

★ ANSWER KEY – CONFIDENTIAL ★

UIL COMPUTER SCIENCE – 2022 DISTRICT

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

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

* See "Explanation" section below for alternate, acceptable answers.

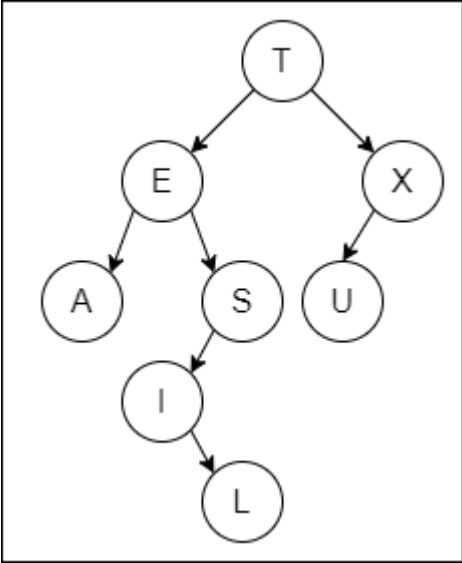
Note: Correct responses are based on **Java SE Development Kit 17 (JDK 17)** from Oracle, Inc. All provided code segments are intended to be syntactically correct, unless otherwise stated (e.g., "error" is an answer choice) and any necessary Java SE 17 Standard Packages have been imported. Ignore any typographical errors and assume any undefined variables are defined as used.

Explanations:

1.	D	$DC_{16} - BD_{16} = 1F_{16}$
2.	A	$14 - 3 - (3 * 7 / 2) = 14 - 3 - 10 = 1$
3.	C	%3f rounds to 3 places after the decimal, and printf does not print a new line
4.	C	lastIndexOf starts searching backwards at position 3, immediately finding an a
5.	B	An even number of trues and falses in an xor chain will always evaluate to false
6.	C	Signum returns a double representing the sign of a given number. Pi is positive, so signum returns 1.0
7.	D	$(-5.0 * 2.5) + 'a' = -12.5 + 97 = 84.5$
8.	A	'X' = 120, 'X' - ' ' = 'x', so 'small x' is output
9.	C	The loop executes 13 times, adding ** to the output on each iteration. Hence 26 asterisks
10.	B	[9, 5, 1, 4, 1, 3] [3, 5, 1, 4, 1, 3] [3, 5, 1, 4, 1, 3] [3, 1, 1, 4, 1, 3] [3, 1, 1, 4, 1, 3] [3, 1, 4, 4, 1, 3] [3, 1, 4, 4, 1, 3]
11.	B	The default delimiter for the next() method is whitespace. There is not any white space in the input string, so by default the code would output 1. By using SetDelimiter to delimit by commas instead, an output of 4 can be achieved.
12.	C	$1 * 1 + 2 * 2 + 4 * 4 + 8 * 8 + 16 * 16 = 1 + 4 + 16 + 64 + 256 = 341$
13.	E	Addition comes before all bitwise operations. Bitwise operations happen in SHAXOR order (shift, and, xor, or)
14.	C	Double.MIN_VALUE is the closest positive double to zero. Because it is positive, signum will return 1.0
15.	B	Due to the removal of 4 and 12, the original positions of 8 and 14 are 9 and 16, respectively. $9 * 5 \% 7 + 16 * 5 \% 7 = 3 + 3 = 6$
16.	B	$0111 \& 1001 = 1$, and the y++ increment takes place after the comparison, so the if statement evaluates to true. Y is then 5 due to the increment
17.	E	ArrayList add has an $O(n)$ worst case big O complexity for add. Every other structure option was either $O(1)$ worst case or $O(\log(n))$
18.	B	$x*x < y*y$ is equivalent to $x < y$. if x and y are picked at random, x will be less than y around half of the time, so .5 is the best estimate.
19.	D	$1024_5 = 139 = 10001011_2$ for a bitcount of 4
20.	A	set .equals method compares content regardless of any ordering. all 5 numbers are present in each set, so .equals will return true
21.	A	stacks can indeed be sorted, and they print their contents first to last

22.	B	<p>22 - 25 deal with an implementation of longest common subsequence. Below is each possible path the recursion could follow. Squares represent base cases where 0 is returned. Edges with +1 represent cases where the second if is triggered. The maximum of any path is going to go a single +1 edge, as only one exists. This is analogous to saying the two words only share one letter, so Longest Common Subsequence cannot exceed 1.</p>
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23.	C	<p>The dynamic programming table will look like this:</p> <table><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>2</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>2</td></tr></table> <p>Representing a LCS of “or”, of length 2</p>	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	2	0	0	1	1	2
0	0	0	0	0																							
0	0	0	0	0																							
0	0	1	1	1																							
0	0	1	1	2																							
0	0	1	1	2																							
24.	D	Each recursive call to rec spawns 2 new calls, and this occurs to a recursive depth of N. Hence runtime is 2 ^N																									
25.	B	Each value in the table is filled by referencing a constant number of other table values. the table is N*N, so runtime is N ²																									
26.	C	1210 ₄ = 100																									
27.	B	Cloud has exactly one constructor																									
28.	A	altitude is too high to be cumulonimbus, so type() returns cirrus																									
29.	C	B is cumulonimbus, so dangerous() returns true.																									
30.	D	[4, 5, 2, 3, 1] 1 swap [2, 4, 5, 3, 1] 2 swaps [2, 3, 4, 5, 1] 2 swaps [1, 2, 3, 4, 5] 4 swaps total of 9 swaps																									
31.	C	This is a syntactically correct functional interface and lambda function declaration. The function takes an input i and returns i % 10 + i / 10. For 12345, this evaluates to 1239																									
32.	D	Bubble sort is an O(N ²) sort, so multiplying size by 4 would expect to multiply runtime by 4 ² . 5 * 4 * 4 = 80 seconds.																									

33.	D	For any assignment between A, B, and C, D being 1 will produce one result, and D being 0 will produce the other. The number of true assignments must equal the number of false assignments, so the answer is 8.
34.	C	 <pre> graph TD T((T)) --> E((E)) T --> X((X)) E --> A((A)) E --> S((S)) X --> U((U)) S --> I((I)) I --> L((L)) </pre> <p>Post-order traversal will visit left, right, and then node.</p>
35.	C	^ denotes line beginning in java's regular expressions
36.	B	only 7 unique integers will be added to the hash table, so size will be 7. hashCode only affects the bucket that an element ends up in. After being bucketed, .equals() determines if a number is unique.
37.	C	In the worst case, every element added to a hash table could end up in the same bucket, making contains() a linear time method. Because add() calls contains(), add's worst case performance is O(N) as well
38.	E	The structure is a hash table that uses a linkedlist to handle collisions
39.	17	<p>The number must be between 15 and 20, inclusive</p> <p>The number must be odd</p> <p>The number must not be a multiple of 5</p> <p>The number must not end in 9</p> <p>The only number to satisfy all constraints is 17</p>
40.	12	A skinny tree can have a single node per level, for a total of 12 levels