Computer Science Answer Key
UIL Region 2015

1) C

2) A

3) D

4) D

5) B

6) B

7) A

8) E

9) B

10) D

11) B

12) A

13) A

14) D

15) C

16) C

17) C

18) D

19) C

20) E

21) B

22) D

23) E

24) B

25) B

26) A

27) D

28) B

29) omitted

30) A

31) C

32) B

33) A

34) E

35) A

36) A

37) C

38) E

39) SA/M+SU^NG^*-

40) 243

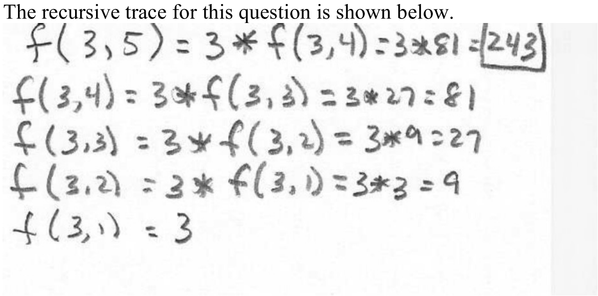
Note to Graders:

- 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 2 Packages are assumed to have been imported as needed.
- Assume any undefined (undeclared) variables have been defined as used.

Explanations:

1. 74_{16} + 1101010_2 = 116_{10} + 106_{10} = 222_{10} = 336_8 = DE_{16} = 11011110_2
2. `21/3*5+8 = 7*5+8 = 35+8 = 43`
3. The correct labels for each part are: `System`-class, `out`-object, `println`-method, `"Hello"`-parameter
4. Each “s” is replaced by “th”, not just the first one. The capital “S” is not considered.
5. In this expression, the second part of the expression where q is the only variable is the only part that really matters since q is true and using it with OR makes the entire expression true.
6. The log base 10 of 1000 is 3.0 (log10 returns a double) since 10 to the power of 3 is 1000.
7. The integer value of the character `'d'` is 100 (`'a'` is 97), therefore 100 - 33.3 is 66.7.
8. The sequence of values for a is: 0, 1(0+1), 4(1-2+5), 9(4+5), 16(9-1+8), 32(16+16), 33(32+1), 36(33-2+5), 41(36+5), 80(41-1+40), 160(80+80)
9. The sequence of values for a is: 100, 66, 44, 29, 19, 12, 8. Decimal division is indeed occurring, but the autocast feature of the /= operator converts the result back to an integer.
10. Here are the contents after the first reassignment statement - 5 3 1 3 2 - and here are the final contents - 5 2 1 3 2. The 4 is no longer in the list.
11. Only statements I and III WILL work with this code...nextChar is not a valid Java input statement.
12. Here is the sequence of the contents of each string throughout the loop.
    ```
    "" "state of texas"
    "f" "state o texas"
    "fo" "state  texas"
    "fo " "state texas"
    "fo  " "statetexas"
    "fo  t" "stateexas"
    "fo  te" "statexas"
    "fo  tee" "statxas"
    "fo  teet" "staxas"
    "fo  teetx" "staas"
    "fo  teetxa" "stas"
    ```
13. This expression involves operators from lines 3, 8, and 14 of the Java Operator Precedence chart. The 2*5 occurs first, followed by 10&7 (bitwise 1010_2 AND 111_2 ==> 0010_2), producing 2_{10}, which is then added to x resulting in the value 4 being output.
14. This problem involves the concept of common memory for Integer objects, in which any values between -127 and 128 directly assigned to Integer objects are stored in common memory, but any values constructed with the new operator are in separate memory. At first, x and y are indeed equal in the fact that they are referencing the same common memory value 100, but x and z are not since z was constructed with the new operator. Once both values are increased to 130, common memory is no longer involved, and both objects are in different memory locations.
15. The sublist method returns a view of the portion of the list between the specified fromIndex, inclusive, and toIndex, exclusive, working in a similar way to the String substring method.
16. The three parameters represent the start of the current String object (3 - "m"), the start of the parameter String (1 - "m"), and the length of the region (6) to be considered in both strings.
17. Below is the adjacency matrix for this graph, which contains 5 ones and 4 zeroes. The 1 in the top row at (P,R) indicates there is a direct one-hop path from vertex P to R, and likewise for the other 1s. A zero indicates there is no direct path.
    ```
     PQR
    P001
    Q111
    R100
    ```
18. 15 (00001111) left shift 4 becomes 240(11110000).
19. The four ordered triples that make this expression false are: 000, 001, 101, 111.
20. The formula for the first number is: hi-lo+1 (56-27+1), and the second number (offset) is always the low value(27), which means in this case there are 30 values in the range, starting with 27.
21. Since null elements are not comparable (have no natural ordering process), they cannot be inserted into a heap data structure which requires ordering to function.
22. Two layers of brackets {} and commas are required to establish the 2D array structure in a static assignment statement, the outside layer to indicate the rows, the inside layer the columns.
23. See the JDK Docs for more complete explanations for TreeMap and HashMap
24. Each choice, except for B, is a step in the simplification process. Choice A is the first step after breaking the top overbar using DeMorgan's law, followed by choice D as the double negative over the second parentheses disappears. Choice E follows as the overbar over the first term is broken, followed by $(A+\overline{B})+(A+\overline{B})$ when the double negative over the first A goes away, and finally choice C where the two like terms merge together into one term.
25. Choice B is not one of the four traversals listed, but is the order in which the elements would be stored in a 1D array representation of this binary tree.
26. The evaluation sequence is as follows: 5 + 3.1 = 8.1, 8.1+"34" = "8.134", and finally "8.134" + '1' = "8.1341".
27. Since the two Math methods sqrt and cbrt return double values, the value produced by the return expression for this method is a double value, therefore the return data type should be **`double`**.
28. The square root of 121 (11.0) plus the cube root of 343 (7.0) equals 18.0.
29. A TreeSet uses the **compareTo** method to determine element duplication as well as order since storage in natural ascending order is a feature of this collection.
30. When a class extends an abstract class, any abstract method in the abstract class must be implemented. Any other method in the abstract class MAY be overridden, but that is not required.
31. The evaluation of the expression first mathematically adds 1.0 and 9 with a result of 10.0, which is then concatenated to "B" to create the String value "10.0B".

32. In the implementation of Class Two, since the alpha method is abstract in Class One, it must be defined in Class Two. Choice B only overrides beta(), which is optional. Choices A, C, and D are all valid.
33. B describes the merge sort, C the insertion sort, D the selection sort, and E the bubble sort.
34. Choice A is A $A * B * C$, choice B is $\overline{(A * B) * C}$, choice C is $A * B + C$, and choice D is $\overline{\overline{A + B} + C}$
35. 10011101 converts back to 01100011, which is the value 99, hence the original bit string is equivalent to -99.
36. Here are the contents of this list after each command in the code: [4], [4, 5], [6, 4, 5], [6, 4, 5, 7], [6, 4, 5, 7, 8], [4, 5, 7, 8], [5, 7, 8], with the 4 being popped at the end.
37. The outside x loop values are 1, 2, 4, 8, 16, and 32. The inside loop goes from 1 to each of those values, adding a star to the string each time. The length of the string is simply the sum of all of those termination values, which is 63.
38. The values from positions 1 to 4 (7,5,2,4) in the list are sorted, with the others remaning in their original places.
39. The equivalent infix expression for this prefix expression is
`S / A + M - S ^ U * N ^ G`, which then converts to the equivalent postfix version:
`S A / M + S U ^ N G ^ * -`
40. The recursive trace for this question is shown below.



f(3,5) = 3*f(3,4) = 3*81 = $\boxed{243}$
f(3,4) = 3*f(3,3) = 3*27 = 81
f(3,3) = 3*f(3,2) = 3*9 = 27
f(3,2) = 3*f(3,1) = 3*3 = 9
f(3,1) = 3