QUESTION 1

What is the sum of 101100_2 and $C09_{16}$?

A. $C39_{16}$ B. $C41_{16}$ C. 3026_8 D. 6065_8 E. 5101_8

QUESTION 2

What is output by the code to the right?

A. 2 B. 1 C. 0

D. 21 E. 10

```
int x = 21;
int y = 10;
System.out.print( y % x );
```

QUESTION 3

What is output by the code to the right?

A. 0 B. 15 C. 1

D. -15 E. 16

```
int total = 0;
for(int i = 15; i >= 0; i--)
  total++;

System.out.print( total );
```

QUESTION 4

What is output by the code to the right?

A. bess_z_16

B. bessz

C. bess

D. bess_z_!^

E. e

```
String name = "BeSS_Z_16";
name = name.toLowerCase();
System.out.println( name );
```

QUESTION 5

What is output by the code to the right?

A. false B. true C. null

D. -1 E. The output cannot be known until runtime.

```
boolean[] used = new boolean[5];
boolean result = used[2] || used[3];
System.out.print( result );
```

QUESTION 6

What is output by the code to the right?

A. 9 B. 6.25 C. 9.25

D. 7.75 E. 9.0

```
double a = 2.25;
a++;
double b = 1.25 + a * 2;
System.out.print( b );
```

QUESTION 7

Which answer is logically equivalent to the following Boolean expression? `p` and `q` are `boolean` variables.

```
!( !p && q )
```

A. `!!p && !q` B. `p || q` C. `true` D. `p && q` E. `p || !q`

QUESTION 8

What is output by the code to the right?

A. 5 B. 4 C. 3

D. 2 E. 1

```
int r = 3, s = 6;
if( s > r && r > 0 ){
  r++;
  if( s > 5 )
    r++;
}
else
    r--;
System.out.print( r );
```

QUESTION 9

What replaces **<*1>** in the code to the right so that method `won` increments the instance variable `wins` by 1?

A. `++wins`

B. `won()`

C. `this.wins++`

D. `wins.inc()`

E. More than one of these.

Assume **<*1>** is filled in correctly.

```
public class Record{
  private int wins;
  private int losses;

  public void won(){
    <*1>;
  }

  public void lost(){
    losses++;
  }

  public double ave(){
    int total = wins + losses;
    return (double)wins / total;
  }
}

////////////////////////////////////////
// client code
Record rec = new Record();
rec.lost();
System.out.print( rec.ave() );
```

QUESTION 10

What is output by the client code to the right?

A. `0` B. `NaN` C. `0.0`

D. There is no output due to a syntax error in the client code.

E. There is no output due to a runtime error that occurs when the client code is executed.

QUESTION 11

What is output by the code to the right?

A. `127` B. `1` C. `15000`

D. `120` E. `153`

```
int m = 15;
int n = 3;
m = m << n;
System.out.println( m );
```

QUESTION 12

What is output by the code to the right?

A. `-3.0` B. `0` C. `-2`

D. `-3` E. `-2.0`

```
double val = -2.5;
System.out.print( Math.floor(val) );
```

QUESTION 13

What is output by the code to the right?

A. `ed`
`laz`

B. `ed laz`

C. `ed`

D. `"ed\nlaz"`

E. `ed\nlaz`

```
String ch = "ed\nlaz";
System.out.print( ch );
```

QUESTION 14

What is output by the code to the right?

A. `1.8` B. `1.800` C. `1.789`

D. `1` E. `2.0`

```
String format = "%3.1f";
double v = 1.789;
System.out.printf( format, v );
```

QUESTION 15

What is returned by the method call `example(3, 8)`?

A. `-5` B. `-6` C. `6`

D. `4` E. `5`

```
public static int example(int x, int y){
  y -= x;
  x--;
  return y++;
}
```

QUESTION 16

What is output by the code to the right if the value `4` is entered at the call to `key.nextInt()`?

A. `4`

B. `12`

C. The code successfully completes execution with no output.

D. There is no output due to a syntax error.

E. There is no output due to an `ArrayIndexOutOfBoundsException`.

```
int[] temps = {7, 13, 16, 12};
Scanner key = new Scanner( System.in );
int d = key.nextInt();

if( d > 0 || d < temps.length )
  System.out.print( temps[d] );
```

QUESTION 17

How many `*`'s are output by the code to the right?

A. `5` B. `24` C. `36`

D. `10` E. `25`

```
for(int i = 1; i < 6; i++){
  for(int j = 1; j < 6; j++){
    if( i != j )
      System.out.print( "*" );
    else
      break;
  }
}
```

QUESTION 18

What is returned by the method call `self(11)`?

A. `5` B. `11` C. `6`

D. `1` E. `0`

```
public static int self(int n){
  if( n <= 0 )
    return 0;
  else
    return 1 + self( n - 2 );
}
```

QUESTION 19

What is output by the code to the right?

A. `[Z, MM, A]` B. `[A, MM, Z]`

C. `[A, Z, MM]` D. `[Z, A, MM]`

E. There is no output due to a syntax error.

```
ArrayList<String> letters;
letters = new ArrayList<String>();
letters.add("Z");
letters.add("A");
letters.add("MM");
Collections.sort( letters );
System.out.println( letters );
```

QUESTION 20

What replaces **<*1>** in the code to the right to indicate the `Lunch` class inherits the `Meal` class?

A. `inherits`

B. `extends`

C. `implements`

D. `isa`

E. `sub`

Assume **<*1>** is filled in correctly.

QUESTION 21

What is output by the line marked `Line 1` in the client code to the right?

A. `0`

B. `2`

C. `6`

D. `3`

E. `5`

QUESTION 22

What is output by the line marked `Line 2` in the client code to the right?

A. `14`

B. `7`

C. `7.5`

D. There is no output due to a syntax error in that section of client code.

E. There is no output due to a `ClassCastException`.

```
public class Meal{

  private int price;

  public Meal(int p){
    price = p;
  }

  public int getPrice(){
    return price;
  }

  public void inc(){
    price++;
  }
}

public class Lunch <*1> Meal{

  private boolean hasDrink;

  public Lunch(int p, boolean d){
    super( p );
    hasDrink = d;
  }

  public int getPrice(){
    int result = super.getPrice() / 2;
    if( hasDrink )
      result++;
    return result;
  }
}

////////////////////////////////////////
// client code
Meal sat = new Meal(5);
sat.inc();
System.out.print( sat.getPrice() ); //Line 1


Meal sun = new Lunch(13, true);
System.out.print( sun.getPrice() ); //Line 2
```

QUESTION 23

What is output by the code to the right when method `second` is called?

A. `2`

B. `-1`

C. `3`

D. `4`

E. `0`

```
public static void first(int[] data){
  data = new int[4];
}

public static void second(){
  int[] list = {2, 3};
  first( list );
  System.out.print( list[1] );
}
```

QUESTION 24

What is output by the code to the right?

A. `[8, 12, 10]` B. `[8, 10, 12]`

C. `[12, 10, 8]` D. `[10, 8]`

E. `[10, 12, 8]`

```
LinkedList<Integer> scores;
scores = new LinkedList<Integer>();
scores.addLast( 12 );
scores.addFirst( 10 );
scores.add( 8 );
System.out.println( scores );
```

QUESTION 25

What is output by the code to the right?

A. `5` B. `10` C. `9`

D. There is no output due to a syntax error.

E. There is no output due to an `ArrayIndexOutOfBoundsException`.

```
char[][] table = new char[10][5];
System.out.print( table[8].length );
```

QUESTION 26

Method `sort` to the right attempts to implement the insertion sort algorithm, but the method has one or more syntax errors. Which of the following best describes how to correct the syntax error(s)?

A. The `int` variable `j` and the `String` variable `cur` must both be declared before the `for` loop.

B. The statement
`vals[j + 1] = vals[j--];`
must be replaced with the following statements:

```
vals[j + 1] = vals[j];
j--;
```

C. The statement `String cur = vals[i];` must be replaced with the following statement:

```
String cur = new String( vals[i] );
```

D. The line
`while( j >= 0 && cur < vals[j] ){`
must be replaced with the following:

```
while( j >= 0
  && cur.compareTo( vals[j] ) < 0 ){
```

E. More than one of these.

```
// sort into ascending value
// using the insertion sort algorithm

public static int sort(String[] vals){
  int count = 0;

  for(int i = 1; i < vals.length; i++){
    int j = i - 1;
    String cur = vals[i];

    while( j >= 0 && cur < vals[j] ){
      vals[j + 1] = vals[j--];
      count++;
    }

    vals[j + 1] = cur;
  }
  return count;
}
```

Assume method `sort` has been corrected.

QUESTION 27

What is returned by method `sort` if `vals` initially contains the following `String`s?

`{"S", "O", "M", "K", "D", "B", "A"}`

A. `0` B. `18` C. `7`

D. `21` E. `6`

QUESTION 28

What is output by the client code to the right?

A. `true`

B. `false`

C. `null`

D. There is no output due to a syntax error.

E. There is no output due to an `IndexOutOfBoundsException`.

```
public static boolean same(
                    ArrayList<Object> ls){
  Object last = ls.get( ls.size() - 1 );
  return ls.get(0).equals( last );
}

////////////////////////////////////////
// client code
ArrayList<String> initials;
initials = new ArrayList<String>();
initials.add("DT");
initials.add("TD");
initials.add("dt");
System.out.println( same( initials ) );
```

QUESTION 29

What is output by the code to the right assuming method `handle` is sent a `Scanner` object that is connected to a file that contains the following data?

```
.5  1  0.1
+0.5 1G
0.5 1.5
```

A. `out5.1`

B. `not2.1`

C. `not0.0`

D. `not0.50.5`

E. `37.1`

```
/* nextDouble() throws an
   InputMisMatchException when the next
   input token cannot be translated into
   valid double value.


   nextDouble() throws a
   NoSuchElementException if the input is
   exhausted.
*/

public static void handle(Scanner s){
  double total = 0.0;
  try{
    for(int i = 0; i < 10; i++)
      total += s.nextDouble();
    System.out.print( total );
  }
  catch(InputMismatchException e1){
    System.out.print("not");
  }
  catch(NoSuchElementException e2){
    System.out.print("out");
  }
  System.out.print( total );
}
```

QUESTION 30

What is output by method `figure` if `input` initially contains the following `String`s?

`{"Java", "C", "Eiffel", "C++"}`

A. `[Java, Eiffel]`

B. `[Java, Eiffel, C++]`

C. `[C, C++]`

D. `[Java, C]`

E. There is no output due to an `IllegalStateException`.

```
public static void figure
                  (ArrayList<String> input){
  Iterator<String> it = input.iterator();
  while( it.hasNext() ){
    if( it.next().length() <= 3 )
      it.remove();
  }

  System.out.println( input );
}
```

QUESTION 31

If the `ArrayList nums` contains N items what is the running time of method `removeAll`? Choose the most restrictive correct answer.

A. O(N) B. $O(N^2)$ C. $O(N^3)$

D. $O(N^{1/2})$ E. O(NlogN)

```
public static void removeAll
                  (ArrayList<Integer> nums){
  int i;
  for(i = nums.size() - 1; i >= 0; i--){
    nums.remove(i);
  }
}
```

QUESTION 32

Which of these method calls returns `5`?

A. `pieces("1cs2cs3cs4cs5cs_easy")`

B. `pieces("cs1cs2cscs315sc")`

C. `pieces("apcs_uilcs_ibcs_hscs_")`

D. Both A and B

E. Both B and C

```
public static int pieces(String st){
  String[] result = st.split("cs");
  return result.length;
}
```

QUESTION 33

Given the following measurements, what is the most likely running time for method `sample(int[] data)` where N is equal to `data.length`? Choose the most restrictive correct answer.

Value of N	Time for method `sample` to complete
1,000	1 second
4,000	64 seconds
16,000	4096 seconds

A. O(NlogN) B. $O(N^3)$ C. $O(N^4)$ D. $O(2^N)$ E. O(N!)

QUESTION 34

What is returned by the method call `find(mat, -2)` where `mat` is the 2D array below?

0	4	8	5	8	5	2	-2
9	3	8	1	8	5	1	2
9	9	7	7	5	5	5	3
-4	5	3	7	3	3	2	-2
0	0	0	0	0	0	0	0
1	0	0	6	0	0	-3	3
2	1	-1	3	-1	2	-2	5
2	4	-2	2	-1	-1	7	0

A. `0` B. `1` C. `2`

D. `4` E. `8`

```
//pre: mat is a square 2d array
public static int find(int[][] mat, int t){
  final int L = mat.length - 1;
  int res = 0;
  boolean ok = true;
  int c = 0;
  int i;

  while( c < mat.length ){
    ok = mat[c][L] >= t && mat[L][c] >= t;
    if( ok ){
      i = 1;
      while( ok && i <= L ){
        ok = mat[c][i] <= mat[c][i-1];
        ok =ok && mat[i][c] <= mat[i-1][c];
        i++;
      }
      res = ok ? res + 1 : res;
    }
    c++;
  }
  return res;
}
```

QUESTION 35

Consider the following class that attempts to implement the `Structure` interface shown to the right.

```
public class SimpleStructure
                    implements Structure{
  private Comparable comp;

  public Structure add(Comparable obj){
    comp = obj;
  }
}
```

Which of the following is true about the `SimpleStructure` class?

A. The class compiles with no errors.

B. The class does not compile because it does not implement the `toString` method.

C. The class does not compile because the `add` method does not return a `Structure`.

D. The class does not compile because it does not have a constructor.

E. More than one of these.

QUESTION 36

What is output by the client code to the right?

A. `75056`

B. `05567`

C. `7650`

D. `0567`

E. There is no output.

QUESTION 37

What type of data structure does the `NEStructure` class implement?

A. A linked list

B. A binary search tree

C. A min heap

D. A max heap

E. A stack

```
public interface Structure{
  public Structure add(Comparable obj);
  public String toString();
}

public class EmptyStructure
                      implements Structure{
  public Structure add(Comparable obj){
    return new NEStructure( obj );
  }

  public String toString(){
    return "";
  }
}

public class NEStructure
                      implements Structure{
  private Comparable data;
  private Structure left;
  private Structure right;

  public NEStructure(Comparable obj){
    data = obj;
    left = new EmptyStructure();
    right = new EmptyStructure();
  }

  public Structure add(Comparable obj){
    int val = obj.compareTo( data );
    if( val < 0 )
      left = left.add( obj );
    else if( val > 0 )
      right = right.add( obj );
    return this;
  }

  public String toString(){
    return right.toString() + data +
                            left.toString();
  }
}
////////////////////////////////////////
// client code
Structure s1 = new EmptyStructure();
s1 = s1.add(7);
s1 = s1.add(5);
s1 = s1.add(0);
s1 = s1.add(5);
s1 = s1.add(6);
System.out.println( s1 );
```

QUESTION 38

What is output by the client code to the right?

A. `A`

B. `B`

C. `null`

D. There is no output due to a syntax error in the client code.

E. There is no output due to a `NullPointerException`.

```
public class Node{
  public Object data;
  public Node p, n;

  public Node(Object obj){
    data = obj;
  }
}
////////////////////////////////////////
// client code
Node a = new Node("A");
Node b = new Node("B");
a.p = a;
a.n = b;
b.p = a.p.p;
b.n = b.p.n.p;
System.out.println( b.n.data );
```

QUESTION 39

What type of variables must `one` and `two` be so that the running time of method `countMatches` is O(N) when it returns `0`? The variables `one` and `two` both contain N distinct elements, but they do not share any elements in common.

	one	two
A.	ArrayList	HashSet
B.	LinkedList	ArrayList
C.	ArrayList	ArrayList
D.	ArrayList	TreeSet
E.	LinkedList	HashSet

```
public int countMatches(List<Integer> one,
                        Collection<Integer> two){

  int totalMatches = 0;
  for(int i = 0; i < one.size(); i++)
    if( two.contains( one.get( i ) ) )
      totalMatches++;

  return totalMatches;
}
```

QUESTION 40

What is output by the code to the right when method `doExample` is called?

A. `0`

B. `6`

C. `null`

D. There is no output due to a syntax error.

E. There is no output due to an `ArrayIndexOutOfBoundsException`.

```
public static void poorlyWritten(int[] data){
  int total = 0;
  try{
    int i = 0;
    while( true ){
      total += data[i];
      i++;
    }
  }
  catch(ArrayIndexOutOfBoundsException e){
  }
  System.out.print( total );
}

public static void doExample(){
  int[] data = {1, 2, 3};
  poorlyWritten( data );
}
```