QUESTION 1

What does 1101100_2 minus 1111_2 equal?

A. $5D_{16}$ B. 1100011_2 C. 103_{10} D. F_{16} E. 1001111_2

QUESTION 2

What is output by the code to the right?

A. 5.5 B. 6.5 C. 8.75

D. 7.5 E. 6.0

```
double a = 2.5;
int x = 3;
a = a * 2 + (x / 2);
System.out.println( a );
```

QUESTION 3

What is output by the code to the right?

A. 15 B. 11 C. 10

D. 5 E. 4

```
int hold = 15;
for(int i = 0; i <= 10; i++){
  hold--;
}
System.out.print( hold );
```

QUESTION 4

What is output by the code to the right?

A. 12 B. 9 C. 3

D. 6 E. 15

```
String t1 = "eiffel";
String t2 = "php";
String t3 = t2 + t1 + t2;
System.out.print( t3.length() );
```

QUESTION 5

What is output by the code to the right?

A. null B. -1 C. 0

D. 1 E. 3

```
int[] fibs = {1, 1, 2, 3, 5, 8, 13};
fibs[3] = fibs[0];
fibs[0]--;
System.out.print( fibs[3] );
```

QUESTION 6

What is output by the code to the right?

A. 2 B. 30 C. 10

D. 12 E. 0

```
int r = 20;
int s = 10;
int t = s + s + s + s / r;
System.out.print( t );
```

QUESTION 7

Which answer is logically equivalent to the following Boolean expression, where `x, y and z` are `int` variables?.

```
(x > y) && !(y <= z)
```

A. `!(x <= y) && (y > z)` B. `!(x > y) && !(y <= z)`

C. `(x > y) || !(y <= z)` D. `(x <= y) && !(y <= z)`

E. `!( (x > y) && !(y <= z) )`

QUESTION 8

What is output by the code to the right?

A. 3 B. 23 C. 13

D. 1 E. 2

```
String home = "";
if( home == null )
  System.out.print( 1 );
else
  System.out.print( 2 );
if( home.length() != 0 )
  System.out.print( 3 );
```

QUESTION 9

How many constructors does the `Table` class have?

A. 2

B. 0

C. 4

D. 1

E. 3

QUESTION 10

What is output by the client code to the right?

A. `null, legs: 0`

B. `, legs: 4`

C. `Ikea, legs: 4`

D. `blob, legs: 4`

E. `Ikea, legs: 0`

```
public class Furniture{

  private String name;

  public Furniture(){
    name = "blob";
  }

  public Furniture(String n){
    name = n;
  }

  public String toString(){
    return name;
  }
}

public class Table extends Furniture{
  private int legs;

  public Table(int n){
    super("Ikea");
    legs = n;
  }

  public String toString(){
    String result = super.toString();
    result += ", legs: " + legs;
    return result;
  }
}

////////////////////////////////////////
// client code
Table endTable = new Table(4);
System.out.print( endTable );
```

QUESTION 11

What is output by the code to the right?

A. -2 B. -1 C. 0

D. 1 E. -2147483648

```
int m = 1;
int n = ~m;
System.out.print( n );
```

QUESTION 12

The code to the right contains a syntax error. Which of the following best explains the reason for the syntax error?

A. Variable `b2` has not been initialized.

B. The `Math.round` method does not exist.

C. `long`s may not be stored in `int` variables without casting.

D. Arguments to the `Math.round` method cannot be less than 0.

E. `double`s may not be stored in `int` variables without casting.

```
double b2 = -2.55;
int x = Math.round( b2 );
```

QUESTION 13

What is output by the code to the right?

A.
```
A
GREAT
FILM
```

B. `A \`

C. `A "GREAT" film`

D. `A \"GREAT\" film`

E. `A GREAT FILM`

```
System.out.print("A \"GREAT\" film");
```

QUESTION 14

What is output by the code to the right?

A. `2009` B. `+2009` C. `002009`

D. `d+2009` E. `+02009`

```
System.out.printf("%+06d", 2009);
```

QUESTION 15

What is returned by the method call `happy( happy(2, 3), happy(3, 2) )`?

A. `10` B. `9` C. `21`

D. `7` E. `18`

```
public int happy(int x, int y){
  x--;
  ++y;
  return x * y;
}
```

QUESTION 16

What is output by the code to the right?

A. `0` B. `2` C. `3`

D. `4` E. `16`

```
int counter = 0;
String pos = "Dean_of_Students";

for(int i = 0; i < pos.length(); i++){
  char ch = pos.charAt(i);
  if( Character.isUpperCase( ch ) )
    counter++;
}

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

QUESTION 17

Which of the following best describes what the code to the right will output?

A. If `b` is initialized to `true` the code prints `true`, otherwise it prints `false`.

B. If `b` is initialized to `true` the code prints `false`, otherwise it prints `true`.

C. The code always prints out `truefalse`.

D. The code always prints out `true`.

E. The code always prints out `false`.

```
boolean b;
// code to initialize b;

boolean oldB = b;
b = (b == false);
System.out.print( b == oldB );
```

QUESTION 18

What is output by the code to the right?

A. `falsefalse` B. `falsetrue`

C. `truefalse` D. `truetrue`

E. `true`

```
ArrayList<String> f;
f = new ArrayList<String>();
List<String> s;
s = new LinkedList<String>();

System.out.print(f instanceof List);
System.out.print(s instanceof LinkedList);
```

QUESTION 19

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

A. `b3a63` B. `3db63` C. `3ab66`

D. `b3a66` E. `3ab63`

```
public int pi(int x){
  System.out.print( x + "a" );
  return x * 2;
}

public void rho(){
  int y = 3;
  System.out.print( "b" + pi(y) + y );
}
```

QUESTION 20

What is returned by method `enigma` if `data` is the array shown below?

`{2, 0, 1, 3, -5, 2, 5, -3}`

A. `9` B. `4` C. `8`

D. `-1` E. `5`

```
public int enigma(int[] data){
  int i = 0;
  for(; i < data.length; i++){
    if( data[i] < 0 )
      break;
  }
  return i == data.length ? -1 : i;
}
```

QUESTION 21

What is output by the code to the right?

A. `2` B. `3` C. `4`

D. `5` E. `6`

```
HashSet<String> set;
set = new HashSet<String>();

set.add("A");
set.add("B");
set.add("AA");
set.add("B");

System.out.print( set.size() );
```

QUESTION 22

Which of the following can replace **<*1>** in the code to the right so that the code segment compiles without error?

I. `Collection<Integer>`
II. `Object`
III. `Queue<Integer>`

A. I only B. II only C. III only

D. I, II, and III E. None of the choices.

```
<*1> tally = new LinkedList<Integer>();
```

QUESTION 23

What is output by the code to the right?

A. `0`

B. `10`

C. `45`

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

E. There is no output due to an infinite loop that occurs when the code is run.

```
ArrayList<Integer> nums;
nums = new ArrayList<Integer>();
for(int i = 0; i < 10; i++)
  nums.add(i);

Iterator<Integer> it = nums.iterator();
int count = 0;
while( it.hasNext() )
  count++;

System.out.println( count );
```

QUESTION 24

What can replace **<*1>** in the code to the right so that the code segment compiles without error.

A. Any valid identifier that is not already in scope.

B. Only the identifier `e`.

C. Only the identifier `this.Exception`.

D. Any single digit.

E. One or more `&`'s.

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

QUESTION 25

What is output by the code to the right?

A. `e2`

B. `454`

C. `e297`

D. `e1`

E. `e1e2`

```
try{
  int[] passnums = {31, 2, 45, 4, 97};
  int i1 = passnums[2];
  int i2 = passnums[3];

  System.out.print( passnums[i1] );
  System.out.print( passnums[i2] );
}
catch(NullPointerException <*1>){
  System.out.print( "e1" );
}
catch(ArrayIndexOutOfBoundsException <*1>){
  System.out.print( "e2" );
}
```

QUESTION 26

What is output by the code to the right?

A. ULBDER B. EULB

C. EEEEEEE D. REDBLUE

E. EULBDER

```
String colors = "REDBLUE";
Stack<Character> st;
st = new Stack<Character>();

for(int i = 0; i < colors.length(); i++)
  st.push( colors.charAt(i) );

while( !st.isEmpty() )
    System.out.print( st.pop() );
```

QUESTION 27

Which of the following can replace **<*1>** in the code to the right so that method `passItOn` compiles without error?

I. `LinkedList<Integer>`
II. `HashSet<String>`
III. `ArrayList<Map.Entry<String, Integer>>`

A. I only B. II only C. III only

D. I and II E. I, II, and III

```
public void passItOn(<*1> coll){
  Collections.sort( coll );
}
```

QUESTION 28

What Java programming language feature allows the primitive `int`s to be used as arguments to the constructor calls in the client code to the right even though the data type of the parameter `d` is `Object`, not `int`?

A. exceptions

B. static variables

C. autoboxing

D. recursion

E. method overloading

```
public class Node{
  public Node one;
  public Node two;
  public Object data;

  public Node(Node o, Node t, Object d){
    one = o;
    two = t;
    data = d;
  }

  public Node(){
  }

}

////////////////////////////////////////
// client code
Node n1 = new Node(null, null, 1);
Node n2 = new Node(n1, new Node(), 2);
Node n3 = new Node(n1, n2, 3);

n1.two = n3;
n2.two.one = n3.one;
n1.one = n3.two.one;

System.out.println( n2.one.two.one.data );
```

QUESTION 29

What is output by the client code to the right?

A. 1

B. 2

C. 3

D. There is no output due to a `ArrayIndexOutOfBoundsException`.

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

QUESTION 30

What is output by the code to the right?

A. 1 B. 3 C. -1

D. -19 E. -3

```
String s1 = "CAN";
String s2 = "CANTOR";
System.out.print( s1.compareTo( s2 ) );
```

QUESTION 31

If N equals `d.size()` what is the average running time of method `search` when `d` is an `ArrayList` and when `d` is a `LinkedList`? Pick the most restrictive correct set of answers.

	ArrayList	LinkedList
A.	O(N)	O(logN)
B.	O(logN)	O(NlogN)
C.	O(NlogN)	$O(N^2)$
D.	O(logN)	O(logN)
E.	O(l)	O(logN)

```
// pre: list != null and
// elements in list are sorted in
// ascending order.
public int search(List<Integer> d,
                                    int tgt){
  Integer t = new Integer(tgt);
  int res = -1;
  int low = 0;
  int hi = d.size() - 1;
  int count = 0;
  while( res == -1 && low <= hi ){
    count++;
    int mid = (low + hi) / 2;
    int diff = t.compareTo( d.get(mid) );
    if( diff == 0 )
      res = mid;
    else if( diff > 0 )
      low = mid + 1;
    else
      hi = mid -1;
  }
  return res;
}

////////////////////////////////////////
// client code
ArrayList<Integer> t;
t = new ArrayList<Integer>();
for(int i = 0; i < 1000; i++)
  t.add( 0 );
System.out.print( search(t, 0) );
```

QUESTION 32

What is output by the client code to the right?

A. `0`

B. `1000`

C. `499`

D. `999`

E. `500`

QUESTION 33

Assume method `fib(int[] data)` is $O(2^N)$ where N = `data.length`. When method `fib` is passed an array with `length` = 50 it takes 0.5 seconds for method `fib` to complete. If method `fib` is then passed an array with `length` = 54 what is the expected time it will take method `fib` to complete?

A. 0.54 seconds B. 4 seconds C. 16 billion seconds D. 8 seconds E. 0.51 seconds

QUESTION 34

What is output when method `work` is called if `data` is the array shown below?

`{3, 2, 3, 0, 4, 0, 3, 1, 5, 0}`

A. `1`

B. `21`

C. `15`

D. `0`

E. `1080`

```
public void work(int[] data){
  int result = 1;
  for(int i = 0; i < data.length; i++){
    if( data[i] != 0 )
      result *= data[i];
    else
      result = 1;
  }
  System.out.print(result);
}
```

QUESTION 35

The `Arrays.sort(int[] a)` method calls a helper method with the following header:

```
private static void sort1(int x[], int off, int len) {
```

The parameters `off` and `len` specify a sub-array in `x` to be sorted. `len` is the length of the sub-array.
The implementation of the method `sort1` is:

```
if( len < 7 )
    // perform an insertion sort on the sub-array
else
    // perform a quicksort on the sub-array
```

Which of the following is the best reason the `sort1` method uses this hybrid (combination of quicksort and insertion sort) sorting algorithm?

A. So that the sort will work on all primitive integer types: `byte`, `short`, `int` and `long`.

B. Primitive `int`s do not have a `compareTo` method.

C. So that the sort will be stable, meaning the relative order of equal items in the original array is unchanged.

D. So that an auxiliary linked list is not needed to complete the sort.

E. It is usually faster to sort a small array using the insertion sort algorithm rather than the quicksort algorithm.

QUESTION 36

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

A. `0`

B. `1`

C. `5`

D. `16`

E. `32`

QUESTION 37

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

A. `[2, 3]`

B. `[]`

C. `[2, 3, 3]`

D. `8`

E. `[8, 5]`

```
public void ps(int[] d, int p,
       ArrayList<Integer> cur,
       ArrayList<ArrayList<Integer>> res){

  if(p == d.length)
    res.add( gc(cur) );
  else{
    ps(d, p + 1, cur, res);
    cur.add(d[p]);
    ps(d, p + 1, cur, res);
    cur.remove( cur.size() - 1 );
  }
}

public ArrayList<Integer> gc(
                        ArrayList<Integer> org){
  ArrayList<Integer> r;
  r = new ArrayList<Integer>();
  for(int i : org)
    r.add(i);
  return r;
}

////////////////////////////////////////
// client code
int[] ds = {2, 3, 8, 3, 5};
ArrayList<ArrayList<Integer>> res;
res = new ArrayList<ArrayList<Integer>>();
ArrayList<Integer> c = new ArrayList<Integer>();
ps(ds, 0, c, res);

System.out.println( res.size() ); // line 1
System.out.println( res.get(5) ); // line 2
```

QUESTION 38

What replaces **<*1>** in the code to the right to decrement the value stored inside the variable `p`?

A. `p -= 1`

B. `p *= -1`

C. `p >> 2`

D. `p << 1`

E. `p++`

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

QUESTION 39

What is output by the client code to the right?

A. `MM`

B. `UU GG MM GG`

C. `GG`

D. `12`

E. `UU`

QUESTION 40

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

A. a stack

B. a heap

C. a list

D. a binary search tree

E. a priority queue

```
public class Structure{

  private ArrayList<Integer> ks;
  private ArrayList<Object> vs;

  public Structure(){
    ks = new ArrayList<Integer>();
    vs = new ArrayList<Object>();
  }

  public void add(int k, Object v){
    int p = ks.size();
    while(p > 0 && k <= ks.get(p - 1) )
      <*1>;
    ks.add(p, k);
    vs.add(p, v);
  }

  public boolean isEmpty(){
    return ks.size() == 0;
  }

  public Object access(){
    return vs.get( ks.size() - 1 );
  }

  public Object remove(){
    ks.remove(ks.size() - 1);
    return vs.remove( vs.size() - 1 );
  }
}

////////////////////////////////////////
// client code

Structure str = new Structure();

str.add(10, "GG");
str.add(12, "MM");
str.add(12, "GG");
str.add(5, "UU");

System.out.print( str.access() );
```