Problem 1. Asymptotic Analysis

We has received requests for more examples of asymptotic analysis! For each of the following, give the performance of the specified procedure (both time and space) in big-O notation as a function of n.

1.
```
void MoreQuacks(int n)
{
        for (int i=0; i<n; i++)
        {
                for (int j=n+1; j<i; j++)
                {
                        System.out.println("Quack.");
                }
        }
}
```

2.
```
void WhoQuacked(int x)
{
        for (int i=10000; i>=1; i/=2)
        {
                System.out.println("Duck.");
        }
}
```

3.
```
void MakeMeQuack(int n)
{
        if (n >= 1000) {
                System.out.println("Quack.");
                return;
        }
        int[] a = new int[n];
        MakeMeQuack(n+1);
}
```

```
4.      int RecursiveQuacks(int n)
        {
            if (n < 2)
            {
                System.out.println("Quack.");
                return 1;
            }
            else
            {
                for (j=1; j<n; j++) System.out.println("Quack.");

                int a = RecursiveQuacks(n/3);
                int b = RecursiveQuacks(n/3);
                int c = RecursiveQuacks(n/3);
                return(a+b+c);
            }
        }

5.      void QuackWithAStack(int n, Stack s)
        {
            for (int i=0; i<n/2; i++) {
                s.push(i);
                s.pop();
                System.out.println("Quack.");
            }
        }

6.      int RecursiveQuackQueue(int n, Queue q)
        {
            if (n<2) {
                return n;
            }
            for (int i=0; i<2; i++) {
                q.enqueue(RecursiveQuackQueue(n/2, q));
            }
            return n;
        }
```

Problem 2.   More Asymptotic Analysis

If the previous problems weren't enough, try your hand at the following. For each of the problems below, choose the best (tightest) asymptotic upper bound from among the given options. Some of the following may appear more than once, and some may appear not at all. **Please write the letter in the blank space beside the question.**

A. $O(1)$ B. $O(\log n)$ C. $O(n)$ D. $O(n \log n)$

E. $O(n^2)$ F. $O(n^4)$ G. $O(2^n)$ H. None of the above.

Problem 2.a.

$$T(n) = \left(\frac{3n^2}{32}\right)\left(\frac{n^2}{2}\right) + \frac{n^2}{n - 10} + n^2 \log n \qquad T(n) = \boxed{}$$

Problem 2.b.

$$T(n) = T(n/4) + 3n \qquad T(n) = \boxed{}$$

3

Problem 2.c.

$$T(n) = T\left(\frac{n}{4}\right) + T\left(\frac{3n}{4}\right) + 3n$$

$T(n) =$

Problem 2.d.

$$T(n) = T\left(n - \frac{n}{2}\right) + 2n^2$$

$T(n) =$

Problem 2.e.   (Optional)

$$T(n) = \sum_{i=1}^{5} T(n/2) + c$$

$T(n) =$

Problem 2.f.   (Optional)

$$T(n) = 2T(n-1) + 5n$$

$T(n) =$