

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)
    StringtoLowerCase()
    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)
```

UIL COMPUTER SCIENCE WRITTEN TEST – 2017 INVITATIONAL A

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) HeLO
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.

- 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.

$$V = \frac{1}{3} (b)^2 h$$

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","B111","%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;

```
// 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 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($n \log n$)

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?

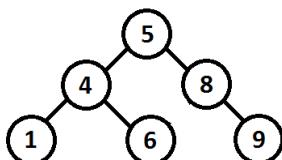
- A) Stack
- B) Priority Queue
- C) Queue
- D) Map
- E) HashSet

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

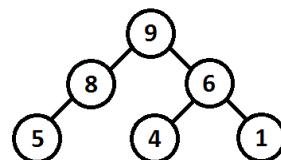
Question 34.

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?

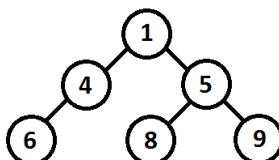
A)



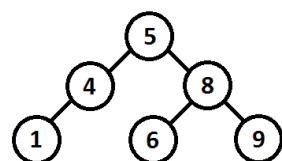
B)



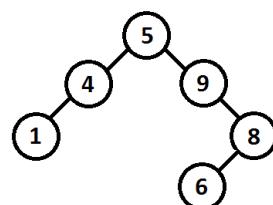
C)



D)

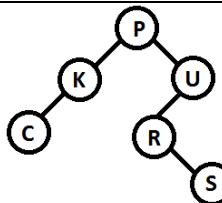


E)

**Question 35.**

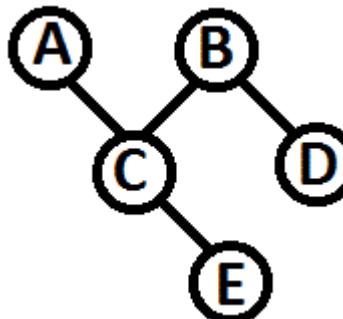
How many leaves does the binary tree shown to the right contain?

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

**Question 36.**

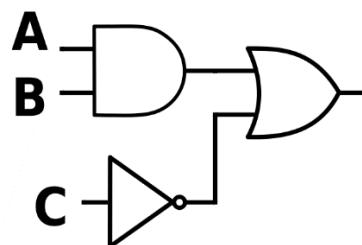
Which of the following pairs of vertices from the graph shown to the right are adjacent?

- 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.

Conference _____

Code Number _____

UIL COMPUTER SCIENCE WRITTEN TEST

Questions (+6 points for each correct answer, -2 points for each incorrect answer)

- | | | | |
|-----------|-----------|-----------|-----------|
| 1) _____ | 11) _____ | 21) _____ | 31) _____ |
| 2) _____ | 12) _____ | 22) _____ | 32) _____ |
| 3) _____ | 13) _____ | 23) _____ | 33) _____ |
| 4) _____ | 14) _____ | 24) _____ | 34) _____ |
| 5) _____ | 15) _____ | 25) _____ | 35) _____ |
| 6) _____ | 16) _____ | 26) _____ | 36) _____ |
| 7) _____ | 17) _____ | 27) _____ | 37) _____ |
| 8) _____ | 18) _____ | 28) _____ | 38) _____ |
| 9) _____ | 19) _____ | 29) _____ | 39) _____ |
| 10) _____ | 20) _____ | 30) _____ | 40) _____ |

FOR ADMINISTRATIVE USE ONLY

# Right:	×	6 pts	=	
# Wrong:	×	-2 pts	=	
# Skipped:	×	0 pts	=	0

	Score	Initials
Judge #1:		
Judge #2:		
Judge #3:		

★ANSWER KEY – CONFIDENTIAL★

UIL COMPUTER SCIENCE – 2017 INVITATIONAL A

Questions (+6 points for each correct answer, -2 points for each incorrect answer)

- | | | | |
|--------------|--------------|--------------|----------------------|
| 1) <u>A</u> | 11) <u>B</u> | 21) <u>E</u> | 31) <u>A</u> |
| 2) <u>D</u> | 12) <u>A</u> | 22) <u>B</u> | 32) <u>B</u> |
| 3) <u>A</u> | 13) <u>E</u> | 23) <u>A</u> | 33) <u>C</u> |
| 4) <u>E</u> | 14) <u>E</u> | 24) <u>D</u> | 34) <u>D</u> |
| 5) <u>A</u> | 15) <u>C</u> | 25) <u>C</u> | 35) <u>A</u> |
| 6) <u>A</u> | 16) <u>D</u> | 26) <u>B</u> | 36) <u>D</u> |
| 7) <u>B</u> | 17) <u>B</u> | 27) <u>E</u> | 37) <u>E</u> |
| 8) <u>E</u> | 18) <u>C</u> | 28) <u>C</u> | 38) <u>C</u> |
| 9) <u>C</u> | 19) <u>D</u> | 29) <u>D</u> | *39) <u>4</u> |
| 10) <u>A</u> | 20) <u>A</u> | 30) <u>D</u> | *40) <u>10100101</u> |

* See "Explanation" section below for alternate, acceptable answers.

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.

Explanations:

1. A $64 + 16 + 8 + 4 + 1 = 93$
2. D $15 - 10 / 5 + 8 * 2 = 15 - 2 + 16 = 13 + 16 = 29$
3. A The escape sequences \" and \\ force a quote and a backslash into the output.
4. E toUppercase() makes ALL characters uppercase.
5. A true&&false||true = false||true = true. and comes before or in the order of operations.
6. A ceil finds the next largest whole number and returns it as a double type value.
7. B $2.2 * 8 = 17.6$. Variable o is of type double so the decimal is preserved.
8. E Both conditions for the if statements are true, therefore both assignment statements are executed.
9. C Variable x starts at 1 and ends at 6. 1, 2, 3, 4, 5, 6 asterisks.
10. A Default values for int arrays is zero and the length is fixed when the array is created.
11. B get() is not a method in the Scanner class. nextLine() will read all of the words at once so they would all be printed on the same line. next() will read the words one at a time.
12. A $4 + 5 + 6 + 7 + 8 + 9 = 39$
13. E Since the increment operator comes before the variable m in the expression one is added to m **before** the assignment is made. $8 + 2 - 6 = 4$. However, o is decremented **after** the print statement executes.
14. E The range of values that can be stored in a short variable is -32768 to 32767.
15. C The size of a newly instantiated ArrayList is zero. The remove(x) method removes the element at index value x.
16. D When the delimiter for the split method starts a string (in this case "a"), an additional element that contains an empty string is placed into the array at index value 0.
17. B The Stack data structure uses a first in, last out model. New Mexico and Louisiana are popped out. Stacks do allow duplicates.
18. C $6 + 4 + 2 + 10 = 22$
19. D As long as one operand is double the result will be double.
20. A Each corresponding entry of the two matrices are added. Simple matrix addition.
21. E The return type of a method must match the type of the value that is returned by the code. temp is double therefore sum must be double.
22. B The default constructor sets x and y to zero. Class B inherits the add method from class A.
23. A Since B extends A, all are true.
24. D Fields x and y are public, therefore they can be accessed by any object of type A or B. The line B b1=new B(); will not compile.
25. C s1 and s2 point to the **same** string constant but s3 points to a different string that contains the same characters.
26. B The regular expression "B\\D+" matches any string that starts with a capital B and is followed by one or more non-digit (anything but 0-9) characters. "Bill" is the only string that meets those conditions.
27. E
28. C After two passes through the while loop, Rob is the middle element.
29. D
30. D Math.random() returns a decimal value x such that $0 \leq x < 1$. Casting truncates, so the value can never be 5.

w	x	y	z
0	0	0	10
4	4	1	-1
8	4	3	-1
13	4	5	-1
20	4	7	-1
23	3	1	-1
26	3	3	-1
31	3	5	-1
38	3	7	-1
40	2	1	-1
43	2	3	-1
48	2	5	-1
55	2	7	-1
56	1	1	-1
59	1	3	-1
64	1	5	-1
71	1	7	-1
71	0	9	-1

31. A
32. B Primitive variables are passed by value. Therefore, any changes made to a and b within the method are not seen in the client code.
33. C A queue uses a first in, first out model for removal.
34. D The first element added to a binary tree becomes the root node. Everything to the left of the root node must be less than the root and everything to the right must be greater than the root. Each sub tree must follow the same rule.
35. A A leaf is any node that does not contain any child nodes.
36. D Nodes that are adjacent are connected by one edge.
37. E is and. is not. is or.
- $$\begin{aligned}
 (A+B)(A+C) &= AA+AC+AB+BC \\
 &= A+AC+AB+BC \\
 &= A(1+C+B)+BC \\
 &= A \cdot 1 + BC \\
 &= A+BC
 \end{aligned}$$
38. C
39. 4 The infix version of this expression would be $(28-4^*3)/((6+6)/3) = 4$.
40. 10100101 Write down the binary equivalent of 91. 01011011. Take the complement (flip the bits). 10100100. Add one to the complement. 10100101.

UIL COMPUTER SCIENCE WRITTEN TEST

2017 INVITATIONAL B

FEBRUARY/MARCH 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)
    StringtoLowerCase()
    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)

```

UIL COMPUTER SCIENCE WRITTEN TEST – 2017 INVITATIONAL B

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 is the sum of 01101001_2 and 00101011_2 ?

- A) 00101000_2 B) 10010101_2 C) 10011100_2 D) 10010111_2 E) 10010100_2

Question 2.

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

- A) 8 B) 0.125 C) 2 D) 0 E) 2.0

```
out.println( (9+2) / 22 * 4 );
```

Question 3.

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

A) Hello"r"World!

B) Hello"

"World!

C) Hello

World!

D) Hello World!

E) "Hello"r"World!"

```
out.print("Hello\"\\r\"World!");
```

Question 4.

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

- A) crossc B) rossc C) cross
D) ross E) Error. Cannot call substring method
using a string constant.

```
out.print("crosscountry".substring(1, 5));
```

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) -9.0 B) -9 C) 9.0 D) 9 E) 3.0

```
out.print(Math.abs(9.0));
```

Question 7.

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

- A) -9.0 B) 5.25 C) -5.25 D) -9.75

E) Error. Will not compile because of a type mismatch.

```
double p=4.5;  
int q=3;  
double r=-2.25;  
r-=p+q;  
out.print(r);
```

Question 8.

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

- A) i U L
- B) U i
- C) i U
- D) U i L
- E) L

```
char c1='U',c2='i',c3='L';
if(c1<c2)
    out.print(c1+" "+c2+" ");
else
    out.print(c2+" "+c1+" ");
out.println(c3);
```

Question 9.

Which of the following represents the output of this code segment?

```
for(int x=4;x>0;x--)
{
    for(int y=1;y<=x;y++)
        out.print("*");
    out.println();
}
```

- | | | | | |
|---------|------|---------|----------|------|
| A. **** | B. * | C. **** | D. ***** | E. * |
| *** | ** | *** | | |
| ** | *** | *** | | |
| * | **** | **** | | |

Question 10.

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

- A) 8 1 -3 1 2
- B) 5 -1 5 1 2
- C) 8 1 8 1 2
- D) -1 1 -3 1 2
- E) -1 1 1 7 2

```
int[] a={5,1,-3,7,2};
a[0]=a[2]+a[4];
a[3]=a[1];
for(int x:a)
    out.print(x+" ");
```

Question 11.

Which of the following import statements is required to make this class compile and run correctly?

```
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.nextLine());
    }
}

A) import static java.lang.System.out;
B) import java.io.File;
C) import java.io.IOException;
D) import java.util.Scanner;
E) All of the above.
```

Question 12.

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

- A) 9
- B) 5
- C) 6
- D) 8
- E) 1

```
int w=1, x=2, y=3;
for(int z=1; z<=y; z++)
    w*=x;
out.print(w);
```

Question 13.

What is the correct order of operation for the operators listed here?

I. = II. ++ III. && IV. &

- A) III, IV, I, II
- B) IV, III, II, I
- C) II, I, IV, III
- D) II, III, IV, I
- E) II, IV, III, I

Question 14.

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

- A) 8 B) 16 C) 32 D) 64 E) None of the above.

```
out.print(Byte.SIZE);
```

Question 15.

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

- A) [dog, cat]
- B) [dog, bird, cat]
- C) [dog, cat, bird]
- D) [dog, bird, turtle]
- E) Error. ElementNotFoundException.

```
ArrayList<String> a=new
ArrayList<String>();
a.add("dog");
a.add("cat");
a.add(1,"bird");
a.add("turtle");
a.remove(3);
a.remove("turtle");
out.print(a);
```

Question 16.

Which of the following can replace <code> in the code segment shown to the right?

- A) ArrayList
- B) List
- C) LinkedList
- D) A and C
- E) B and C

```
<code><Integer> list=new
LinkedList<Integer>();
int[] nums={5,10,15,20,25};
for(int i:nums)
    list.add(i);
list.add(30);
list.add(2, 35);
out.print(list.get(4)+" ");
out.print(list);
```

Question 17.

Assuming that <code> has been filled in correctly, what is the output of the code segment to the right?

- A) 15 [30, 5, 10, 35, 15, 20, 25]
- B) 15 [5, 10, 35, 15, 20, 25, 30]
- C) 20 [5, 10, 35, 15, 20, 25, 30]
- D) 20 [5, 10, 35, 15, 25, 30]
- E) 15 [30, 5, 10, 35, 20, 25]

Question 18.

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

- A) xyz mno
- B) abc
- C) xaybzcmno
- D) xyzmno
- E) None of the above.

```
String s="xaybzcmno";
Scanner s2=new Scanner(s);
s2.useDelimiter("[abc]");
while(s2.hasNext())
    out.print(s2.next());
```

Question 19.

If a particular method whose run time efficiency is $O(n^2)$ requires 1 second to process 2000 elements in a data set, how long will it take to process 10000 elements?

- A) 25 seconds
- B) 20 seconds
- C) 10 seconds
- D) 8 seconds
- E) 64 seconds

Question 20.

Which of the following is not a valid identifier?

- A) _mileage
- B) \$amount
- C) 7thChar
- D) firstName
- E) print

Question 21.

Which of the following must replace <code> in the method shown to the right so that the values stored in list are placed in ascending order?

- A) list[i]<s
- B) list[i]<x
- C) list[i]<y
- D) list[x]<y
- E) list[y]<x

// use method abc to answer questions 21,
// 22, and 23

```
public static void abc(int[] list) {
for(int s=0;s<list.length;s++) {
    int x=s;
    int y=list[s];
    for(int i=s+1;i<list.length;i++) {
        if(<code>){
            x = i;
            y=list[x];
        }
    list[x]=list[s];
    list[s]=y;
}
}
```

Question 22.

Once <code> has been replaced correctly, which of the following algorithms does method abc implement?

- A) selection sort
- B) insertion sort
- C) mergesort
- D) quicksort
- E) bubble sort

Question 23.

What is the Big O value for method abc?

- A) $O(1)$
- B) $O(n \log n)$
- C) $O(\log n)$
- D) $O(n)$
- E) $O(n^2)$

Question 24.

Which of the following must replace <code1> in the class shown on the right so that the values passed to parameters a and b are correctly assigned to the fields a and b?

- A) super.
- B) this.
- C) null.
- D) int
- E) No additional code is needed

Question 25.

Which of the following must replace <code2> in the class shown on the right to ensure that the `toString` method functions correctly?

- A) int
- B) out.print
- C) return
- D) String
- E) No additional code is needed

Question 26.

Assuming that <code1> and <code2> have been filled in correctly, what is the output of this client code?

```
SomeClass sc1=new SomeClass(3,2);
SomeClass sc2=new SomeClass();
out.print(sc1+" "+sc2);
```

- A) 3 2
- B) 3 0 2 0
- C) 0 0 0 0
- D) 3 2 null null
- E) 3 2 0 0

// Use the code for SomeClass to
// answer questions 24, 25, and 26.

```
public class SomeClass {
    private int a;
    private int b;

    public SomeClass() {}

    public SomeClass(int a,int b) {
        <code1>a=a;
        <code1>b=b;
    }

    public String toString() {
        <code2> (a+" "+b);
    }
}
```

Question 27.

Which of the following reserved words must take the place of <code1> to make class B inherit class A's fields, constructors and methods?

- A) instanceof
- B) super
- C) static
- D) extends
- E) implements

Question 28.

The add() method in class B is intended to find the sum of fields x, y, and z. Which of the following should replace <code2> to ensure that add() functions as intended?

- A) return super.add(z);
- B) return super.add() + z;
- C) return x + y + z;
- D) return super.x + super.y + z;
- E) B, C, and D

// Use for questions 27 and 28.

```
public class A {  
  
    private int x;  
    private int y;  
  
    public A() {}  
    public A(int a, int b) {  
        x=a;  
        y=b; }  
    public void setX(int a) {  
        x=a; }  
    public void setY(int a) {  
        y=a; }  
    public int add() {  
        return x+y; }  
  
}  
  
public class B <code1> A {  
    private int z;  
  
    public B(int m, int n, int o) {  
        setX(m);  
        setY(n);  
        z=o; }  
    public int add() {  
        <code2>}  
}
```

Question 29.

What is the final state of matrix x after this client code has been executed? Method abc is shown to the right.

```
int[][] x={{2,5,8},{6,5,4},{1,2,3}};
x=abc(x);
```

A) 5 8 2

5 4 6

2 3 1

B) 1 2 3

2 5 8

6 5 4

C) 3 4 8

1 5 5

1 6 2

D) Error. Method abc throws an

ArrayIndexOutOfBoundsException.

E) Error. Invalid call to method abc in client code.

```
public static int[][] abc(int[][] m) {
    for(int r=0;r<m.length;r++) {
        int t=m[r][0];
        for(int c=0;c<m[r].length-1;c++)
            m[r][c]=m[r][c+1];
        m[r][m[r].length-1]=t;
    }
    return m;
}
```

Question 30.

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

A) 5 31

B) 4 30

C) 6 63

D) 5 7

E) 5 30

```
int e=1,g=1;
while(e<5) {
    if(g%2==0)
        g+=1;
    else{
        g*=2;
        continue;
    }
    e++;
}
out.print(e+" "+g);
```

Question 31.

What the output of the method shown to the right if the client code contains this method call?

```
rec(9);
```

A) 1 2 4 9

B) 0 1 2 4 9

C) 9 4 2 1 0

D) 1 2 4

E) 9 4 2 1

```
public static void rec(int x) {
    if(x<=1)
        out.print(x+" ");
    else
    {
        rec(x/2);
        out.print(x+" ");
    }
}
```

Question 32.

Which of the following Java statements will compile and is equivalent to the mathematical formula shown to the right?

- A)** double a=1/2*(b1+b2)*h;
- B)** double a=1.0/2.0*b1+b2*h;
- C)** double a=1.0/2.0*h*(b1+b2);
- D)** All of the above.
- E)** None of the above.

$$A = 1/2(b_1 + b_2)h$$

Question 33.

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

- A)** 8 12.5 25
- B)** 8.0 12.5 25.0
- C)** Error. Cannot print variables declared as final.
- D)** Error. Type mismatch: cannot convert from double to float.
- E)** Error. The final local variable var3 cannot be reassigned.

```
double var1=8.0,var2;
final float var3=4.5f;
var2=var1+var3;
var3+=var2+var1;
out.print(var1+" "+var2+" "+var3);
```

Question 34.

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

- A)** -5
- B)** 5
- C)** -4
- D)** 4
- E)** 0

```
String s1="Computer",s2="Computation";
out.print(s1.compareTo(s2));
```

Question 35.

Which of the following is the correct method header for a method that returns a sales person's commission, given their total sales and their commission rate?

- A)** public static double com(ts,cr)
- B)** public static double com(double ts,double cr)
- C)** public static com(double ts,double cr)
- D)** public static double com(double,double)
- E)** public static double (double ts,double cr)

Question 36.

Which of the following Boolean expressions will produce the truth table shown on the right?

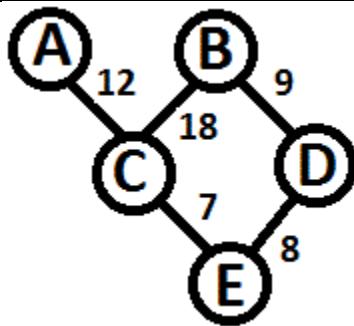
- A)** $A \oplus B \oplus A$
- B)** $A \oplus B * A$
- C)** $A * B + A$
- D)** $A \oplus B + A$
- E)** $A * B * A$

A	B	
T	T	T
T	F	T
F	T	T
F	F	F

Question 37.

Which of the following best describes the graph shown to the right?

- A) unweighted directed and complete
- B) unweighted directed
- C) unweighted undirected
- D) weighted undirected and complete
- E) weighted undirected

**Question 38.**

What is the time complexity (Big O value) for adding an element to the end of a singly linked list that contains n elements?

- A) $O(1)$
- B) $O(n)$
- C) $O(n^2)$
- D) $O(\log n)$
- E) $O(n \log n)$

Question 39.

What is the decimal equivalent of this 8 bit binary number which is shown in 2's complement?

10101110

Question 40.

What is the value of this expression shown using prefix notation?

+ * / 12 4 3 10

Conference _____

Code Number _____

UIL COMPUTER SCIENCE WRITTEN TEST

Questions (+6 points for each correct answer, -2 points for each incorrect answer)

- | | | | |
|-----------|-----------|-----------|-----------|
| 1) _____ | 11) _____ | 21) _____ | 31) _____ |
| 2) _____ | 12) _____ | 22) _____ | 32) _____ |
| 3) _____ | 13) _____ | 23) _____ | 33) _____ |
| 4) _____ | 14) _____ | 24) _____ | 34) _____ |
| 5) _____ | 15) _____ | 25) _____ | 35) _____ |
| 6) _____ | 16) _____ | 26) _____ | 36) _____ |
| 7) _____ | 17) _____ | 27) _____ | 37) _____ |
| 8) _____ | 18) _____ | 28) _____ | 38) _____ |
| 9) _____ | 19) _____ | 29) _____ | 39) _____ |
| 10) _____ | 20) _____ | 30) _____ | 40) _____ |

FOR ADMINISTRATIVE USE ONLY

# Right:	×	6 pts	=	
# Wrong:	×	-2 pts	=	
# Skipped:	×	0 pts	=	0

	Score	Initials
Judge #1:		
Judge #2:		
Judge #3:		

★ANSWER KEY – CONFIDENTIAL★

UIL COMPUTER SCIENCE – 2017 INVITATIONAL B

Questions (+6 points for each correct answer, -2 points for each incorrect answer)

- | | | | |
|--------------|--------------|--------------|-----------------|
| 1) <u>E</u> | 11) <u>E</u> | 21) <u>C</u> | 31) <u>A</u> |
| 2) <u>D</u> | 12) <u>D</u> | 22) <u>A</u> | 32) <u>C</u> |
| 3) <u>B</u> | 13) <u>E</u> | 23) <u>E</u> | 33) <u>E</u> |
| 4) <u>D</u> | 14) <u>A</u> | 24) <u>B</u> | 34) <u>D</u> |
| 5) <u>A</u> | 15) <u>B</u> | 25) <u>C</u> | 35) <u>B</u> |
| 6) <u>C</u> | 16) <u>E</u> | 26) <u>E</u> | 36) <u>D</u> |
| 7) <u>D</u> | 17) <u>C</u> | 27) <u>D</u> | 37) <u>E</u> |
| 8) <u>D</u> | 18) <u>D</u> | 28) <u>B</u> | 38) <u>A</u> |
| 9) <u>A</u> | 19) <u>A</u> | 29) <u>A</u> | *39) <u>-82</u> |
| 10) <u>D</u> | 20) <u>C</u> | 30) <u>A</u> | *40) <u>19</u> |

* See "Explanation" section below for alternate, acceptable answers.

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.

Explanations:

1. E $01101001_2 = 105_{10}$ and $00101011_2 = 43_{10}$. $105 + 43 = 148$. $148_{10} = 10010100_2$.
2. D $(9+2)/22^4 = 11/22^4 = 0^*4 = 0$
3. B The escape sequence `\"` places a quote into the string. `\r` is for a return (same as `\n`).
4. D Index numbers start at zero (0). So, the substring begins at r and continues to one less than the second parameter, which is the second s.
5. A `true&&!false&&true = true&&true&&true = true`
6. C `abs(x)` returns a double value that is the absolute value of x.
7. D $r = -2.25 - (4.5 + 3)$
8. D ASCII value of U is 85 and i is 105. Therefore U is less than i.
9. A For each iteration of the outer loop the inner loop iterates one fewer times.
10. D $a[0] = -3+2$. $a[3] = 1$.
11. E
12. D $1 \times 2 \times 2 \times 2 = 8$
13. E
14. A The byte data type requires 8 bits of memory.
15. B [dog] then [dog, cat] then [dog, bird, cat] then [dog, bird, cat, turtle] then [dog, bird, cat]. Trying to remove an element that is not in the list does not cause an error.
16. E Both the interface List and the class LinkedList can serve as the data type for the variable list.
17. C The values in the array nums are placed in the linked list in the order shown. 30 is added to the end of the list. 35 becomes the 3rd item in the list. 20 is the element located at index number 4 and `get(x)` does not remove the element that it returns.
18. D [abc] is the same as a OR b OR c. Delimiters are not printed.
19. A $10,000$ is 5 times greater than $2,000$. $5^2 = 25$.
20. C Identifiers may not begin with a number. Underscores and dollar signs are allowed.
21. C We are searching for the smallest element left in the unsorted portion of the list.
22. A `list[i] < y {x=i; y=list[x];}` is the salient feature of a selection sort.
23. E $O(n^2)$ for all cases.
24. B `this` reserved word indicates that the fields named a and b should be used and not the parameters of the same name.
25. C All methods that are not `void` must return a value matching the methods return type.
26. E The call to the default constructor `SomeClass()` does not assign values to a and b. The default value of int type fields is 0.
27. D
28. B x and y are private and cannot be accessed from class B so a call to `super.add()` is required.
29. A The code shifts all of the columns to the left and moves column 0 to the far right.
30. A `continue` skips any remaining code in the loop body.
31. A The call stack would look like this when the base case is reached.

print 1
print 2
print 4
print 9

The result of each method call is then popped off the stack and printed.

32. C Not A because $\% = 0$, Not B because parenthesis are missing.
33. E `final` creates a constant. The value of a constant cannot be reassigned.
34. D The ASCII value of each corresponding character is compared until a difference is found. In this case, $e=101$ and $a=97$. $101 - 97 = 4$.
35. B A. Parameters don't have a type. C. Method does not have a return type. D. Parameters aren't named. E. Method does not have a name.
36. D $* = \&\& = \text{AND}$, $+ = || = \text{OR}$, $\oplus = ^ = \text{XOR}$
37. E It is weighted because each edge is labeled with a value and it is undirected because none of the edges indicate a direction.
38. A No iteration of any kind is required to add an element to the end of a linked list.
39. -82 Start with the original two's complement number. 10101110. We know the decimal equivalent will be negative because the left most sign bit is 1. Flip the bits to get 01010001. Add 1 to that to get 01010010. Convert to decimal to get 82 and it has to be negative so the answer is -82.
40. 19 Same as $12/4^3+10 = 3^3+10 = 9+10 = 19$.