

★ANSWER KEY – CONFIDENTIAL★

COMPUTER SCIENCE WRITTEN TEST – FEBRUARY 18, 2017

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

- 1) C 11) C 21) D 31) B
 2) A 12) D 22) E 32) B
 3) C 13) B 23) D 33) C
 4) B 14) E 24) A 34) D
 5) B 15) D 25) C 35) B
 6) A 16) C 26) E 36) B
 7) C 17) A 27) B 37) C
 8) E 18) A 28) C 38) E
 9) B 19) E 29) E 39) A B C + D E - * -
 10) D 20) B 30) A 40) 11011100

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.

Explanation

- 1) C $16_8 + 32_{16} = 1000000_2 = 100_8 = 64_{10} = 40_{16} = 2g_{24}$
 2) A $x = 0.1$; $y = 9$; $z = 9.0$
 3) C r is a literal double-quote (") character. p is a String consisting of a plus sign (+) character.
 4) B The String class is immutable (i.e., it contains no modifier methods). The `replaceAll()` method returns a newly constructed String object, but does not modify the original String object.
 5) B
- | P | Q | R | X |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |
- 6) A $3 / 4 = 0$ (truncation due to integer division). `Math.ceil()` returns "the smallest (closest to negative infinity) double value that is greater than or equal to the argument and is equal to a mathematical integer."

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- 7) C `eger = 45; ingPoint = 40.2; answer = 40; erAnswer = 3`. The compound division-assignment (`/=`) operator is evaluated after the addition operation (`+`) and an implicit type-cast to `short`. The following statements are equivalent:
- `erAnswer /= 10 + 2; ← equivalent → erAnswer = erAnswer / ((short)(10 + 2));`
- 8) E The first `if` statement (printing "W") will be evaluated separately from the `if/else-if/else` statement (printing either "X", "Y", or "Z"). Since 2017 is not a multiple of 4, the first `if` statement will print "W" and in the multi-conditional chain, the `else-if` statement will print "Y".
- 9) B After concatenation, the value of `dijkstra` is "Computer science is nomore about computers than astronomyis about telescopes." (Note the lack of spaces at the concatenation points).
- 10) D `Arrays.binarySearch()` returns the bitwise complement of the index position at which a searched-for value (e.g., "Will") would be inserted into a sorted array. The bitwise complement operator (`~`) returns the 1's-complement of an operand (i.e., `~n = -n - 1`).
- 11) C For each word in the input string that has a length greater than 3 characters, the following word is read and printed.
- 12) D The `while` loop continues as long as both `if` conditions are true (i.e., `tri / 2 < 100 && tri * 2 < 150`).
- 13) B `one = (5 + ((4 / 3) * 2) > (((5 * 4) / 3) + 2) = false`
`two = (false || (!false && false)) = false`
- 14) E The use of the addition operation (`+`) on character (`char`) values evaluates to an integer (`int`) value.
- 15) D `cat = [cat]; dog = [cat, dog]; bird = [cat, dog, bird]`
- 16) C `= (((127 >> 6) << 8) >> 2) << 1)`
`= (((1 << 8) >> 2) << 1)`
`= ((256 >> 2) << 1)`
`= (64 << 1)`
`= 128`
- 17) A `(a / b)` throws an `ArithmeticException` (i.e., divide by zero) which is a subclass of `RuntimeException`. The `finally` branch is always executed and does not disrupt execution of the remaining code.
- 18) A `"oneTwo" < "threeOne" < "twoThree"`
- 19) E `right.addAll(left)` iterates through each item in `left` from bottom to top, pushing each item onto `right`. Since `right` is empty at that point in the code segment, this effectively makes `right` an identical `Stack` to `left` (i.e., containing the same items and in the same order).
- 20) B `'J' = 74` (minimum Unicode value in the string); `'u' = 117` (maximum Unicode value in the string)
- 21) D `\w` = a *word* character (e.g., `[a-zA-Z_0-9]`); `\s` = a *whitespace* character (e.g., space, tab, newline, etc.); `\d` = a *digit* character (e.g., `[0-9]`); `/` = a literal forward-slash character
- 22) E Because of the commas, `"27,862,596"` cannot be parsed as an `Integer` (i.e., it throws a `NumberFormatException`).
- 23) D `alpha()` counts the number of swap operations performed while sorting the contents of `int[] a`.
- 24) A `alpha()` sorts the contents of `int[] a` into descending order.
- 25) C For each index position, `e`, in `int[] a`, `alpha()` uses method `beta()` to search for the largest remaining value to swap into position `e` (using method `gamma()` to perform the swap).
- 26) E Selection Sort is a quadratic operation yielding $O(N^2)$ performance in the best, average, and worst cases.
- 27) B `beta()` returns the index position of the largest value in `int[] a` between index positions `b` (inclusive) and `c` (exclusive).
- 28) C Sequential Search is a linear operation yielding $O(N)$ performance in the average and worst cases.
- 29) E `gamma()` exchanges the items at index positions `b` and `c` of `int[] a`.
- 30) A A swap operation performs in constant time with a $O(1)$ performance.
- 31) B Pre-order: `<Root node>` [Pre-order traversal of the left sub-tree] [Pre-order traversal of the right sub-tree]
- 32) B Scans through the matrix, `m`, to find the 2-by-2 block with the largest sum of digits (e.g., `6 + 4 + 9 + 8 = 27`).
- 33) C `map = {C=J, J=C, K=r, S=i, _=a, a=_, c=p, d=w, i=r, k=t, n=p, o=d, p=n, r=i, t=k, w=d}`

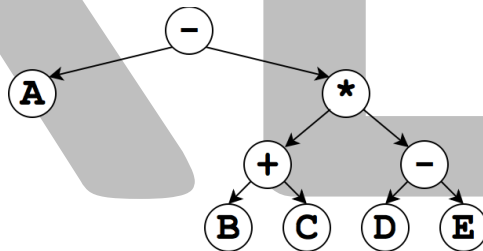
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- 34) D The keyset for map contains { _, C, J, K, S, a, c, d, i, k, n, o, p, r, t, w }.
- 35) B Edge connectivity is the minimum number of edges that can be removed to disconnect the graph. For example, removing edges BE, BG, and BH will disconnect vertex B from the rest of the graph. Removing fewer than 3 edges from this graph will result in it still being connected.
- 36) B Vertex connectivity is the minimum number of vertices that can be removed to disconnect the graph. For example, removing vertices A, B, and G will disconnect vertex H from the rest of the graph. Removing fewer than 3 vertices from this graph will result in it still being connected.
- 37) C The diagram represents an *S-R NOR Latch* (or 1 bit of memory) whose output bit, Q, can be set to a value of 1 (i.e., when R = 0 and S = 1) or reset to a value of 0 (i.e., when R = 1 and S = 0). After setting/resetting the latch, the feedback loop allows it to retain its value while both inputs are off (i.e., when R = 0 and S = 0). The behavior of an S-R Latch when both inputs are on (i.e., when R = 1 and S = 1) is undefined.

38) E

| P | Q | (A) | (B) | (C) | (D) | (E) |
|---|---|-----|-----|-----|-----|-----|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 |

- 39) (A - (B + C) * (D - E)) corresponds to the following expression tree:



A post-order traversal of the tree (A B C + D E - * -) is the postfix form of the expression.

- 40) +36 = 00100100; -36 = 11011100
- $$\begin{array}{r}
 \downarrow\downarrow\downarrow\downarrow\downarrow\downarrow\downarrow\downarrow \\
 11011011 \quad (1\text{'s complement of } +36 = -37) \\
 + \quad \quad \quad 1 \\
 \hline
 11011100 \quad (2\text{'s complement of } +36 = -36)
 \end{array}$$