Note: Correct responses are based on Java, J2sdk v 5.0, from Sun Microsystems, Inc. All provided code segments are intended to be syntactically correct, unless otherwise stated (i. e. `error` is an answer choice) and any necessary Java 2 Standard Packages have been imported. Ignore any typographical errors and assume any undefined variables are defined as used.

QUESTION 1

What is $FFA_{16} + 333_{16} = ?$

A. $122D_{16}$ B. $123D_{16}$ C. $133C_{16}$ D. 1323_{16} E. $132D_{16}$

QUESTION 2

What is output by the code to the right?

A. 6.6 B. 7 C. 5 D. 18 E. 6

```
int x = 3 * 6;
int y = x / 5 + x % 5;
out.println( y );
```

QUESTION 3

What is output by the code to the right?

A. 64 B. 32 C. 60

D. 46 E. 36

```
int t = 1;
do{
   t += 2;
   t *= 2;
}while(t < 32);
out.println(t);
```

QUESTION 4

What is output by the code to the right?

A. S1 B. UD C. BSBB D. 2SB2 E. DB2

```
String s1 = "SB";
s1 = 2 + s1 + 2;
out.println(s1);
```

QUESTION 5

What is output by the code to the right?

A. 3 B. 8 C. No output due to syntax error

D. 5 E. No output due to runtime exception

```
int[] data = {6,1,3,5,4,7,2,3,5};
int x1 = data[ data[1] + data[5] ];
out.println(x1);
```

QUESTION 6

What is output by the code to the right?

A. 00000

B. 45600

C. 00003

D. 01230

E. 78000

```
int lim = 5;
int[][] mat = new int[lim][lim];
int t1 = 0;
for(int i = lim-1; i >= 0; i--)
  for(int j = 0; j < i; j++){
    mat[i][j] = t1;
    t1++;
}
for(int c = 0; c < lim; c++)
  out.print( mat[3][c] );
```

QUESTION 7

What does method `g` return?

A. `g` always returns the value of `a`

B. `g` always returns the value of `a`

C. the average of `a`, `b`, and `c`

D. the minimum of `a`, `b`, and `c`

E. the maximum of `a`, `b`, and `c`

```
public int g(int a, int b, int c){
   int x = a;
   if( a < b )
      x = b;
   if( x < c )
      x = c;
   return x;
}
```

QUESTION 8

Which of the following are syntactically legal Java indentifiers?

I. `_val` II. `my_VAL` III. `2_val`

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

QUESTION 9

For what values of `a` and `b` does the boolean expression to the right evaluate to true? **`!(a && b) && !a`**

I. `a = false, b = false`
II. `a = false, b = true`
III. `a = true, b = false`
IV. `a = true, b = true`

A. I only B. II only C. III only D. IV only E. more than one of these

QUESTION 10

What replaces **`<*1>`** to ensure class `Simple` can not be extended by any other classes?

A. `static` B. `abstract` C. `super`
D. `final` E. `void`

```
public <*1> class Simple{
  // code for class Simple
}
```

QUESTION 11

What is output by the code to the right?

A. `77777` B. `257120` C. `01234` D. `27770`
E. There is no output due to a runtime Exception

```
int[] list = new int[5];
list[0] = 2;
list[2] = 5;
for(int i = 1; i < list.length-1; i++)
   list[i] = list[i-1] + list[i+1];
for(int i : list)
   out.print(i);
```

QUESTION 12

What is output by the code to the right?

A. `0` B. `6` C. `3`
D. There is no output due to a runtime Exception
E. There is no output due to a syntax error

```
int[] list2 = {6,0,3,6,7};
list2++;
++list2;
out.println(list[0]);
```

QUESTION 13

Consider the interfaces and class to the right. If `earth` is a fully instantiated object of type `Planet` what can replace **`<1*>`** in the statement:

`earth.<1*>;`

I. `getVelocity()`
II. `getMass()`
III. `toString()`

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

```
public interface Projectile{
  public double getVelocity();
}

public interface Particle{
  public double getMass();
}

public class Planet implements
  Projectile, Particle{

  public double getVelocity(){
     return 100;
  }

  public double getMass(){
     return 1000;
  }
}
```

QUESTION 14

What is output by the code to the right?

A. `27` B. `32` C. `58` D. `59` E. `0`

```
int f = 33;
int g = 58;
int h = f | g;
out.print(h);
```

QUESTION 15

The `length` field in the `CD` class stores the total length of time of the music on a `CD` in seconds.

What replaces **<1*>** in the code to the right to calculate the average song length rounded to the nearest **minute**?

I. `Math.round( length / numSongs / 60f )`

II. `Math.round( length / numSongs / 60. )`

III. `Math.floor( length / numSongs / 60 )`

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

D. I and II only E. II and III only

QUESTION 16

What replaces **<2*>** in the code to the right so that the natural ordering of `CD` objects is based on their `length`. `CD`s with a larger `length` are considered larger than `CD`s with a smaller `length`.

A. `getLen() - other.getLen()`

B. `length - other.getLen()`

C. `length - other.length`

D. both answers A and B E. answers A, B, and C

For the questions #17-22, assume **<1*>** and **<2*>** have been filled correctly.

QUESTION 17

What is output by the client code marked **question 17**?

A. No output due to a syntax error

B. No output due to a runtime Exception

C. `The River` D. `The River:Part 2` E. `null`

QUESTION 18

What is output by the client code marked **question 18**?

A. `null:0` B. `null:null` C. `0:0`

D. No output due to a syntax error

E. No output due to a runtime Exception

QUESTION 19

What is output by the client code marked **question 19**?

A. There is no output due to a runtime error

B. There is no output due to a syntax error

C. `-1` D. `0` E. `1`

QUESTION 20

What is output by the client code marked **question 20**?

A. There is no output due to a runtime error

B. There is no output due to a syntax error

C. `true` D. `false` E. `0`

```
public class CD
     implements Comparable<CD>{

  private String title;
  private int numSongs;
  private int length;

//pre: n > 0, len > 0
  public CD(String t, int n, int len){
     title = t;
     numSongs = n;
     length = len;
  }

  public int getLen(){ return length; }

  public int aveSongLen(){ return <1*>; }

  public String toString(){
     return title + ":" + numSongs;
  }

  public String getTitle(){ return title;
  }

  public int compareTo(CD other){
     return <2*>;
  }
}
```

```
//---- question 17 client code -------
CD c1 = new CD("The River", 11, 440);
c1.title += ":Part 2";
out.println( c1.getTitle() );
```

```
//---- question 18 client code -------
CD c2 = new CD();
out.println( c2 );
```

```
---- question 19 client code -------
CD c2 = new CD("River", 10, 300);
String s2 = "Bruce";
out.println(c2.compareTo(s2));
```

```
---- question 20 client code -------
CD c2 = new CD("Movies", 8, 350);
String s2 = "Dire Straits";
out.println(c2.equals(s2));
```

Questions 21 and 22 refer to the `CD` Class on the Previous Page

QUESTION 21

Which is the parent class of the `CD` class?

A. CD does not have a parent class B. `MediaItem` C. `Comparable` D. `Item` E. `Object`

QUESTION 22

Which of the following lines of code will not cause a syntax error?

I. `Comparable<CD> c3 = new Comparable<CD>("Next", 8, 350);`

II. `Comparable<CD> c4 = new CD("Tommy", 8, 350);`

III. `CD c5 = Comparable<CD>("Cowboys", 9, 330);`

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

QUESTION 23

What is the running time of method `one`? Pick the most restrictive correct answer.

A. $O(1/N)$ B. $O(1)$ C. $O(N)$ D. $O(N^2)$ E. $O(N!)$

QUESTION 24

What is the running time of method `two`? Choose the most restrictive correct answer.

A. $O(1/N)$ B. $O(1)$ C. $O(N)$ D. $O(N^2)$ E. $O(N!)$

```
public static int two(int N){
  int result = 0;
    for(int i = 1; i < N; i++)
      for(int j = 1; j < i; j++)  {
        result += one(j, i); c++;}
  return result;
}

public static int one(int x, int y){
  return y / x;
}
```

QUESTION 25

What is returned by `f(7)` ?

A. `0` B. `3` C. `7` D. `19` E. `21`

QUESTION 26

What is the running time of method `f`? Choose the most restrictive correct answer.

A. $O(N)$ B. $O(1)$ C. $O(N^2)$ D. $O(N/2)$ E. $O(2^N)$

```
public static int f(int x){
  if( x < 0 )
     return 3;
  else
     return 2 + f( x - 1 );
}
```

QUESTION 27

Which data type could be placed in **`<1*>`** in the code to the right?

I. `char` II. `boolean` III. `String`

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

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

```
switch( <1*> ){
  // body of switch
  // statement not shown
}
```

QUESTION 28

What is returned by `h(8)` ?

A. `11`

B. 8

C. `13`

D. `10`

E. Nothing is returned. The call `h(8)` results in infinite recursion.

```
public static int h(int x){
  if( x < 1 )
    return i(2);
  else
    return 2 + i(x-1);
}
public static int i(int x){
  if(x < 3)
    return 2;
  else
    return h(x-2) + 1;
}
```

QUESTION 29

Assume the following array is sent as a parameter to method `sort` to the right.

{13, 39, 12, 9, 5, 13}

What are the contents of array `arr` at the point `marked` **<1*>** when `i` is equal to `3`?

A. {9, 12, 13, 39, 5, 13}

B. {12, 13, 39, 9, 5, 13}

C. {5, 9, 12, 13, 39, 13}

D. {13, 39, 12, 9, 5, 13}

E. {39, 13, 12, 9, 5, 13}

```
public static void sort(int[] arr){
  int pos, temp;
  for(int i = 1; i < arr.length; i++){
    pos = i;
    while( pos > 0 && arr[pos-1] > arr[pos]){
      temp = arr[pos-1];
      arr[pos-1] = arr[pos];
      arr[pos] = temp;
      pos--;
    }
    // <1*>
  }
}
```

QUESTION 30

What sorting algorithm is implemented by the static method `sort` in question 29?

A. Selection Sort B. Insertion Sort C. Quick sort D. Merge Sort E. The method does not correctly sort

QUESTION 31

In question 29, if the array `arr` initially contains N distinct values in random order, what is the expected runtime of method `sort`?

A. O(N) B. $O(N^2)$ C. O(N log N) D. $O(N^3)$ E. O(N * sqrt(N))

QUESTION 32

What is output by the code to the right? Assume the `Queue` data structure has been correctly implemented.

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

B. There is no output due to a runtime error.

C. rreedd

D. rdeedr

E. dreerd

```
String s4 = "red";
int j = s4.length() - 1;
Queue<String> q = new ListQueue<String>();
for(int i = 0; i < s4.length(); i++, j--){
  q.enqueue( s4.substring(i, i+1) );
  q.enqueue( s4.substring(j, j+1));
}
while( !q.isEmpty() )
  out.print(q.dequeue());
```

QUESTION 33

What is output by the code to the right?

A. 8 9

B. 9 32

C. 41

D. 32 27

E. 16 27

```
int x2 = 32;
int tot = 1;
do{
  tot *= 3;
  x2 /= 2;
}
while( tot < x2 );
out.println( x2 + " " + tot);
```

QUESTION 34

What is output by the code to the right?

A. 5

B. 4

C. 0

D. 3

E. There is not output due to an infinite loop

```
int x5 = 30;
int tot = 0;
while( x5 > 0 ){
  x5 /= 3;
  tot++;
}
out.println(tot);
```

QUESTION 35

The following values are inserted in the order shown into a binary search tree using the traditional insertion algorithm. What is the result of an in order traversal of the resulting tree?

A. 7, 1, 5, 3 B. 3, 5, 1, 7 C. 1, 3, 5, 7 D. 7, 5, 3, 1 E. Not enough information to determine the answer

QUESTION 36

What is the height of the shortest resulting binary search tree from question 35? The height of a tree is the number of links from the root of the tree to the deepest leaf.

A. 4 B. 0 C. 1 D. 2 E. 3

QUESTION 37

What is output by the following client code?

```
PublicSchool sc1 = new HighSchool("A", "Plains");
out.println( sc1 );
```

A. `Name: Plains` B. `, Div: A`

C. `Name: Plains, Div: A`

D. There is no output due to a syntax error

E. There is no output due to a runtime error

QUESTION 38

If the line marked **`// line 1`** is removed from the code to the right what is the output of the client code from question 37?

A. `Name: null` B. `, Div: A`

C. `Name: null, Div: A`

D. There is no output due to a syntax error

E. There is no output due to a runtime error

QUESTION 39

What is output by the following client code?

```
PublicSchool sc2 = new PublicSchool("Ozona");
out.println(sc2);
```

A. `Name: Ozona` B. `, Div: AAA`

C. `Name: Ozona, Div: AAA`

D. There is no output due to a syntax error

E. There is no output due to a runtime error

QUESTION 40

What is output by the following client code?

```
HighSchool sc3 = new PublicSchool("AAAAA", "LBJ");
out.println( sc3 );
```

A. `Name: LBJ` B. `, Div: AAAAA`

C. `Name: LBJ, Div: AAAAA`

D. There is no output due to a syntax error

E. There is no output due to a runtime error

```
public class PublicSchool {
  private String myName;

  public PublicSchool(String s){
    myName = s;
  }

  public String toString(){
    return "Name: " + myName;
  }
}

public class HighSchool
            extends PublicSchool {

  private String myDiv;

  public HighSchool(String div,
                    String name) {
   super(name); //line 1
   myDiv = div;
  }

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