UIL COMPUTER SCIENCE WRITTEN TEST – 2016 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 is equivalent to $123_8 + 45_8$?

A) 1230_4 **B)** 168_8 **C)** 78_{16} **D)** 130_{10} **E)** More than one of these

Question 2.

What is the value of `z` in the code segment to the right?

A) `0.0` **B)** `2.0` **C)** `3.0` **D)** `6.0`

E) No output due to an error.

```
double x = 6;
double y = 1/2;
double z = x * y;
```

Question 3.

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

A) `6 Points`

B) `6 Points right`

C) `6 pts right`

D) `6 pts`

E) No output due to an error.

```
int right = 6;
int wrong = -2;
int skip = 0;
String pts = "Points";
out.printf("%d pts", right);
```

Question 4.

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

A) `ihgfedc....d.f.hi` **B)** `ih.f.d.....d.f.hi`

C) `ihgfedcbabcdefghi` **D)** `ih.f.d....cdefghi`

E) No output due to an error.

```
String pal = "ihgfedcbabcdefghi";
pal = pal.replaceAll("[cabbage]", ".");
out.println(pal);
```

Question 5.

Given the code segment to the right, when will `r` be `false`?

A) Only when `a < b` **B)** Never

C) Only when `a > b` **D)** Always

E) It is impossible to determine.

```
boolean p = (a < b);
boolean q = (a != b);
boolean r = !(p && q);
```

Question 6.

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

A) `4.0 3.0 3.0` **B)** `3.0 4.0 3.0` **C)** `3.0 4.0 4.0`

D) `4.0 3.0 4.0` **E)** `3.0 3.0 3.0`

```
double bang = Math.ceil(Math.PI);
double pow = Math.floor(Math.PI);
double oof = Math.min(bang, pow);
out.println(bang + " " + pow + " " + oof);
```

Question 7.

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

A) `0` **B)** `4` **C)** `8` **D)** `16`

E) No output due to an error.

```
byte nibble = 4;
nibble += nibble;
nibble -= nibble;
nibble *= nibble;
nibble /= nibble;
out.println(nibble);
```

Question 8.

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

A) `1` **B)** `2` **C)** `3` **D)** `12` **E)** `13`

```
int ulo = 3;
if (4 % ulo == 1)
   out.print("1");
if (5 % ulo == 2)
   out.print("2");
else
   out.print("3");
```

Question 9. What is the output of the code segment to the right? **A)** 707274 **B)** FHJL **C)** FHJ **D)** FGHIJKL **E)** FGHIJK	```java for (char ch = 'F'; ch < 'L'; ch += 2) out.print(ch); ```

Question 10. What is the output of the code segment to the right? **A)** [13, 9, 3, 11, 5, 12] **B)** [13, 8, 3, 12, 6, 11] **C)** [13, 3, 0, -1, 1, 2] **D)** [13, 12, 3, 2, -1, 0] **E)** No output due to an error.	```java int[] alpha = new int[6]; alpha[0] = 13; alpha[3] = alpha[0] - 1; alpha[2] = alpha[3] / 4; alpha[5] = alpha[3]--; alpha[1] = alpha[5] - alpha[2]; alpha[4] = alpha[3] / 2; out.println(Arrays.toString(alpha)); ```

Question 11. What is the output of the code segment to the right? **A)** 8 **B)** 10 **C)** 5 **D)** 28 **E)** No output due to an error.	```java int total = 0; String msg = "4 -10 12 8 -6 7 3 -1 2 9 0"; Scanner parser = new Scanner(msg); while (parser.nextInt() % 2 == 0) total += parser.nextInt(); out.println(total); ```

Question 12. What is the output of the code segment to the right? **A)** 31 **B)** 33 **C)** 54 **D)** 63 **E)** No output due to an infinite loop.	```java int seqA = 0; int seqB = 1; int seqSum = seqA + seqB; while (seqSum < 50) { seqA = seqB; seqB = seqA + seqB; seqSum += seqB; } out.println(seqSum); ```

Question 13. What is the output of the code segment to the right? **A)** 2 2 2 **B)** 4 2 6 **C)** 2 3 7 **D)** 4 3 7 **E)** No output due to an error.	```java int q = 0; int r = q++ + ++q; int s = ++q + q++; out.println(q + " " + r + " " + s); ```

Question 14. Which pair of Java primitive data types occupies the same number bits of storage in memory? **A)** byte, char   **B)** int, double   **C)** short, char   **D)** float, double   **E)** short, float

Question 15. What is the output of the code segment to the right? **A)** [Donald, Huey, Dewey, Louis, Daffy] **B)** [Dewey, Daffy, Louis] **C)** [Dewey, Daffy, Huey, Louis] **D)** [Dewey, Donald, Louis, Daffy] **E)** [Dewey, Daffy, Louis, Huey]	```java List<String> ducks = new LinkedList<>(); ducks.add("Donald"); ducks.add(1, "Huey"); ducks.add(0, "Dewey"); ducks.add(ducks.size() - 1, "Louis"); ducks.set(1, "Daffy"); out.println(ducks); ```

Question 16. What is the output of the code segment to the right? **A)** 0 **B)** 56 **C)** 63 **D)** 170 **E)** 508	```java out.println(511 >> 3); ```

Question 17. What is the output of the code segment to the right? **A)** 1212210202 **B)** 000999999 **C)** 1212210202000 **D)** 333333 **E)** No output due to an error.	```java out.println(Integer.toString(999999, 3)); ```

Question 18.

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

A) `[10, 10, 9, 7]`

B) `[6, 9, 9, 6]`

C) `[6, 6, 5, 3]`

D) `[10, 14, 15, 13]`

E) No output due to an error.

```
int[][] table = new int[4][5];
int[] rows = new int[table.length];

for (int i = 0; i < table.length; i++)
  for (int j = i; j < table[i].length; j++)
    table[i][j] = i + j;

int i = 0;
for (int[] row : table) {
  int tot = 0;
  for (int n : row)
    tot += n;
  rows[i++] = tot;
}
out.println(Arrays.toString(rows));
```

Question 19.

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

A) `[24k, cop, Doc, LBJ, null]`

B) `[24k, Doc, LBJ, cop, null]`

C) `[, 24k, Doc, LBJ, cop, null]`

D) `[null, , 24k, Doc, LBJ, cop]`

E) No output due to an error.

```
String[] ids = new String[3];
ids = new String[] { "LBJ", "cop", "Doc",
                     "null", "", "24k"};
Arrays.sort(ids);
out.println(Arrays.toString(ids));
```

Question 20.

Given the class definitions to the right, which of the following client code statements would be a valid variable initialization?

A) `Alpha aaa = new Alpha("Alfa");`

B) `Beta bbb = new Beta("Bravo");`

C) `Alpha ccc = new Beta();`

D) `Beta ddd = new Alpha();`

E) More than one of the above.

```
public class Alpha {
  private String id;

  public Alpha () {
    id = "Echo";
  }

  public String id() { return id; }

  public String toString() { return id; }
}

public class Beta extends Alpha {
  private String id;

  public Beta(String id) {
    this.id = id;
  }

  public String id() { return id; }
}
```

Question 21.

Given the class definitions to the right, what is the output of the following client code segment?

```
Alpha agent = new Beta("007");
out.println(agent.id());
```

A) `007`   B) `Alpha`   C) `Beta`   D) `id`   E) `Echo`

Question 22.

Given the class definitions to the right, what is the output of the following client code segment?

```
Alpha agent = new Beta("007");
out.println(agent);
```

A) `007`   B) `Alpha`   C) `Beta`   D) `id`   E) `Echo`

Question 23.

Which of the following Big-O approximations for an algorithm would represent the most optimal performance?

A) $O(N^3)$ B) $O(N)$ C) $O(N * \log_2 N)$ D) $O(\log_2 N)$ E) $O(N^2)$
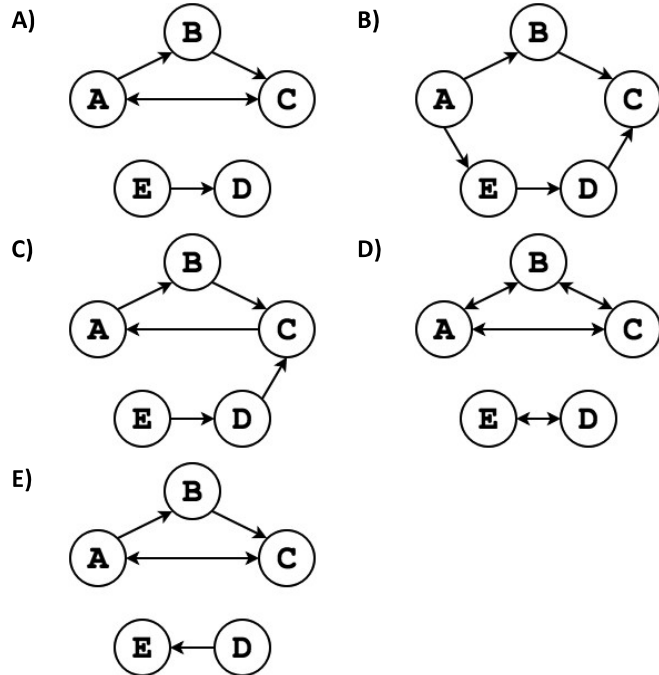
Question 24.

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

A) `true`   B) `false`   C) `valid`   D) `invalid`

E) No output due to an error.

```
String userid = "uil_2016";
String format = "\\w+\\d+";
if (userid.matches(format))
  out.println("valid");
else
  out.println("invalid");
```

Question 25.

Which of the following graphs illustrates the connections shown in the adjacency matrix to the right?

A)

B)

C)

D)

E)

	A	B	C	D	E
A	false	true	true	false	false
B	false	false	true	false	false
C	true	false	false	false	false
D	false	false	false	false	false
E	false	false	false	true	false

Question 26.

Which of the following types of graphs does the matrix to the right describe?

A) Connected graph   B) Weighted graph

C) Directed graph   D) A and B only

E) A and C only

Question 27.

Which of the following is equivalent to the Boolean expression to the right?

A) `P || Q`

B) `!P && !Q`

C) `!P || Q`

D) `true`

E) `false`

`!(P && Q) || Q`

Question 28.

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

A) `fifteen`   B) `15`   C) `510`

D) No output due to a syntax error.

E) No output due to a runtime error.

`out.println(Integer.parseInt(5 + "10"));`

Question 29.

Which of the following standard searching and sorting algorithms always performs with the same O(N * $\log_2$ N) performance in the best-, average-, and worst-case scenarios?

A) Quicksort   B) Sequential Search   C) Merge Sort   D) Binary Search   E) Selection Sort

Question 30.

Given the code segment to the right, what are the contents of the `parts` array?

A) `[UIL.C, mp, t, r.Sc, , nc]`

B) `[UIL.C, mp, t, r.Sc, nc]`

C) `[L.C, mp, t, r.Sc, , nc]`

D) `[UIL.Computer.Science]`

E) `[, , L.C, mp, t, r.Sc, , nc]`

```
String whole = "UIL.Computer.Science";
String[] parts = whole.split("[aeiou]");
```

Question 31.

Given the recursive method to the right, what value is returned by invoking `sputter(8)`?

A) `#........`

B) `#........#....#..#.`

C) `#.#.#.#.#.#.#.#.`

D) `#.#..#....#........`

E) No output due to an error.

```
public static String sputter(int n) {
  if (n <= 0) { return ""; }

  String splat = "#";

  for (int i = 0; i < n; i++)
    splat += ".";

  return splat + sputter(n / 2);
}
```

Question 32.

What is the output of **Line #1** in the code segment to the right?

A) `[9, 7]`   **B)** `[36, 7]`

C) `[10, 60, 11, -2]`   **D)** `[10, 11]`

E) No output due to a runtime error.

```
Stack<Integer> stack = new Stack<>();
Queue<Integer> queue = new LinkedList<>();

stack.push(10);
stack.push(24);
stack.push(36);
queue.add(stack.pop() + stack.pop());
stack.push(11);
stack.push(9);
stack.push(7);
queue.add(stack.pop() - stack.pop());

out.println(stack);          // Line #1
out.println(queue);          // Line #2
```

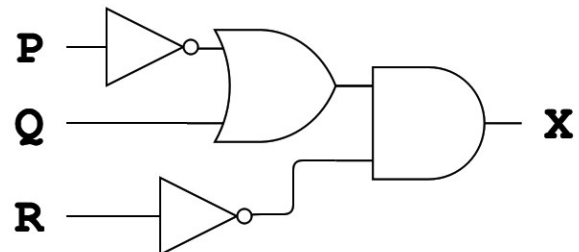**Question 33.**

What is the output of **Line #2** in the code segment to the right?

A) `[34, 25]`   **B)** `[-14, 2]`

C) `[60, -2]`   **D)** `[60, 2]`

E) No output due to an error.

Question 34.

Which of the following Boolean expressions corresponds to the logic diagram to the right?

A) X = (P + $\overline{Q}$) * R

B) X = ($\overline{P}$ * Q) + $\overline{R}$

C) X = (P * $\overline{Q}$) + R

D) X = ($\overline{P + Q}$) * $\overline{R}$

E) X = ($\overline{P}$ + Q) * $\overline{R}$

Question 35.

Which of the following set of inputs for the logic diagram to the right will result in a `true` output for X?

A) `P = true; Q = true; R = false;`

B) `P = false; Q = false; R = true;`

C) `P = false; Q = true; R = true;`

D) `P = true; Q = false; R = false;`

E) `P = true; Q = false; R = true;`

Question 36.

What is the 8-bit, 2's complement binary representation of –55?

A) `–00110111`　　　**B)** `10110111`　　　**C)** `11001000`　　　**D)** `11001001`　　　**E)** `–11001000`

Question 37.

What is the postfix notation for the arithmetic expression to the right?

A) `+ * z – y w x`　　　　　**B)** `w x – y * z +`

C) `+ * – w x y z`　　　　　**D)** `w x y z – * +`

E) `z + y * (x – w)`

`(w – x) * y + z`

Question 38.

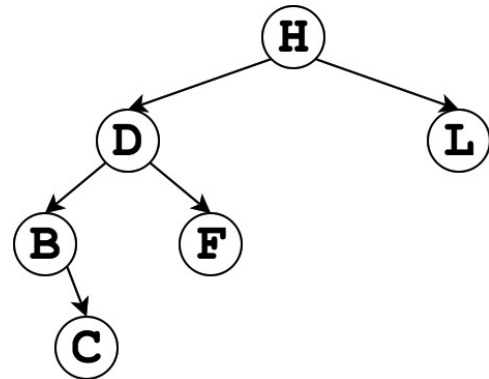How many uniquely different ways can the 4 nodes to the right be arranged such that they form a valid binary search tree?

A) `1`　　　**B)** `4`　　　**C)** `10`　　　**D)** `14`　　　**E)** `24`

Question 39.

What is the pre-order traversal of the nodes in the binary tree shown to the right?

Write your answer on the answer sheet.

Question 40.

Write a simplified, Boolean expression to describe output `X`, given inputs `A`, `B`, and `C`, as shown in the truth table to the right, where 0 denotes `false` and 1 denotes `true`. Your answer should use as few logical operators as possible.

Write your answer on the answer sheet.

A	B	C	X
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1