

A+ Computer Science

M/C Written Test

General Directions:

- 1) DO NOT OPEN EXAM UNTIL TOLD TO DO SO.
- 2) **NO CALCULATORS of any kind may be used.**
- 3) You have 45 minutes to complete this contest. If you are in the process of actually writing an answer when the signal to stop is given, you may finish writing that answer.
- 4) Papers may not be turned in until forty-five minutes have elapsed. If you finish the test before the end of the allotted time, remain at your seat and retain your paper until told to do otherwise. You may use this time to check your answers.
- 5) All answers must be written on the answer sheet/Scantron card provided. Indicate your answers in the appropriate blanks provided on the answer sheet or on the Scantron card. Clean erasures are necessary for accurate Scantron grading.
- 6) You may place as many notations as you desire anywhere on the test paper except on the answer sheet or Scantron card which is reserved for answers only.
- 7) You may use additional scratch paper provided by the contest director.
- 8) All questions have ONE and only ONE correct (BEST) answer. There is a penalty for all incorrect answers. **All provided code segments are intended to be syntactically correct, unless otherwise stated (i.e. `error` is an answer choice). Ignore any typographical errors and assume any undefined variables are defined as used.**
- 9) A reference to commonly used Java classes is provided with the test and you may use this reference during the contest. You may detach the reference sheets from the test booklet but **DO NOT DO SO UNTIL THE CONTEST BEGINS.**
- 10) Assume that any necessary import statements for Standard Java 23 Packages and classes (e.g. `.lang`, `.util`, `System`, `Math`, `Double`, etc.) are included in any programs or code segments that refer to methods from these classes and/or packages.

Scoring:

- 1) All questions will receive 6 points if answered correctly; no points will be given or subtracted if unanswered; 2 points will be deducted for each incorrect answer.

**For more Computer Science practice tests and materials,
go to www.apluscompsci.com**

Note: Correct responses are based on **Java Development Kit 23** from Oracle, 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 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 NOT equivalent to the expression 123_4 ?

- A. 36_7 B. 21_{13} C. 1001_2 D. 43_6 E. 30_9

QUESTION 2

What is output by the code to the right?

- A. 215 B. 179 C. 157 D. 138
E. There is no output due to a compile error.

```
out.println(212 - 17 * 5 + 11);
```

QUESTION 3

What is output by the code to the right?

- A. WhatA B. AWhat C. AWhatA
D. There is no output due to a compile error.
E. There is no output due to a runtime error.

```
out.printf("%sWhat%s", "A");
```

QUESTION 4

What is output by the code to the right?

- A. kunaMatna B. kunaMatana
C. HaMtatuna D. Matunakata
E. There is no output due to a runtime error.

```
String s = "HakunaMatata";
s = s.substring(0, 9);
s += s.substring(4, 7);
s = s.substring(2, 11);
out.println(s);
```

QUESTION 5

What is output by the code to the right?

- A. true B. false

```
boolean a = true;
boolean b = true;
a &= a ^ b & a;
out.println(a);
```

QUESTION 6

What is output by the code to the right?

- A. 1.0 B. -1.0 C. 0
D. There is no output due to a compile error.
E. There is no output due to a runtime error.

```
double d = 5.5;
double a = Math.ceil(d);
double b = Math.floor(d);
out.println(b - a);
```

QUESTION 7

What is the output by the code to the right?

- A. 15
B. 123
C. 1212
D. 24
E. 103

```
int i = 10, j = 12;
if(i <= ++j)
    i += j - i;
if(j <= --i)
    j -= 1;
else
    j -= 10;
out.print(""+i+j);
```


QUESTION 8 What is output by the line marked //q08 in the code to the right ? A. 31 B. 24 C. 29 D. 35 E. 26	<pre>int[] i = new int[] { 17, 5, -3, 8, 19, -2}; int sum = 0; for(int j = 0; j < 4; j++) sum += j * i[5 - j]--; out.println(sum); //q08</pre>
QUESTION 9 What is output by the line marked //q09 in the code to the right ? A. 17 B. 20 C. 15 D. 11 E. 29	<pre>for(int j = 0; j < 6; j++) { i[j] = j * 3 ^ 7; i[5 - j] += j & 3; } out.println(i[3]); //q09</pre>
QUESTION 10 What is output by the line marked //q10 in the code to the right ? A. 22 B. 30 C. 24 D. 28 E. 25	<pre>for(int j = 0; j < 4; j++) i[j + 2] += --i[j]; out.println(i[2]); //q10</pre>
QUESTION 11 What is output by the line marked //q11 in the code to the right ? A. 10 B. 11 C. 13 D. 9 E. All of the above.	<pre>String s = "14 95 194810 86 97"; s += "20 29 87 193 28 30 574"; String x = "([0-3])"; String[] r = s.split(x); Scanner sc = new Scanner(s); sc.useDelimiter(x); out.println(r.length); //q11 int n = 0; while(sc.hasNext() && sc.next().length() <= 5) n++; out.println(n); //q12</pre>
QUESTION 12 What is output by the line marked //q12 in the code to the right ? A. 2 B. 1 C. 3 D. 4 E. No output due to a runtime error.	
QUESTION 13 What is the correct order of precedence for the operators to the right ? A. I, II, IV, III B. I, IV, III, II C. IV, I, II, III D. I, II, III, IV E. II, I, III, IV	<pre>I. >> II. ^ (bitwise) III. (bitwise) IV. ?: (ternary)</pre>
QUESTION 14 What is the output by the code to the right ? A. 64 B. 16 C. 8 D. 4 E. 32	<pre>out.println(Float.SIZE);</pre>

QUESTION 15

What could replace `<1*>` in the code to the right so that it compiles without error?

- A. Collection B. List C. Object
D. B and C. E. All of the above.

```
ArrayList<<1*>> a;
a = new ArrayList<<1*>>();
a.add(a);
a.add(new LinkedList<>());
a.add(new Stack<String>());
a.remove(1);
out.println(a);
```

QUESTION 16

What is output by the code to the right ?

- A. [a, []] B. [(this), []]
C. [[], []] D. [(this Collection), []]
E. There is no output due to a runtime error.

QUESTION 17

What is the average-case big O runtime of the code to the right ?

- A. O(1) B. O(N^2) C. O(log N)
D. O(N) E. O(N log N)

QUESTION 18

Which of the following could not be output by the line marked //q18 in the code to the right?

- A. 17 B. 15 C. 100
D. 104 E. 105

```
HashSet<Double> hs;
hs = new HashSet<Double>();
double k = Math.random() * 89 + 15;
for(int i = 0; i < k; i++) {
    double w = Math.random() * 212 + i;
    if(!hs.contains(w))
        hs.add(w);
}
out.println(hs.size()); //q18
out.println(hs.add(-212)); //q19
```

QUESTION 19

What is output by the line marked //q19 in the code to the right?

- A. false B. true
C. Output cannot be determined until runtime.
D. There is no output due to a runtime error.
E. There is no output due to a compile error.

QUESTION 20

Which of the following is a legal Java instantiation?

- A. `LinkedList<Integer> a = new Queue<Integer>();`
B. `Collection a = new LinkedHashMap<String, String>();`
C. `ArrayList<> a = new ArrayList<>();`
D. `List a = new Stack<LinkedList>();`
E. More than one of the above.

QUESTION 21

What is the output by the code to the right?

- A. 52
B. 64
C. 39
D. 28
E. There is no output due to a runtime error.

```
int num = 0;
for(int y = 0; y < 5; y++) {
    num = num + y << 1;
}
out.println(num);
```

QUESTION 22

Which of the following could replace <1*> in the code to the right so that the constructor compiles and runs as intended?

- A. `super(name, legs, eyes);`
- B. `name = name;`
`legs = legs;`
`eyes = eyes;`
- C. `name = this.name;`
`legs = this.legs;`
`eyes = this.eyes;`
- D. `this.name = name;`
`this.legs = legs;`
`this.eyes = eyes;`
- E. More than one of the above.

QUESTION 23

Which of the following could replace <2*> in the code to the right so that the constructor compiles and runs as intended?

- A. `super(name, legs, eyes);`
`speed = s;`
- B. `speed = s;`
`name = "Fly";`
`legs = 6;`
`eyes = 2;`
- C. `super("Fly", 6, 2, s);`
- D. `super("Fly", 6, 2);`
`speed = s;`
- E. More than one of the above.

QUESTION 24

Which of the following could replace <3*> in the code to the right so that the client code works as intended?

- A. `super.name` B. `name` C. `this.name`
- D. B or C. E. Any of the above.

QUESTION 25

What is output by the code to the right?

- A. `false Fly:6:2`
- B. `false Centipede:100:2`
- C. `true Spider:8:100`
- D. There is no output due to a compile error.
- E. There is no output due to a runtime error.

QUESTION 26

What is output by the client code to the right?

- A. 10 B. 34
- C. 20
- D. 9
- E. There is no output due to a runtime error.

```
class Bug{
    int legs, eyes;
    String name;

    public Bug
        (String name, int legs, int eyes) {
        <1*>
    }

    public String toString() {
        return name+":"+legs+":"+eyes;
    }

    public boolean isSpider() {
        return legs == 8;
    }
}

class Fly extends Bug{
    int speed;

    public Fly(int s) {
        <2*>
    }

    public int run() {
        return legs;
    }

    public String getName() {
        return <3*>;
    }
}

//////////client code//////////
Bug b = new Bug("Centipede", 100, 2);
Fly f = new Fly(11);
out.println(b.isSpider()+" "+f);
```

```
public static int recur(int i) {
    if(i < 1) return 1;
    if(i == 1) return 0;
    if(i % 2 == 1)
        return 2 * recur(i - 1);
    return 3 + recur(i / 3);
}

//////////client code//////////
out.println(recur(27));
```


QUESTION 27

Which of the following is the worst-case big O runtime of a quick sort?

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

QUESTION 28

What is output by the line marked //q28 in the code to the right?

- A. 105 B. b3
C. b6 D. a6
E. There is no output due to a runtime error.

```
int i = 96;
String s = Integer.toString(i, 9);
i = Integer.parseInt(s, 11);
s = Integer.toString(i, 12);
out.println(s); //q28
i = Integer.parseInt(s, 13);
s = Integer.toString(i, 6);
i = Integer.parseInt(s, 7);
s = Integer.toString(i, 8);
i = Integer.parseInt(s, 7);
out.println(i); //q29
```

QUESTION 29

What is output by the line marked //q29 in the code to the right?

- A. 175 B. 148
C. 109 D. 155
E. There is no output due to a runtime error.

QUESTION 30

What is output by the code to the right?

- A. true true
B. true false
C. false true
D. false false
E. There is no output due to a runtime error.

```
String s = "Im_Just_A_Kid";
String m1 = "\\w+";
String m2 = "(\\S){3}.*(\\d)?";
out.print(s.matches(m1));
out.print(" ");
out.print(s.matches(m2));
```

QUESTION 31

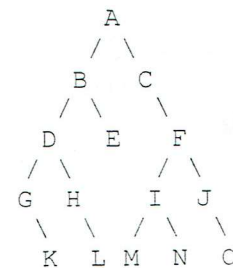
What is the ASCII value of zero '0' ?

- A. 32 B. 0 C. 48 D. 65 E. 97

QUESTION 32

What is the pre-order traversal of the tree to the right?

- A. OJFNIMCAEBLHDKG
B. KGLHDEBMNIOJFCA
C. GKDHLBEACMINFJO
D. ABDGKHLECFIMNJO
E. ABCDEFGHOJKLMNO


QUESTION 33

What is the height of the tree to the right?

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

QUESTION 34

Which of the following could replace `<1*>` in the code to the client code compiles and works as intended?

- A. Object
- B. Integer
- C. Comparable
- D. A or C.
- E. Any of the above.

QUESTION 35

Which of the following could replace `<2*>` in the code to the right so that the Node class works as intended, and the client code compiles and works as intended?

- A. private
- B. protected
- C. public
- D. Nothing is required.
- E. A, B, and D
- F. All of the above.

QUESTION 36

Assuming `<1*>` and `<2*>` have been filled in correctly, what is output by the line marked `//q36` in the code to the right?

- A. false 6
- B. false 5
- C. true 0
- D. true 5
- E. There is no output due to a runtime error.

QUESTION 37

Assuming `<1*>` and `<2*>` have been filled in correctly, what is output by the line marked `//q37` in the code to the right?

- A. 189.29 Somebody false K 89 212
- B. 189.29 Somebody false K 89
- C. Somebody false K 89 212
- D. There is no output due to an infinite loop.
- E. There is no output due to a runtime error.

QUESTION 38

What data structure is being emulated by the Structure class to the right (even if it is not implemented correctly, what is the intended structure)?

- A. Singly-Linked List
- B. Min-Heap
- C. Doubly-Linked List
- D. Max-Heap
- E. Binary Search Tree

```
class Structure{
    Node first;    int size;
    public Structure(<1*> c) {
        first = new Node(c);
        first.prev = first.next = first;
        size = 1;
    }
    public void add(<1*> c) {
        Node n = new Node(c);
        first.prev.next = n;
        n.prev = first.prev;
        first.prev = n;
        n.next = first;
        size++;
    }
    public boolean remove(<1*> c) {
        Node n = first;
        while(n.next != first && n.val != c)
            n = n.next;
        if(n.val != c) return false;
        n.prev.next = n.next;
        n.next.prev = n.prev;
        if(n == first) first = n.next;
        size--;
        return true;
    }
    public String toString() {
        String o = "";
        Node n = first;
        while(n.next != first) {
            o += n.val + " ";
            n = n.next;
        }
        return o.trim();
    }
}
<2*> class Node{
    <1*> val;
    Node next, prev;
    public Node(<1*> val) {
        this.val = val;
    }
}
//////////client code//////////
Structure s = new Structure(7);
s.add("Nobody");
s.add(189.29);
s.add("Somebody");
s.remove(7);
s.add(false);
s.add('K');
s.add(89);
boolean b = s.remove(19);
int k = s.size;
out.println(b+" "+k); //q36
s.remove("Nobody");
s.remove("Nobody");
s.add(212);
out.println(s); //q37
```

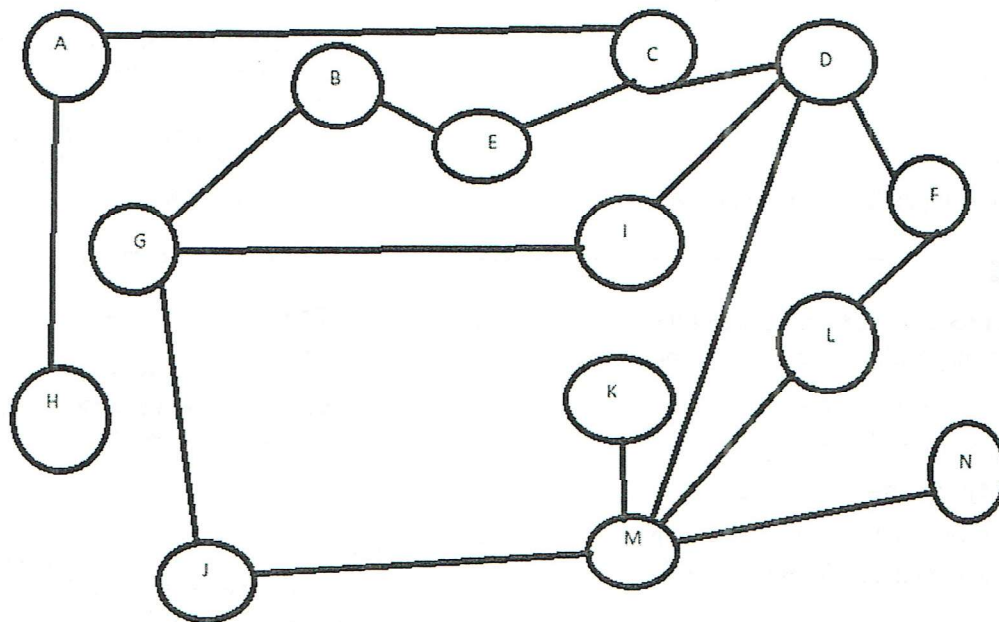
QUESTION 39

What is the sum of all the values popped in the following stack psuedocode?

```
Push 17  
Push 20  
Pop X  
Push 18  
Pop X  
Push 21  
Push 15  
Push 16  
Pop X  
Pop X  
Push 22  
Push 23  
Pop X
```

QUESTION 40

What is the shortest possible path from node C to N in the following graph?



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- | | |
|-------|----------|
| 1) C | 21) A |
| 2) D | 22) D |
| 3) E | 23) D |
| 4) A | 24) E |
| 5) B | 25) A |
| 6) B | 26) C |
| 7) B | 27) A |
| 8) E | 28) C |
| 9) C | 29) D |
| 10) A | 30) A |
| | |
| 11) C | 31) C |
| 12) C | 32) D |
| 13) D | 33) B |
| 14) E | 34) D |
| 15) E | 35) F |
| 16) D | 36) A |
| 17) A | 37) B |
| 18) E | 38) C |
| 19) E | 39) 92 |
| 20) D | 40) CDMN |

Note to Graders:

- All provided code segments are intended to be syntactically correct, unless otherwise stated (e.g. error is an answer). **Ignore any typographical errors.**
- Any necessary Standard Java 23 Packages are assumed to have been imported as needed.
- Assume any undefined (undeclared) variables have been defined as used.

