UIL COMPUTER SCIENCE WRITTEN TEST – 2017 STATE

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 product of 1110_2 and 11101_2?

A) 307_{10} **B)** 12110_4 **C)** $1A6_{16}$ **D)** 1120_7 **E)** 110010111_2

Question 2.

Which of the following is the output of the line of code shown on the right?

A) -2 **B)** 2 **C)** 0 **D)** 4 **E)** -6

```
out.println(36%-8+-14%3);
```

Question 3.

Which of the following is the output of the code shown on the right? *Asterisk * indicate blank spaces.*

A) `Current value is -0000001858`

B) `Current value is -000001858`

C) `Current value is 0000001858`

D) `Current value is *****-1858`

E) `Current value is -1858*****`

```
out.printf("Current value is %0+10d",-1858);
```

Question 4.

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

A) `OutOfBoundsExceptio`

B) `oundsExcepti`

C) `OutOfBoundsExcepti`

D) `OutO`

E) `oundsExceptio`

```
String
s="StringIndexOutOfBoundsException";
out.print(s.substring(s.indexOf("o"),
          s.lastIndexOf("o")));
```

Question 5.

What is printed by the code segment shown on the right?

A) `true`

B) `false`

```
int x=10,y=12,z=15;
boolean b=x==z||x>=y^z>y;
out.print(b);
```

Question 6.

What is printed by the line of code shown on the right?

A) `3.0` **B)** `3` **C)** `4.0` **D)** `4` **E)** `5.0`

```
out.print(Math.log10(10000));
```

Question 7.

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

A) `22 0b1101`

B) `22 13`

C) Error. Throws a run time exception due to an out of range error.

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

E) Error. Invalid number system designation.

```
short s=9;
int i=0b11+0xA;
s=s+i;
out.print(s+" "+i);
```

Question 8.

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

A) `BIG DATA`

B) `Big Data`

C) `big data`

D) `a`

E) Error. StringIndexOutOfBoundsException

```
String s="Big Data";
if(s.length()<=7)
   if(Character.isUpperCase(s.charAt(0)))
         out.print(s.toUpperCase());
   else
         out.print(s.toLowerCase());
else
   if(Character.isAlphabetic(s.charAt(0)))
         out.print(s);
   else
         out.print(s.charAt(s.length()-1));
```

Question 9.

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

A) Error. Will not compile due to the incomplete `for` statement

B) `# # # # # # 8`

C) `# # # # # 9`

D) `# # # # # # 9`

E) Error. Will not compile because final print statement is not within the scope of varialble f.

```
int f=3;
for(;f<9;){
     out.print("# ");
     f++;
}
out.print(f);
```

Question 10.

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

A) Error. Throws an ArrayIndexOutOfBoundsException

B) `0 1 2 3 4 5`

C) `3 0 1 4 2 5`

D) `1 2 4 0 3 5`

E) `5 3 0 4 2 1`

```
int a[]={3,0,1,4,2,5};
int[] b=new int[6];
for(int i=0;i<a.length;i++)
     b[a[i]]=i;
for(int i:b)
     out.print(i+" ");
```

Question 11.

What is the output of the class shown if `datafile.dat` contains the following sentence?

The total time allowed is two minutes.

```
import static java.lang.System.*;
import java.io.*;
import java.util.*;
public class Question11 {

public static void main(String[] args) throws IOException{
      Scanner f=new Scanner(new File("datafile.dat"));
      f.useDelimiter("t");
      while(f.hasNext())
            out.print(f.next());
      }
}
```

A) `The total time allowed is two minutes.`

B) `he oal ime allowed is wo minues.`

C) `The oal ime allowed is wo minues.`

D) `The  o al  ime allowed is  wo minu es.`

E) `Theoalimeallowediswominues.`

Question 12.

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

A) `4 3 7`

B) `4 4 8`

C) `4 4 9`

D) `4 4 0`

E) Error. Will not compile.

```
boolean
b[]={true,false,true,true,false,
true,false,false};
int x=0,y=0,z=0;
while(z<b.length){
     if(b[z])x++;
     else y++;
     z++;
}
out.print(x+" "+y+" "+z);
```

Question 13.

What is the output of the line of code shown on the right?

A) `-33`

B) `-34`

C) `-5`

D) `32`

E) `-4`

```
out.print(~18+(int)14.95);
```

Question 14.

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

A) `125 126 127`

B) `125 126 127 128`

C) `125 126 127 -128`

D) Unknown because the code segment creates an infinite loop.

E) No output. Throws an exception when variable b goes beyond the range of the byte data type.

```
byte b;
for(b=125;b>0;b++)
   out.print(b+" ");
```

Question 15.

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

A) `20 4 true`

B) `30 4 false`

C) `30 3 true`

D) `20 3 false`

E) `30 3 false`

```
ArrayList<Integer> a=new ArrayList<Integer>();
a.add(10);a.add(20);a.add(30);
a.add(40);a.add(50);
out.print(a.get(2)+" ");
a.remove(3);
out.print(a.indexOf(50)+" ");
out.print(a.contains(40));
```

Question 16.

Which of the following statements is false?

A) An identifier is a sequence of characters that consists of letters, digits, underscores (_)and dollar signs ($).

B) An identifier cannot start with a digit.

C) An identifier cannot be a reserved word.

D) An identifier does not have a maximum length.

E) None of the above statements are false.

Question 17.

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

A) `f`

B) `i`

C) `a`

D) `c`

E) `d`

```
String let="Honorificabilitudinitatibus";
int n=0;
char b[][][]=new char[3][3][3];
for(int i=0;i<3;i++)
      for(int j=0;j<3;j++)
            for(int k=0;k<3;k++){
                  b[i][j][k]=let.charAt(n);
                  n++;}
out.println(b[0][2][2]);
```

Question 18.

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

A) 0

B) 3

C) 12

D) 4

E) 2

Question 19.

If the following lines of code are added to the end of the code segment shown on the right, what would be the additional output?

```
Object o=list.get(1);
out.println(o);
```

A) [a]

B) [d, c, b, a]

C) [a, b, c, d]

D) The hexadecimal value representing the memory location of object o.

E) There is no output due to an error.

Question 20.

If the following lines of code are added to the end of the code segment shown on the right, what would be the additional output?

```
Queue<Double> ll=list.get(2);
out.println(ll.remove());
```

A) [1.61, 1.41, 2.71, 3.14]

B) [3.14, 2.71, 1.41, 1.61]

C) 1.61

D) 3.14

E) There is no output due to an error.

```
List<Object> list=new LinkedList<Object>();
ArrayList<Integer> al=new
ArrayList<Integer>();
al.add(1);al.add(2);al.add(3);al.add(4);
Stack<String> s=new Stack<String>();
s.push("a");s.push("b");s.push("c");
s.push("d");
Queue<Double> li=new LinkedList<Double>();
li.add(3.14);li.add(2.71);li.add(1.41);
li.add(1.61);
list.add(al);list.add(s);list.add(li);
out.println(list.size());
```

Question 21.

Which of the following values for string variable s will make this line of code print false?

```
out.print(s.matches("[a-z&&[^aeiou]]+\\d?"));
```

A) bc43

B) bc4

C) bc

D) jklmn9

E) None of the above will make the line of code print false.

Question 22.

What is printed by the line of code shown on the right?

A) 32 **B)** 1A **C)** 20 **D)** 10100 **E)** 26

```
out.print(011+0x11);
```

Question 23.

What is printed by **line #1** in the client code shown on the right?

A) C

B) D

C) CD

D) DC

E) CDCD

Question 24.

What is the output of **line #2** in the client code shown on the right?

A) C

B) D

C) CD

D) DC

E) CDCD

```
public class A {
      private String c="C";
      public String d(){return c;}
}
public class B extends A {
      private String c="D";
      public String d() {return c+e();}
      public String e() {return super.d();}
}
//client code
A a=new A();
out.println(a.d());//line #1
B b=new B();
out.println(b.d());//line #2
```

Question 25.

Consider the hash map `lhm` declared in the line of code shown on the right. Which of the following segments of code will **not** print all of the entries in that map? Disregard the format of the output.

A)
```
Set s=lhm.keySet();
for(Object keys:s)
out.println(keys+" "+lhm.get(keys));
```

B)
```
Set s2=lhm.entrySet();
out.println(s2);
```

C)
```
out.println(lhm);
```

D)
```
Set s=lhm.keySet();
for(String keys:s)
out.println(keys+" "+lhm.get(keys));
```

E) All of the above will correctly print all of the entries in the map `lhm`

```
LinkedHashMap<String,Integer> lhm=new
LinkedHashMap<String,Integer>();
```

Question 26.

Which of the following values will not be printed by the code segment shown on the right?

A) -6

B) 4

C) 2

D) 0

E) -2

```
double ran=Math.random();
int i=(int)(ran*5-3)*2;
out.print(i);
```

Question 27.

What is the output of this call to method `abc` shown on the right?

```
out.print(abc(4));
```

A) 15

B) 6

C) 12

D) 1

E) 24

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

Question 28.

Given the method `abc` shown on the right, what is the output of the call to `abc` shown here?

```
out.print(Arrays.toString(xyz(2,3,4)));
```

A) [0, 0, 3, 5, 2, 2, 2, 2]

B) [0, 0, 5, 5, 2, 2, 2, 2]

C) [0, 0, 0, 2, 2, 2, 2, 2]

D) [5, 7, 2, 2, 2, 2]

E) [5, 5, 2, 2, 2, 2]

```
public static int[] xyz(int x, int y, int z){
     int[] a=new int[8];
     while(z<a.length){
       a[z]=x*y/3;
       a[z/2]=x+y&z;
       z++;
     }
     return a;
   }
```

//Use the following code to answer questions 29, 30, 31 and 32.

```
public static void quickSort(int[] list, int first, int last){
      if(last>first){
            int pivotIndex=partition(list,first,last);
            quickSort(list,first,pivotIndex-1);
            <code 3>
      }
}
public static int partition(int[] list, int first, int last){
      int pivot=list[first];
      int low=first+1;
      int high=last;
      while(high>low)
            {
            while(<code 1>) low++;
            while(<code 2>) high--;
            if(high>low)
                  {
                  int temp=list[high];
                  list[high]=list[low];
                  list[low]=temp;
                  }
            }
      while(high>first&&list[high]>=pivot) high--;
      if(pivot>list[high])
            {
            list[first]=list[high];
            list[high]=pivot;
            return high;
            }
      else
            return first;
      }
```

Question 29.

The methods listed above is intended to implement the Quicksort algorithm. What must replace **<code 1>** and **<code 2>** to ensure that the `partition` method correctly sorts `list` in ascending order?

A) `low<=high&&list[low]>=pivot`
`low<=high&&list[high]<pivot`

B) `low<=high||list[low]<=pivot`
`low<=high||list[high]>pivot`

C) `low<=high`
`low<=high`

D) `list[low]<=pivot`
`list[high]>pivot`

E) `low<=high&&list[low]<=pivot`
`low<=high&&list[high]>pivot`

Question 30.

Assume that **<code 1>** and **<code 2>** have been filled in correctly. What must replace **<code 3>** to ensure that the `quickSort` method correctly sorts `list` in ascending order?

A) `quickSort(list,pivotIndex+1,last);`

B) `quickSort(list,last,pivotIndex+1);`

C) `quickSort(list,pivotIndex,last);`

D) `pivotIndex=partition(list,last,first);`

E) No additional code is required at this point.

Question 31.

Which of the following is the base case condition for the method `quickSort`?

A) `first` equals `last`

B) `last` is greater than `first`

C) `pivotIndex` is equal to zero

D) `pivotIndex` is equal to last

E) `high` is equal to `low`

Question 32.

What is the best, average and worst case time complexity (Big O value) for the Quicksort algorithm?

A) $O(n^2)$ $O(n^2)$ $O(n^2)$

B) O(log n) O(log n) $O(n^2)$

C) O(n log n) O(n log n) $O(n^2)$

D) O(n log n) O(n log n) O(n log n)

E) O(n) O(n log n) $O(n^2)$

```
//Use the following code to answer questions 33, 34 and 35

public class HeapNode {
      private int data;
      public HeapNode(int n){data=n;}
      public int getData(){return data;}
}

public class Heap {
      private HeapNode[] heap;
      private int max;
      private int cur;

      public Heap(int size){
            max=size;
            cur=0;
            heap=new HeapNode[max];}

      public void moveUp(int index){
            //missing implementation
      }

      public void moveDown(int index){
            int largerChild;
            HeapNode top=heap[index];
            while(index<cur/2){
                  int left=2*index+1;
                  int right=left+1;
                  if(right<cur&&heap[left].getData()<heap[right].getData())
                        largerChild=right;
                  else
                        largerChild=left;
                  if(<code 1>)
                        break;
                  heap[index]=heap[largerChild];
                  index=largerChild;}
            heap[index]=top;}

      public boolean isEmpty(){return cur==0;}

      public boolean insert(HeapNode hn){
            if(cur==max) return false;
            heap[cur]=hn;
            moveUp(cur++);
            return true;}

      public HeapNode remove(){
            HeapNode root=heap[0];
            heap[0]=heap[--cur];
            moveDown(0);
            return root;}

      public String toString(){
            String temp="";
            for(int i=0;i<cur;i++)
                  temp+=heap[i].getData()+" ";
            return temp;}
}
```

Question 33.

The classes Heap and HeapNode are a partial implementation of a max heap data structure. Which of the following code segments is the correct implementation of the `moveUp` method?

A.
```
int parent=(index-1)/2;
HeapNode bottom=heap[index];
while(index<0||heap[parent].get
Data()>bottom.getData()){
   heap[index]=heap[parent];
   index=parent;
   parent=(parent-1)/2;}
heap[index]=bottom;
```

B.
```
int parent=2*index+1;
HeapNode bottom=heap[index];
while(index>0&&heap[parent].get
Data()<bottom.getData()){
   heap[index]=heap[parent];
   index=parent;
   parent=2*parent+1;}
heap[index]=bottom;
```

C.
```
int parent=(index-1)/2;
HeapNode bottom=heap[index];
while(index>0&&heap[parent].get
Data()<bottom.getData()){
   heap[parent]=heap[index];
   parent=index ;
   index=(parent-1)/2;}
heap[index]=bottom;
```

D.
```
int parent=(index-1)/2;
HeapNode bottom=heap[index];
while(index>0&&heap[parent].get
Data()<bottom.getData()){
   heap[index]=heap[parent];
   index=parent;
   parent=(parent-1)/2;}
heap[index]=bottom;
```

E.
```
int parent=(index-1)/2;
HeapNode bottom=heap[index];
while(index>0&&heap[parent].get
Data()<bottom.getData()){
   heap[index]=heap[parent];
   index=parent;
   parent=(parent-1)/2;}
bottom=heap[index];
```

Question 34.

Which of the following must replace **<code 1>** in the `moveDown` method so that it will compile and execute correctly within the implementation of a max heap?

A) `top.getData()==heap[largerChild].getData()`

B) `top.getData()>=heap[largerChild].getData()`

C) `top.getData()>=largerChild`

D) `top==largerChild`

E) `top.getData()<heap[largerChild].getData()`

Question 35.

Assume that the `moveUp` method has been properly implemented and that **<code 1>** has been filled in correctly. What is the output of the client code shown on the right?

A) `0 1 3 4 7 10`

B) `10 7 4 3 1 0`

C) `1 7 10 0 3 4`

D) `0 10 1 7 3 4`

E) `10 3 7 0 1 4`

```
Heap h=new Heap(6);
h.insert(new HeapNode(1));
h.insert(new HeapNode(7));
h.insert(new HeapNode(10));
h.insert(new HeapNode(0));
h.insert(new HeapNode(3));
h.insert(new HeapNode(4));
System.out.println(h);
```

Question 36.

Which of the following is equivalent to $A * \bar{B} + \bar{A} * B$?

A) $\overline{A \oplus B}$ **B)** $A \oplus B$ **C)** $A * B$ **D)** $\overline{A * B}$ **E)** $A + B$

Question 37.

What is the value of the postfix expression shown here? (The operands are 1, 2, 9 and 5.)

1 2 + 9 * 5 –

A) 22 **B)** 14 **C)** 48 **D)** 105 **E)** – 42

Question 38.

The method shown on the right will hash a string to a key value to be used in a hash table. If `arraySize` is 100, what is the largest possible value that could be returned by `hashFun`?

A) 312

B) 100

C) 99

D) 27^{100}

E) 100^{27}

```
public static long hashFun(String key){
long hashVal=0;
for(int j=0;j<key.length();j++){
long letter=
   Character.toLowerCase(key.charAt(j))-96;
hashVal=(hashVal*27+letter)%arraySize;
}
return hashVal;
}
```

Question 39.

Find the sum of 11001101 and 11100011. Both values are shown as signed 8-bit two's complement binary numbers. Write your answer as a decimal number.

Question 40.

How many edges does a complete graph with 12 nodes contain?