1 in seqSearchRecHelper so that seqSearchRec will work as intended?

(A)
```
if (last <= 0)
  return -1;
```

(B)
```
if (last < 0)
  return -1;
```

(C)
```
if (last < data.length)
  return -1;
```

(D)
```
while (last < data.length)
```

(E)
```
while (last >= 0)
```