★ANSWER KEY – CONFIDENTIAL★

UIL COMPUTER SCIENCE WRITTEN TEST – 2016 INVITATIONAL A

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

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

* 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.

Explanation

1) C 123_8 + 45_8 = 78_{16} = 170_8 = 1320_4 = 120_{10}. Note that answer B (168_8) is not a valid octal representation.

2) A `x = 6.0, y = 0.0` (integer division), `z = 6 * 0 = 0.0`

3) D `"%d pts"` formats a string consisting of a decimal representation of `right` (6) followed by the string literal `" pts"`. Variables `wrong`, `skip`, and `pts` are not used in the output.

4) B `"[cabbage]"`: Regex matches on any `'a'`, `'b'`, `'c'`, `'e'`, or `'g'` (redundant `'a'` and `'b'` in regex are ignored.

5) A `a < b`→`r = false`, `a == b`→`r = true`; `a > b`→`r = true`

6) A `bang = 4.0` (`ceil()` rounds up), `pow = 3.0` (`floor()` rounds down), `oof = 3.0` (`min()` returns the minimum parameter)

7) E `nibble -= nibble` results in `nibble` being assigned a value of 0. This later leads to `nibble /= nibble`, which results in a "Divide by Zero" exception.

8) D Both `if()` conditions are independent of one another, so the 2nd `if()` will always be evaluated, regardless of the outcome of the 1st `if()`. The else clause is not evaluated here since it is contingent upon the 2nd `if()` evaluating to false, which it doesn't.

9) C `ch` iterates through every other uppercase letter from `'F'` through `'L'` (exclusive). Each character literal is printed in succession, all on the same line of output.

10) A   `alpha[5] = alpha[3]--;`: The post-decrementation operator (`--`) assigns the original value of `alpha[3]` (e.g., 12) to `alpha[5]`. Then `alpha[3]` is decremented from 12 to 11.

11) C   `total = -10 + 8 + 7 = 5`: Each iteration of the loop reads of 2 integers from the input string. If the first integer is even, the second integer is added to `total`. The loop exits when the `Scanner` reads off the 7.

12) D   This code accumulates powers of 2. At the end of each iteration, `seqA` and `seqB` are always powers of 2. The loop exits when the accumulated sum reaches 63.

13) B   `r = 0 + 2 = 2` (side effect: `q = 2`). `s = 2 + 4 = 6` (side effect: `q = 4`).

14) C   `short` and `char` = 16 bits of memory

15) E   `"Dewey"` inserts before `"Donald"`, `"Louis"` inserts before `"Huey"`, `"Daffy"` replaces `"Donald"`

16) C $511_{10} = 0111111111_2 >> 3 = 0000111111_2 = 63_{10}$. Also $511 / 2^3 = 511 / 8 = 63.875 \rightarrow$ truncates to 63.

17) C $999999_{10} = 1212210202000_3$

18) D   table:

0	1	2	3	4
1	2	3	4	5
2	3	4	5	6
3	4	5	6	7

0 + 1 + 2 + 3 + 4 = **10**   rows: 10
2 + 3 + 4 + 5 = **14**   14
4 + 5 + 6 = **15**   15
6 + 7 = **13**   13

19) C   Strings are sorted lexicographically by Unicode character values. `"null"` is a `String` literal, not the `null` reference.

20) B   `Alpha` is abstract and cannot be instantiated as a `new Alpha()`. Constructor `Beta(String id)` in class `Beta` requires a `String` parameter and cannot be instantiated as a `new Beta()`.

21) A   Since `agent` is instantiated as a `new Beta("007")`, the overridden method `id()` in the `Beta` class is used, which accesses the instance variable `id` privately declared within the `Beta` class (i.e., initialized w/ `"007"`).

22) E   The `toString()` method is inherited from the `Alpha` class, which accesses the instance variable `id` privately declared within the `Alpha` class (i.e., initialized w/ `"Echo"`).

23) D $O(1) < O(\log_2 N) < O(N) < O(N * \log_2 N) < O(N^2)$

24) C   Regular expression "\w+\d+" (encoded as a String w/ escape characters: "\\w+\\d|") means "one or more word characters (i.e., \w = [a-zA-Z_0-9]) followed by one or more digit characters (i.e., \d = [0-9])".

25) A   Each true value in the matrix correspond to a directed link from the node for the column to the node for the row.

26) C   Links are represented by non-weighted Boolean values. The matrix is not symmetric (i.e., a directed graph). Nodes D and E are disconnected from nodes A, B, and C.

27) D

P	Q	!(P && Q) || Q	P || Q	!P && !Q	!P || Q
0	0	1	0	1	1
0	1	1	1	0	1
1	0	1	1	0	0
1	1	1	1	0	1

28) C   String concatenation results in the `String "510"` to be parsed into an integer.

29) C   *Quicksort*: $O(N^2)$ in worst case. *Sequential Search*: O(N) in worst and average cases, O(1) in best case. *Binary Search* $O(\log_2 N)$ in worst and average cases, O(1) in best case. *Selection Sort*: $O(N^2)$ in all cases.

30) A   String splits on all individual lowercase vowels. Empty string at the end of the array after the final "e" is truncated.

31) B   Each recursive pass appends a "splat" (#) and `n` trailing dots to the end of the resulting string. Base case: `n <= 0`.

32) D   `stack = [10, 24, 36, 11, 9, 7] = [10, 11]`

33) C   `queue = [(36 + 24), (7 - 9)] = [60, -2]`

34) E   Java equivalent: `(!P || Q) && !R`

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35) A

P	Q	R	($\overline{P}$ + Q) • $\overline{R}$
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

36) D $55_{10} = 00110111_2$

37) B

38) D
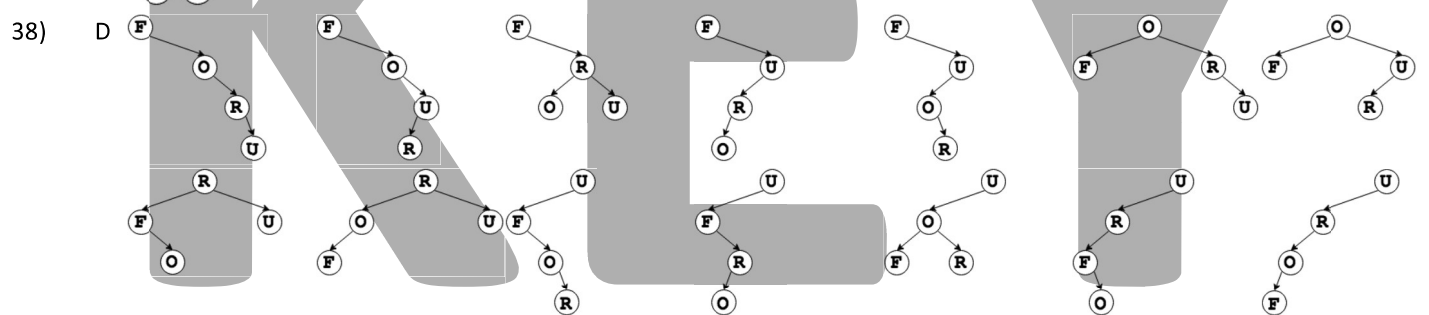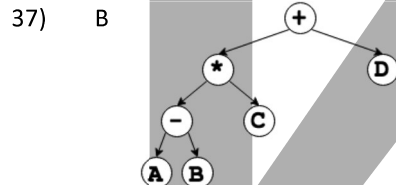
39)   Pre-order: HDBCFL. Post-order: CBFDLH. In-order: BCDFHL. Level-by-level: HDLBFC.

40)   Any answer that equivalently expresses "A Logical-OR C" is acceptable (e.g., "A + C", "C + A", "A || C", "C || A", "A or C", "C or A")