Computer Science Contest #1314-13 Key

February 15, 2014

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

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.
- **NEW SCORING OPTION: This option will award partial credit for this question, and possibly help break some ties in the overall score. Here's how it works:**
    - **Award 3 points for each correct answer**
    - **Deduct 1 point for each incorrect answer.**
  Possible outcomes
    - **+6 = Both answers correct**
    - **+3 = One answer correct, no attempt on the other**
    - **+2 = One answer correct, other answer incorrect**
    - **+0 = No attempt**
    - **-2 = Both answers attempted, both incorrect**

Brie f Explanations:

1. 476_8 + $F0_{16}$ = 318_{10} + 240_{10} = 558_{10} = 1056_8 = $22E_{16}$ = 1000101110_2
2. The loop produces 97+100, 97+99, and 97+98, resulting in the string 197196195.
3. The compile error message reads, "actual argument int cannot be converted to char by method invocation conversion".
4. The toString method returns "Innova Disc – " followed by the type, speed, glide, fade, and turn values
5. The Object toString method is the default in case the toString method is not overridden in the class, which returns the name of the class, followed by the hashcode value in hexadecimal form. The actual hashcode value may differ from one system to another.
6. There are five instance fields in this class – speed, glide, turn, fade, and type.
7. The ! operator reverse the true or false value. P starts out true, then become false. Q stays true since the NOT of P is true.
8. The default value for a double array is 0.0. This nested loop structure simply builds a string of 14 "0.0"s, 14 being the number of elements in the four rows of this array (2+3+4+5 = 14). The length of the resulting string is 14 X 3, or 42, the answer to the universe, of course!
9. The ASCII values for '0', 'A', and 'a', are 48, 65, and 97 respectively, so the resulting string is made of the characters that correspond to the values of the array.
10. The character 'd' has an int value of 100, which when divided by 3 results in 33.
11. Since -9 causes the if condition to be false, only the second output statement is executed. Indentation only matters in Python, NOT in Java.
12. This loop does work! The output values of the loop are: 0 50, 1 25, 2 12, 3 6, 4 3, 5 1, and 6 0.
13. The values of d and e in this loop are 0.0 3.2, 6.4 6.4, 19.2 12.8, and 44.8 25.6.
14. The correct String method for this idea is ***startsWith***. There is no "beginsWith" method in the String class.
15. The Math.rint method ***"returns the double value that is closest in value to the argument and is equal to a mathematical integer."***
16. The order of precedence with bitwise operators is AND, XOR, and then OR. 9 XOR 14 results in 7, 26 AND 2 results in 2, and finally 7 OR 2 results in 7.
17. This simple expression is evaluated in standard math precedence order with 2.5*3 yielding 7.5, which when added to 4 gives 11.5.
18. Casting a double to an int loses the fractional part, which in this expression results in 14 + 14.6 = 28.6
19. See the recursive trace on the right.
20. A short in Java uses 16 bits of storage, the leftmost bit being the sign bit, zero meaning positive, and 1 meaning negative. The actual maximum value for a short is 0111111111111111, but since leading zeroes are not output, only 15 1s are shown.
21. The byte data type uses 8 bits of storage.
22. -1>>>10 essentially fills in the left side of the 32 bit integer with zeroes after the 10 shifts, resulting in only 22 1s of the original 32 that represented the value -1.
23. The xor function is true only when the operands are opposite, so the only true values are a result of false/true (01) or true/false (10).
24. The hex string representation of a double starts with "0x", followed by the decimal value, followed by the exponent indication using the letter "p". The value 16 in hex is "0x1.0p4". 31 is "0x1.fp4".
25. This is pretty straight forward: 65/10*3.14 is 6*3.14, or 18.84 (integer division first, then decimal multiplication).

Recursion solution
$f(6) = f(5)+6 = 13+6 = \boxed{19}$
$f(5) = f(4)+5 = 8+5 = 13$
$f(4) = f(3)+4 = 4+4 = 8$
$f(3) = f(2)+3 = 1+3 = 4$
$f(2) = f(1)+2 = -1+2 = 1$
$f(1) = -1$

26. 14%20 is 14, 20%14 is 6.
27. Since % takes precedence over +, two value pairs produce zero here. 6+6%3 results in 6+0, or 6, which invokes the false result of 6-6, which is zero. -2 and 2 produce -2+2%3, or -2+2, which is zero, yielding the true result of -2+2, which is zero.
28. The resulting sequence is as follows: push 2, push 5, pop the 5, push 7 and 3, pop the 3, push 1 and 6, pop the 6, push 8 and 9, pop the 9, leaving the 8 at the top of the stack.
29. This is an example of inheritance, which uses the ***extends*** keyword. For this to be an abstract class, the A class would have the word ***abstract***, and have at least one abstract method. An interface has the word ***interface***, and uses the ***implements*** keyword.
30. Since the B method returns the value of an instance field, it is considered an accessor method.
31. The default value for an A class object is 10. The class B object has two instance values – one inherited from the parent, and one of its own, with default values of 0 and 9.
32. The new object for ***a*** has a value of 1. The C method for the ***b*** object changes its instance values to the incoming parameter value and its triple. The resulting output is 1 12 and 4.
33. Since the ***a*** object now points to the ***b*** object (which is OK since a parent object reference may point to its child, but not a child to its parent), both outputs are exactly the same, with the B method returning the double value of the E class object.
34. The resulting sequence is as follows: push 2, push 5, pop the 2, push 7 and 3, pop the 5, push 1 and 6, pop the 7, push 8 and 9, pop the 3.
35. The symbol shown is the XOR symbol, similar to the OR with an extra curve at the back.
36. The TreeMap implementation of a Map outputs the values in key order, with [a, b, c, d] being the order in this case.
37. The putAll method literally puts all the values of the a map into the b map. Changes are made to the b map, but the 2 key element was not altered, so the order is [r, b, j, z].
38. The c object uses putAll with the elements of b, then again with a after it removes its 3 key element, so c keeps its 3 key element received from b, and replaces all the others with the ones from a, with a last minute change to the 2 key, resulting in [a, e, j, d].
39. This triple nested loop essentially counts how many words have duplicates of that word's first character. The words that fit this criteria are: `racecar`, `adam`, `madam`, `fife`, `lull`, `abracadabra`, `rare`, `grunge`, and `cosmic`.
40. The results of this sequence are: CMOPU with the C and M popped, then CEOPRST with C and E popped, and finally CEEINOPRST, with the C and E popped last, leaving the E at the front waiting to be popped next.