UIL COMPUTER SCIENCE WRITTEN TEST

2017 INVITATIONAL A

JANUARY/FEBRUARY 2017

General Directions (Please read carefully!)

1. DO NOT OPEN THE EXAM UNTIL TOLD TO DO SO.
2. There are 40 questions on this contest exam. You will have 45 minutes to complete this contest.
3. All answers must be legibly written on the answer sheet provided. Indicate your answers in the appropriate blanks provided on the answer sheet. Clean erasures are necessary for accurate grading.
4. You may write on the test packet or any additional scratch paper provided by the contest director, but NOT on the answer sheet, which is reserved for answers only.
5. All questions have ONE and only ONE correct answer. There is a 2-point penalty for all incorrect answers.
6. Tests may not be turned in until 45 minutes have elapsed. If you finish the test before the end of the allotted time, remain at your seat and retain your test until told to do otherwise. You may use this time to check your answers.
7. If you are in the process of actually writing an answer when the signal to stop is given, you may finish writing that answer.
8. All provided code segments are intended to be syntactically correct, unless otherwise stated. You may also assume that any undefined variables are defined as used.
9. A reference to many commonly used Java classes is provided with the test, and you may use this reference sheet during the contest. AFTER THE CONTEST BEGINS, you may detach the reference sheet from the test booklet if you wish.
10. Assume that any necessary import statements for standard Java SE packages and classes (e.g., `java.util`, `System`, etc.) are included in any programs or code segments that refer to methods from these classes and packages.
11. NO CALCULATORS of any kind may be used during this contest.

Scoring

1. Correct answers will receive **6 points**.
2. Incorrect answers will lose **2 points**.
3. Unanswered questions will neither receive nor lose any points.
4. In the event of a tie, the student with the highest percentage of attempted questions correct shall win the tie.

STANDARD CLASSES AND INTERFACES – SUPPLEMENTAL REFERENCE

package java.lang

```
class Object
  boolean equals(Object anotherObject)
  String toString()
  int hashCode()

interface Comparable<T>
  int compareTo(T anotherObject)
    Returns a value < 0 if this is less than anotherObject.
    Returns a value = 0 if this is equal to anotherObject.
    Returns a value > 0 if this is greater than anotherObject.

class Integer implements Comparable<Integer>
  Integer(int value)
  int intValue()
  boolean equals(Object anotherObject)
  String toString()
  String toString(int i, int radix)
  int compareTo(Integer anotherInteger)
  static int parseInt(String s)

class Double implements Comparable<Double>
  Double(double value)
  double doubleValue()
  boolean equals(Object anotherObject)
  String toString()
  int compareTo(Double anotherDouble)
  static double parseDouble(String s)

class String implements Comparable<String>
  int compareTo(String anotherString)
  boolean equals(Object anotherObject)
  int length()
  String substring(int begin)
    Returns substring(begin, length()).
  String substring(int begin, int end)
    Returns the substring from index begin through index (end - 1).
  int indexOf(String str)
    Returns the index within this string of the first occurrence of str.
    Returns -1 if str is not found.
  int indexOf(String str, int fromIndex)
    Returns the index within this string of the first occurrence of str,
    starting the search at fromIndex. Returns -1 if str is not found.
  int indexOf(int ch)
  int indexOf(int ch, int fromIndex)
  char charAt(int index)
  String toLowerCase()
  String toUpperCase()
  String[] split(String regex)
  boolean matches(String regex)
  String replaceAll(String regex, String str)

class Character
  static boolean isDigit(char ch)
  static boolean isLetter(char ch)
  static boolean isLetterOrDigit(char ch)
  static boolean isLowerCase(char ch)
  static boolean isUpperCase(char ch)
  static char toUpperCase(char ch)
  static char toLowerCase(char ch)

class Math
  static int abs(int a)
  static double abs(double a)
  static double pow(double base, double exponent)
  static double sqrt(double a)
  static double ceil(double a)
  static double floor(double a)
  static double min(double a, double b)
  static double max(double a, double b)
  static int min(int a, int b)
  static int max(int a, int b)
  static long round(double a)
  static double random()
    Returns a double greater than or equal to 0.0 and less than 1.0.
```

package java.util

```
interface List<E>
class ArrayList<E> implements List<E>
  boolean add(E item)
  int size()
  Iterator<E> iterator()
  ListIterator<E> listIterator()
  E get(int index)
  E set(int index, E item)
  void add(int index, E item)
  E remove(int index)

class LinkedList<E> implements List<E>, Queue<E>
  void addFirst(E item)
  void addLast(E item)
  E getFirst()
  E getLast()
  E removeFirst()
  E removeLast()

class Stack<E>
  boolean isEmpty()
  E peek()
  E pop()
  E push(E item)

interface Queue<E>
class PriorityQueue<E>
  boolean add(E item)
  boolean isEmpty()
  E peek()
  E remove()

interface Set<E>
class HashSet<E> implements Set<E>
class TreeSet<E> implements Set<E>
  boolean add(E item)
  boolean contains(Object item)
  boolean remove(Object item)
  int size()
  Iterator<E> iterator()
  boolean addAll(Collection<? extends E> c)
  boolean removeAll(Collection<?> c)
  boolean retainAll(Collection<?> c)

interface Map<K,V>
class HashMap<K,V> implements Map<K,V>
class TreeMap<K,V> implements Map<K,V>
  Object put(K key, V value)
  V get(Object key)
  boolean containsKey(Object key)
  int size()
  Set<K> keySet()
  Set<Map.Entry<K, V>> entrySet()

interface Iterator<E>
  boolean hasNext()
  E next()
  void remove()

interface ListIterator<E> extends Iterator<E>
  void add(E item)
  void set(E item)

class Scanner
  Scanner(InputStream source)
  Scanner(String str)
  boolean hasNext()
  boolean hasNextInt()
  boolean hasNextDouble()
  String next()
  int nextInt()
  double nextDouble()
  String nextLine()
  Scanner useDelimiter(String regex)
```

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Note: Correct responses are based on **Java SE Development Kit 8 (JDK 8)** from Sun Microsystems, Inc. All provided code segments are intended to be syntactically correct, unless otherwise stated (e.g., "error" is an answer choice) and any necessary Java SE 8 Standard Packages have been imported. Ignore any typographical errors and assume any undefined variables are defined as used. **For all output statements, assume that the System class has been statically imported using: `import static java.lang.System.*;`**

Question 1.

Which of the following binary numbers is equivalent to the decimal value 93?

A) 01011101 **B)** 01111001 **C)** 01001111 **D)** 11011101 **E)** 01010101

Question 2.

What is the output of the code segment to the right?

A) 18 **B)** 17 **C)** 14.62 **D)** 29 **E)** -3

```
out.println(15-10/5+8*2);
```

Question 3.

What is the output of the code segment to the right?

A) Here"we\go!

B) Here we go!

C) "Here we go!"

D) Here\"we\\go!

E) Error. Invalid escape sequence.

```
out.print("Here\"we\\go!");
```

Question 4.

What is the output of the code segment to the right?

A) Hello **B)** hello **C)** HeLlO

D) hELLO **E)** HELLO

```
String s = "hello";
out.print(s.toUpperCase());
```

Question 5.

What is the output of the code segment to the right?

A) `true` **B)** `false`

```
out.print(true&&false||true);
```

Question 6.

What is the output of the code segment to the right?

A) `-3.0` **B)** `-3` **C)** `-4.0` **D)** `-4` **E)** `4.0`

```
out.print(Math.ceil(-3.14));
```

Question 7.

What is the output of the code segment to the right?

A) 18.0 **B)** 17.6 **C)** 17.0 **D)** `17` **E)** `18`

```
double m=2.2;
int n=8;
double o=m*n;
out.print(o);
```

Question 8.

What is the output of the code segment to the right?

A) 10 15 150

B) 0 15 0

C) 10 15 15

D) 10 15 0

E) 0 15 150

```
int p=10,q=15,r=0;
if(p*q>100)
   r=p*q;
if(r<=150)
   p=0;
out.print(p+" "+q+" "+r);
```

Question 9.

How many asterisks are printed by the code shown to the right?

A) None **B)** 5 **C)** 6 **D)** 7 **E)** 8

```
int x=1;
while(x<7){
      out.print("*");
      x++;
}
```

Question 10.

What is the output of the code segment to the right?

A) [0, 8, 0, 5, 1] 5

B) [8, 5, 1] 3

C) [0, 8, 0, 5, 1] 3

D) [8, 0, 5, 1, 0] 5

E) [8, 0, 5, 1, 0] 3

```
int[] a=new int[5];
a[1]=8;
a[3]=5;
a[4]=1;
out.print(Arrays.toString(a)+" "+a.length);
```

Question 11.

The file `datafile.dat` contains five words all listed on one line and each word is separated by a space. Which of the following can correctly replace **<code>** in the class shown below so that the program will print each word in the file `datafile.dat` on a separate line.

```
import static java.lang.System.*;
import java.io.*;
import java.util.*;
public class Abc {

public static void main(String[] args) throws IOException{
Scanner s=new Scanner(new File("datafile.dat"));
while(s.hasNext())
          out.println(s<code>);
     }
}
```

A) .get()

B) .next()

C) .nextLine()

D) Both B and C.

E) No additional code is required.

Question 12.

What is the output of the code segment to the right?

A) 39

B) 49

C) 35

D) 45

E) 38

```
int sum=0;
for(int x=4;x<10;x++)
      sum+=x;
out.print(sum);
```

Question 13.

What is the output of the code segment to the right?

A) 3 2 5
B) 10 2 5
C) 3 2 6
D) 4 2 5
E) 4 2 6

```
int m=7,n=2,o=6;
m=++m+n-o;
out.print(m+" "+n+" "+o--);
```

Question 14.

Which of the following values cannot be stored in a variable that is of type short?

A) -128 **B)** -129 **C)** 127 **D)** 0 **E)** All can be stored.

Question 15.

What is the output of the code segment to the right?

A) 1 [5, 3, 1]
B) 0 [5, 3, 1]
C) 0 [3, 1]
D) 2 [3, 1]
E) 0 [5, 3]

```
ArrayList<Integer> a=new
ArrayList<Integer>();
out.print(a.size()+" ");
a.add(5);
a.add(3);
a.add(1);
a.remove(0);
out.print(a);
```

Question 16.

What is the output of the code segment to the right?

A) 1
B) 2
C) 3
D) 4
E) 5

```
String s="analysis of algorithms";
String[] spl=s.split("a");
out.print(spl.length);
```

Question 17.

What is the output of the code segment to the right?

A) [Texas, Mexico, Oklahoma, Texas]
B) [Texas, Oklahoma, Mexico, Texas]
C) [New Mexico, Louisiana, Mexico, Texas]
D) [Texas,New Mexico, Oklahoma, Louisiana, Mexico, Texas]
E) [Texas,New Mexico, Oklahoma, Louisiana, Mexico]

```
Stack<String> s=new Stack<String>();
s.push("Texas");
s.push("New Mexico");
s.pop();
s.push("Oklahoma");
s.push("Louisiana");
s.pop();
s.push("Mexico");
s.push("Texas");
out.print(s);
```

Question 18.

What is printed by the client code shown here given the implementation of the method rec shown to the right?

```
out.print(rec(6));
```

A) 19
B) 26
C) 22
D) 12
E) 10

```
public static int rec(int x){
if(x<=0)
     return 10;
else
     return x+rec(x-2);
}
```

Question 19.

Which of the following Java statements will compile and correctly calculates the volume of a square pyramid? The mathematical formula is shown to the right where b is the base length and h is the height.

$V=1/3(b)^2h$

A) `double v=1.0/3.0*b*b*h;`

B) `double v=(1.0/3)*Math.pow(b,2)*h;`

C) `double v=(double)1/3*(b*b*h);`

D) All of the above.

E) None of the above.

Question 20.

What is the output of the code segment to the right?

A) 3 10 17 13 10 7

B) 9 10 11 7 10 13

C) 5 10 15 15 10 5

D) Error. Throws an ArrayIndexOutOfBoundsException.

E) Error. Will not compile.

```
int[][] x={{2,5,8},{6,5,4}};
int y[][]={{1,5,9},{7,5,3}};
int z[][]=new int[2][3];
for(int i=0;i<x.length;i++)
     for(int j=0;j<x[i].length;j++)
          z[i][j]=x[i][j]+y[i][j];
for(int i=0;i<z.length;i++)
     for(int j=0;j<z[i].length;j++)
          out.print(z[i][j]+" ");
```

Question 21.

Which reserved word must replace **<code1>** in the method listed to the right so that it will compile and execute correctly?

A) No additional code is required .

B) int

C) return

D) final

E) double

```
public static <code1> sum(double[] a){
double temp=0;
for(int x=0;x<a.length;x++)
     temp+=a[x];
return temp;
}
```

Question 22.

Given classes A and B shown to the right, what would be the output of this client code?

```
A a1 = new A();
A a2 = new A(2,3);
B b1 = new B(5,8);
out.println(a1.add()+" "+a2.add()+"
"+b1.add()+" "+b1.subtract());
```

A) 5 13 -3

B) 0 5 13 -3

C) 2 3 7 11 3 5

D) 2 3 7 11

E) Error. Will not compile.

Question 23.

Given classes A and B shown to the right, what would be the output of this client code?

```
B b1 = new B(5,8);
A b2 = new B(1,-8);
out.print((b1 instanceof A)+" ");
out.print((b1 instanceof B)+" ");
out.print((b2 instanceof A)+" ");
out.print((b2 instanceof B));
```

A) true true true true

B) false true false true

C) true true false true

D) false false false false

E) Error. Will not compile.

Question 24.

Given classes A and B shown to the right, what would be the output of this client code?

```
A a1=new A();
a1.x=4;
a1.y=3;
B b1=new B();
b1.x=7;
b1.y=4;
out.print(a1.add()+b1.subtract());
```

A) 18

B) 10

C) Error. Cannot ever directly access fields within a class.

D) Error. Class B does not contain a default constructor.

E) Error. Cannot directly access variables x and y with an object of type B.

```
// Use to answer questions 22, 23 and
// 24.

public class A {

     public int x;
     public int y;

     public A(){
          x=0;
          y=0;}
     public A(int a,int b){
          x=a;
          y=b;}
     public int add(){
          return x+y;}
}
public class B extends A {

     public B(int m,int n){
          x=m;
          y=n;}
     public int subtract(){
          return x-y;}
}
```

Question 25.

What is the output of the code segment to the right?

A) true true true

B) false false false

C) true false false

D) true true false

E) false true true

```
String s1="Computer";
String s2="Computer";
String s3=new String("Computer");
out.print((s1==s2)+" "+(s1==s3)+"
"+(s2==s3));
```

Question 26.

What is the output of the code segment to the right?

A) 0

B) 1

C) 2

D) 3

E) 4

```
String[]
list={"Bill","B1ll","%ill","Bill2","bill"};
int c=0;
for(String s:list)
      if(s.matches("B\\D+"))
            c++;
out.print(c);
```

Question 27.

The method shown to the right implements a binary search. Which of the following should replace **<code>** in the method to ensure that it functions correctly?

A) No additional code is needed.

B) searchIndex=middle ;

C) int middle=front+back;

D) int middle=searchIndex ;

E) int middle=(front+back)/2;

Question 28.

Assume that **<code>** has been correctly inserted into the method. What would be printed by **line#1** if list contained

[Abe, Bob, Cathy, James, Maggie, Nancy, Oren, Rob, Will, Zeke] and the searchItem is Rob?

A) 0

B) 1

C) 2

D) 3

E) 4

Question 29.

What is the least restrictive time complexity (Big O value) for this binary search?

A) O(1)

B) O(n)

C) $O(n^2)$

D) O(log n)

E) O(n log n)

```
// Use this code to answer questions
// 27, 28, and 29.

public static int binarySearch(String[]
list,String searchItem){
int count=0;
int front=0;
int back=list.length-1;
int searchIndex=-1;
while(front<=back){
  count++;
  <code>
  if(list[middle].equals(searchItem)){
      searchIndex=middle;
      break;
  }
  else
if(searchItem.compareTo(list[middle])<1)
      back=middle-1;
else
      front=middle+1;
}
out.println(count);// line#1
return searchIndex;
}
```

Question 30.

Which of the following cannot be the output of the code listed on the right?

A) 0

B) 1

C) 4

D) 5

E) None of the above.

```
double r=Math.random();
int s=(int)(r*5);
out.print(s);
```

Question 31.

What is the output of the code segment to the right?

A) 71 0 9 -1

B) 71 1 8 -1

C) 64 0 9 -1

D) 64 1 8 0

E) 71 0 9 0

```
int w=0,x,y=0,z=10;
for(x=4;x>0;x--)
     for(y=1;y<=8;y+=2){
          w+=Math.max(x, y);
          z+=~z;
     }
out.print(w+" "+x+" "+y+" "+z);
```

Question 32.

What is the output of this client code given the method implementation on the right?

```
int a=3,b=2;
out.print(xyz(a,b)+" ");
out.print(a+" "+b);
```

A) 3 2 5

B) 5 3 2

C) 5 5 25

D) 0 25 5

E) Error. Improper call to method xyz.

```
public static int xyz(int a,int b){
int c=a;
int d=b;
a=c+d;
b=a*5;
return b/a;
}
```

Question 33.

Which of the following data structures is demonstrated by the illustration shown to the right?

A) Stack

B) Priority Queue

C) Queue

D) Map

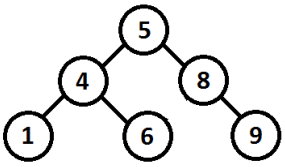
E) HashSet

original list	5 7 1 9 3
add 2	5 7 1 9 3 2
add 4	5 7 1 9 3 2 4
add 6	5 7 1 9 3 2 4 6
remove element	7 1 9 3 2 4 6
remove element	1 9 3 2 4 6

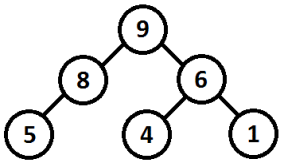
Question 34.

If 5, 4, 8, 1, 6 and 9 are placed into a binary search tree, in that order, which of the following is the correct representation of that tree?

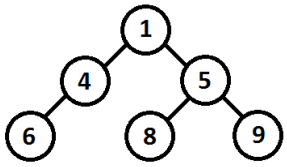
A)



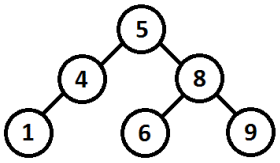
B)



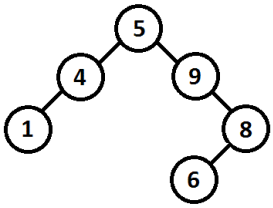
C)



D)



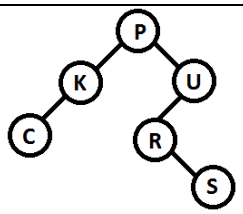
E)



Question 35.

How many leaves does the binary tree shown to the right contain?

A) 2 **B)** 3 **C)** 4 **D)** 5 **E)** 6



Question 36.

Which of the following pairs of vertices from the graph shown to the right are adjacent?

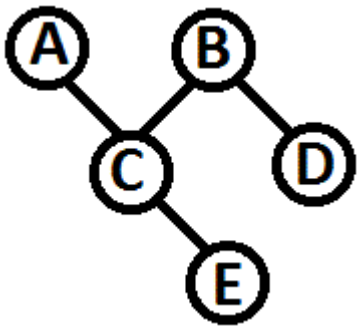
A) AB

B) AE

C) CD

D) CB

E) All of the above.



Question 37.

Which of the following logical statements is represented by the digital electronics diagram shown to the right?

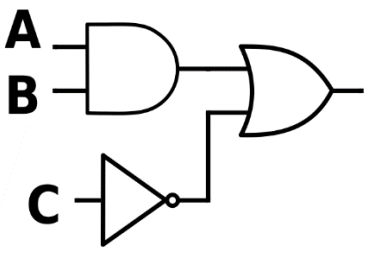
A) $A + B * \bar{C}$

B) $\overline{A * B} + C$

C) $A * B + C$

D) $A + B * C$

E) $A * B + \bar{C}$



Question 38.

Which of the following logical statements is equivalent to the statement shown on the right?

A) $\bar{A} + BC$

B) $A + B + C$

C) $A + BC$

D) $AB + C$

E) None of the above.

$(A + B)(A + C)$

Question 39.

What is the value of the postfix expression shown on the right?

```
28 4 3 * - 6 6 + 3 / /
```

Question 40.

What is the two's complement representation of -91? Restrict your answer to 8 bits.