Started on	Sunday, 22 October 2023, 7:46 PM
State	Finished
Completed on	Sunday, 22 October 2023, 8:49 PM
Time taken	1 hour 3 mins
Grade	**40.50** out of 100.00

Question 1

Complete

Mark 0.00 out of 11.00

Fill in the underlined blank lines in the following code.

```
public static int roundedLog( int n) {
    // Pre-Condition:    n is a positive integer.
    // Post-Condition:  returns ⌊log n⌋ , i.e., logarithm of input n base 2 rounded down.
    int r = 0 ;
    while ( n > 1 ) {
        // Loop Invariant: _____ // fill in this line
        _____ // fill in loop body
    }
    return r ;
}
```

a. // Loop Invariant: the return value stated in the post-condition equals the current value of $r + \lfloor \log n \rfloor$ // fill in this line
   n /=2; r++; // fill in loop body

b. // Loop Invariant: r will eventually become $\lfloor \log n \rfloor$ // fill in this line
   n /=2; r++; // fill in loop body

c. // Loop Invariant: the loop repeatedly increments r and halves n // fill in this line
   n /=2; r++; // fill in loop body

d. // Loop Invariant: the purpose of the loop is to compute $\lfloor \log n \rfloor$ // fill in this line
   r = (int) (Math.log10(n) / Math.log10(2)) ; // fill in loop body

e. More than one of the other choices are correct.

f. None of the other choices are correct.

Question 2

Complete

Mark 8.00 out of 8.00

What is type erasure in Java generics?

a. The process of adding generic type information during compilation

b. The process of removing all generic type information during compilation

c. The process of enforcing generic type information at runtime

d. The process of dynamically updating generic type information during program execution

Question 3

Complete

Mark 10.00 out of 10.00

The solution to the recurrence relation $T(n) = T(n-2) + n/2$ is $T(n) = \Theta$ (____?____).

a. n

b. $n \log n$

c. None of the other choices.

d. $\log n$

e. n^2

Question 4

Complete

Mark 11.00 out of 11.00

We are given an array $A[0..n-1]$ of n numbers where the first $\log n$ numbers appear in arbitrary order but the remaining $n - \log n$ numbers appear in increasing order. We are also given a search key k and want to find out whether number k appears in array A. The most efficient algorithm to do the search will take Θ (_____?_____) time in the worst case.

a. n

b. $\log \log n$

c. None of the other choices.

d. $\log n$

e. $\log^2 n$

Question 5

Complete

Mark 0.00 out of 10.00

```
/**
 * Pre-Cond:   Input is an integer array A.
 * Post-Cond: Elements of A are rearranged into two groups.
 *            Non-negative elements form the first group;   negative elements the second group.
 *            The relative order of elements within each group remains undisturbed.
 * Example:   [ -4,  6,  2,  8,  -9,  -7,  0,  -5,  3]   becomes   [ 6,  2,  8,  0,  3,  -4,  -9,  -7,  -5].
 */
public static void splitBySign(Integer[] A) {
    // TODO:  place a correct subset of the numbered lines below in correct order here.
}
```

1. int r = A.length -1;
2. r = A.length -1;
3. int r = 0;
4. r = 0;
5. A[r--] = S.pop();
6. A[r++] = S.pop();
7. if (A[i] >= 0) A[r++] = A[i]; else S.push(A[i]);
8. if (A[i] < 0) A[r--] = A[i]; else S.push(A[i]);
9. while (!S.empty())
10. Stack<Integer> S = new Stack<>();
11. for (int i = 0; i < A.length; i++)
12. for (int i = A.length -1; i >= 0; i--)

a. None of the other choices are correct.

b. 3, 10, 11, 7, 2, 9, 5.

c. 3, 10, 11, 7, 9, 5.

d. 1, 10, 12, 8, 9, 5.

e. More than one of the other choices are correct.

f. 10, 3, 12, 7, 9, 5.

Question 6

Complete

Mark 0.00 out of 8.00

If $T_1(n) = O(f(n))$ and $T_2(n) = O(f(n))$, then $T_1(n) = O(T_2(n))$.

a. False

b. True

Question 7

Complete

Mark 0.00 out of 11.00

The worst-case running time of the algorithm below is $T(n) = \Theta$ (_____?_____).

```
public static double foo( double x , int n) {
    if ( x  < 10 || n < 5 ) return 2*x*(n+5) ;
    double e = 0;
    for ( int i = 0; i < n; i++ )   e += 5*(i+7)*(i+n);
    return foo(x+4 , n/2) + foo(x+7 , n/2) + 5*(e+3)*(n+7) ;
}
```

a. n

b. n^2

c. $n^2 \log n$

d. This method may not terminate.

e. $n \log n$

f. 2^n

Question 8

Complete

Mark 11.00 out of 11.00

What is the asymptotic running time of the method below as a function of n?

```
public void doubleLoop ( int n ) {
   for ( int k = 1; k < n*n; k +=5 )
       for ( int m = 1; m < k; m *=3  )
           System.out.println( k*m*m );
}
```

- a. $\Theta(n^2 \log n)$
- b. None of the other choices.
- c. $\Theta(n^2)$
- d. $O(n \log n)$
- e. $O(n \log^2 n)$
- f. $\Omega(n^4 \log n)$

Question 9

Complete

Mark 0.00 out of 10.00

Order the following three functions of n in increasing order of growth rate:

$$F(n) = \frac{3n^2 \log^5 n + 4n^3}{7 \log^2 n + 2\sqrt{6n \log^2 n}}, \quad G(n) = \frac{5n \log^{100} n + 7n^3 \sqrt{n} \log n}{n^{1.7} + n^2 \log n}, \quad H(n) = \frac{5n^4 + n \log n}{n + 5\sqrt{n} \log n}.$$

- a. $F(n) \ll G(n) \ll H(n)$
- b. $H(n) \ll G(n) \ll F(n)$
- c. $G(n) \ll F(n) \ll H(n)$
- d. None of the other choices.
- e. $G(n) \ll H(n) \ll F(n)$
- f. $H(n) \ll F(n) \ll G(n)$

Question 10

Complete

Mark 0.50 out of 10.00

Consider the following:

1. fully parenthesized infix expression `( ( ( x + 3 ) - ( y * z ) ) / ( ( 7 * y ) - ( 5 * x ) ) )`
2. un-parenthesized postfix expression `5 x * 7 y * - y z * x 3 + - /`
3. un-parenthesized postfix expression `x 3 + y z * - 7 y * 5 x * - /`
4. un-parenthesized prefix expression `/ - + x 3 * y z - * 7 y * 5 x`

The question is which of them are equivalent, i.e., represent exactly the same expression.

- a. No two of them are equivalent.
- b. Only 1, 3 are equivalent.
- c. Only 1, 4 are equivalent.
- d. Only 1, 3, 4 are equivalent.
- e. Only 1, 2, 4 are equivalent.
- f. 1 is equivalent to 3, and 2 is equivalent to 4.

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Jump to...

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