Note: Correct responses are based on Java, J2sdk v 6.0, 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 $100101_2 + 110111_2$?

A. 92_{10} B. 11100_2 C. 1001010_2 D. 88_{10} E. 82_{10}

QUESTION 2

What is output by the code to the right?

A. 34 B. 117 C. 78 D. 43 E. 3274

```
int a = 3;
int b = 9;
int c = 4;
System.out.println(a + a * b + c);
```

QUESTION 3

What is output by the code to the right?

A. 5 2 B. i+" "+j

C. 18 3 D. 7 E. 52

```
int i = 5, j = 2;
j += j;
i++;
i *= --j;
System.out.println(i+" "+j);
```

QUESTION 4

What is output by the code to the right?

A. 0 B. 13 C. 50 D. 51 E. 53

```
int sum = 0;
for(int i = 1; i*i <= 100; i++){
  sum += i;
  if(sum % 2 == 0){
    sum--;
  }
}
System.out.println(sum);
```

QUESTION 5

What is output by the code to the right?

A. 00000 B. 0 C. 5 D. 000000000

E. There is no output due to a run-time error.

```
String s = "00000";
while(s.charAt(s.length()-1) == '0'){
  s=s.substring(0, s.length()-1);
}
System.out.println(s);
```

QUESTION 6

What is output by the code to the right?

A. 0 B. 100 C. 101 D. 10 E. 99

```
int[] f = {1,1};
int c = 0;
while(f[1] < 100){
   int tmp = f[0]+f[1];
   f[0] = f[1];
   f[1] = tmp;
   c++;
}
System.out.println(c);
```

QUESTION 7

What is output by the code to the right?

A. true false B. false true

C. true true D. false false

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

```
boolean t = true, f = false;
boolean dumb = t | t & f;
boolean dumber = (t ^ f | f) & f;
System.out.println(dumb+" "+dumber);
```

QUESTION 8

What is output by the code to the right?

A. `3` B. `0` C. `2` D. `5`

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

```
int magic = 64;
int count = 0;
if(magic % 2 == 0 && magic < 30){
  count += 5;
}else if(magic < 100){
  count += 3;
}else{
  count += 2;
}
System.out.println(count);
```

QUESTION 9

What is output by the code to the right?

A. `22.50` B. `22.5` C. `22.500` D. `22`

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

```
System.out.printf("%03.2f", 22.5);
```

QUESTION 10

Which of these is not a Java keyword?

A. `final` B. `define` C. `protected` D. `abstract` E. `enum`

QUESTION 11

What is output by the code to the right?

A. `200 0` B. `0 1000`

C. `0 200` D. `1000 0`

E. `200`

```
int x = 200;
int y = 0;
for(int i = 0; i < 1000; i++){
   x = Math.max(x-1, 0);
   y = Math.min(y+1, 200);
}

System.out.println(x+" "+y);
```

QUESTION 12

What is output by the code to the right?

A. `2yx` B. `252`

C. `2.07` D. `2.552`

E. `9`

```
int x = 2;
int y = 5;
double z = y/x;
String s = y+x+"";

System.out.println(z+s);
```

QUESTION 13

What is output by the code to the right?

A. `Pingxy` B. `Ping42`

C. `42` D. `4 2`

E. `Ping6`

```
int x = 4;
int y = (int)Math.sqrt(x);

if( Math.sqrt(x) == y )
  System.out.print("Ping");
System.out.println(x+""+y);
```

QUESTION 14

What is output by the code to the right?

A. 0

B. 1

C. 2

D. 3

E. 4

```
int[][] m = {{3,2,1},
             {4,1,2},
             {3,4,5}};

int sum = 0;
for(int i = 0; i < m.length; i++){
  for(int k = 0; k < m.length; k++){
    sum += m[i][k];
    sum -= m[k][2-i];
  }
}
System.out.println(sum);
```

QUESTION 15

How many lines of output is printed by the code to the right?

A. 6 B. 7 C. 8 D. 5 E. 9

```
System.out.print("jedimind\ntricks");
System.out.println("\n\n");
System.out.print("aesop\n");
System.out.println("rock");
```

QUESTION 16

What is output by the code to the right?

A. 28 28 B. 0 0 C. 20 0 D. 28 24 E. 24 28

```
int b = 28, x, y;
x = (b >> 2) << 2;
y = (b >> 3) << 3;
System.out.println(x+" "+y);
```

QUESTION 17

What is output by the code to the right?

A. 6 4 B. 7 3 C. 3 7 D. 4 8 E. 6 2

```
ArrayList<Integer> list;
list = new ArrayList<Integer>();

for(int i = 0; i < 10; i++)
  list.add(i);
for(int i = 10; i >= 0; i--)
  list.add(10-i, i);

System.out.print(list.get(3) + " ");
System.out.println(list.get(7));
```

QUESTION 18

What is output by the code to the right?

A. 533021 B. 120335

C. 533021 D. 12035

E. 201335

```
int[] a = {1, 2, 0, 3, 3, 5};
String s = "";
for(int i : a){
    s += a[i];
}
System.out.println(s);
```

QUESTION 19

What is output by the following client code?

```
B child = new B(5);
```

A. 656 B. 5

C. 6 D. 56

E. 65

```
class A{
  public A(int chop){
    chop++;
    System.out.print(chop);
  }
}

class B extends A{
  public B(int chop){
    super(chop);
    System.out.println(chop);
  }
}
```

QUESTION 20

What is output by the code to the right?

A. 1

B. 126

C. 523

D. 28

E. 94

```
int[][] ch = new int[10][10];
ch[0][0] = 1;

for(int i = 1; i < 10; i++){
  for(int k = 0; k <= i; k++){
    ch[i][k] = ch[i-1][k];
    if( k != 0 ){
      ch[i][k] += ch[i-1][k-1];
    }
  }
}

System.out.println(ch[9][4]);
```

QUESTION 21

What output by the following client code?

```
int[] x = {0, 0, 2, 2};
int[] y = {0, 2, 2, 0};
System.out.println(myst(x,y));
```

A. 5.0

B. 3.0

C. 2.0

D. 4.0

E. 1.0

QUESTION 22

What output by the following client code?

```
int[] x2 = {5, 8, 7};
int[] y2 = {6, 12, 6};
System.out.println(myst(x2,y2));
```

A. 10.0

B. 8.0

C. 6.0

D. 4.0

E. 1.0

```
public double myst(int[] x, int[] y)
{
  int area = 0;
  int N = x.length;
  for(int i = 1; i+1<N; i++)
  {
    double x1 = x[i] - x[0];
    double y1 = y[i] - y[0];
    double x2 = x[i+1] - x[0];
    double y2 = y[i+1] - y[0];
    double cross = x1*y2 - x2*y1;
    area += cross;
  }
  return Math.abs(area/2.0);
}
```

QUESTION 23

What replaces **<*1>** in the code to the right to return the set of keys of `p`?

A. `keySet()`

B. `keys()`

C. `getKeys()`

D. `listKeys()`

E. None of the above

```
public int find(int[] value, int[] cost)
{
  TreeMap<Integer, Integer> p;
  p = new TreeMap<Integer,Integer>();
  int n = value.length;
  for(int i=0;i<n;i++){
    Integer x = p.get(cost[i]);
    if(x == null)
      p.put(cost[i], value[i]);
    else
      p.put(cost[i], value[i] + x);
  }
  int[] keys = new int[p.size()];
  int u=0;
  for(int key:p.<*1>)
    keys[u++] = key;

  int[] cu = new int[keys.length];
  cu[0] = p.get(keys[0]);
  for(int i = 1; i < cu.length; i++){
      cu[i] = p.get(keys[i]);
      cu[i] += cu[i-1];
  }
  int ans = 0;
  for(int j = 0; j < cu.length; j++){
    int curr = cu[j] - keys[j];
    ans = Math.max(ans, curr);
  }
  return ans;
}
```

QUESTION 24

Assumming that **<*1>** has been filled correctly, what is output by the following client code?

```
int[] v = {1,5,3,10,2};
int[] c = {2,2,1,2,1};
System.out.println(find(v,c));
```

A. 1 B. 22 C. 15

D. 17 E. 19

QUESTION 25

Assuming `value` and `cost` both has `n` elements, what is the worst case runtime of the code to the right ?

A. O(N)

B. O(NlogN)

C. $O(N^2)$

D. $O(2^N)$

E. O(N!)

QUESTION 26

What is returned by the method call `knuth("ABAB")`?

A. 2 B. 3 C. 4

D. 5 E. 0

```
public static int knuth(String str)
{
  int N = str.length();
  int[] F = new int[N+1];
  char[] S = str.toCharArray();
  int at = 0;
  for(int i = 2; i < N;i++){
    while(at > 0 && S[i-1] != S[at])
      at = F[at];
    if(S[i-1] == S[at])
      F[i] = ++at;
  }
  at = 0;
  for(int i = 1; i < N; i++){
    while(at > 0 && S[at] != S[i])
    at = F[at];
    if(S[at] == S[i])
      at++;
  }
  return N-at;
}
```

QUESTION 27

What is returned by the method call `knuth("BCABCAB")`?

A. 2 B. 3 C. 4

D. 5 E. 1

QUESTION 28

What is returned by the method call `knuth("ABCDA")`?

A. 2 B. 3 C. 4

D. 5 E. -1

QUESTION 29

What is output by the following client code?

```
int[][] can = {{0,1,0,0,0},
               {0,0,1,0,0},
               {0,0,0,1,0},
               {0,0,0,0,1},
               {0,0,0,0,0}};
new Dag(can);
```

A. 13240 B. 23450 C. 12340 D. 01234 E. 43210

QUESTION 30

What is output by the following client code?

```
int[][] can = {{0,1,1,0,0},
               {0,0,0,0,1},
               {0,0,0,1,1},
               {0,0,0,0,0},
               {0,0,0,0,0}};
new Dag(can);
```

A. 21200 B. 41320 C. 43210 D. 12340 E. 41302

QUESTION 31

What is the average case runtime of the code to the right assuming `can` is an `n` by `n` matrix ?

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

C. $O(N^3)$ D. $O(2^N)$

E. O(N!)

QUESTION 32

Suppose that the function angry was instead implemented using the following psuedo-code.

```
public void angry(){
  while(true){
      let S =
        set of all values i such that !vis[i];
      if S is empty
        break;
      randomly pick a single j from S
      happy(j);
  }
}
```

What characteristic of can must be true such that `new Dag(can)` is deterministic and will return the same output everytime?

A. For every distinct pair `i,j` if `can[i][j]` is true, then `can[j][i]` is false.

B. `can` contains no more than n-1 1's

C. Each row of `can` contains at most one 1.

D. Each column of `can` contains at most one 1.

E. `can` contains at most n-1 1's and each row has at most one 1 and each column has at most one 1.

```
public class Dag{
  int c = 0, n = 0;
  int[][] can;
  boolean[] vis;
  int[] order;

  public Dag(int[][] can){
    this.can = can;
    n = can.length;
    vis = new boolean[n];
    order = new int[n];
    angry();
    String face = "";
    for(int i = 0; i < n; i++)
      face += order[i];
    System.out.println(face);
  }

  public void angry(){
    for(int i = 0; i < n; i++){
      if(!vis[i])
        happy(i);
    }
  }

  public void happy(int i){
    vis[i] = true;
    for(int j = 0; j < n; j++){
      if(!vis[j] && can[i][j]==1)
        happy(j);
    }
    order[c++] = i;
  }
}
```

QUESTION 33

What replaces **<*1>** in the code to the right so that the class `Point` uses the `Comparable` interface?

A. `uses`

B. `implements`

C. `tries`

D. `extends`

E. `is`

QUESTION 34

What sorting algorithm does the line marked `line 1` implement?

A. Merge Sort

B. Bubble Sort

C. Quick Sort

D. Heap Sort

E. Bogo Sort

QUESTION 35

Consider the code to the right. What is the output by the line marked `line 2`?

A. `0`

B. `1`

C. `2`

D. `3`

E. `4`

QUESTION 36

Consider the code to the right. What is the output by the line marked `line 3`?

A. `1`

B. `2`

C. `3`

D. `4`

E. `0`

```
class Point <*1> Comparable<Point>
{
  private int x, y;
  private static int id=0;

  public Point(int x, int y){
    this.x=x;
    this.y=y;
  }

  public int compareTo(Point p){
    if(y != p.y) return y - p.y;
    return x - p.x;
  }

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


////////////////////////////////
//client code
Point p1 = new Point(3,3);
Point p2 = new Point(2,3);
Point p3 = new Point(5,2);

ArrayList<Point> p;
p = new ArrayList<Point>();
p.add(p1);
p.add(p2);
p.add(p3);

HashSet<Point> s;
s = new HashSet<Point>(p);

Collections.sort(p);          //line 1
Iterator u = p.iterator();

System.out.println(u.next());//line 2
Iterator v = s.iterator();

System.out.println(v.next());//line 3
```

QUESTION 37

What is returned by the method call `block(x)`?

A. `0`

B. `1`

C. `2`

D. `3`

E. `4`

QUESTION 38

What is returned by the method call `block(y)`?

A. `5`

B. `4`

C. `3`

D. `2`

E. `1`

QUESTION 39

What is returned by the method call `block(z)`?

A. `1`

B. `2`

C. `3`

D. `4`

E. `0`

```
public int block(int[] a)
{
  int left = -1;
  int max = 0;
  int len = a.length;

  for(int i=0;i<len;i++){
    if(a[i] == 1){
      if(left == -1){
        left = i;
      }
    }else{
      if(left != -1){
        int right = i-1;
        int curr = right-left+1;
        max = Math.max(max, curr);
      }
      left = -1;
    }
  }
  return max;
}


////////////////////////////////
//client code
int[] x = {1, 1, 0, 1, 0};
int[] y = {1, 1, 0};
int[] z = {1, 1, 1, 1, 1, 1};
```

QUESTION 40

What is returned by the method call `fix("BBBUGUG")`?

A. `B`

B. `U`

C. `BBUG`

D. `BBBUGUG`

E. `BUG`

```
public String fix(String s)
{
  while(s.indexOf("BUG") != -1)
  {
    int i = s.indexOf("BUG");
    String a = s.substring(0, i);
    String b = s.substring(i+3);
    s = a + b;
  }
  return s;
}
```