Name: ____Julia Nelson_____ Date: _____09/13/19_____

Pledge: "I pledge my honor that I have abided by the Stevens Honor System."__

Give the complexity of the following functions. Choose the most appropriate notation from among O, θ, and Ω.

1.
```
void function1(int n) {
    for (int i = 1; i <= n; i++) {
        for (int j = i; j <= n; j += 2) {
            cout << "*";
        }
    }
}
```
Answer: ____$\theta(n^2)$____ ...(n x $\lfloor$ n/2 $\rfloor$)

2.
```
void function2(int n) {
    int count = 0;
    for (int i = 1; i * i <= n; i++) {
        count++;
    }
    cout << count;
}
```
Answer: __$\theta(\sqrt{n})$___ ...$\lceil$ ($\sqrt{n}$) $\rceil$ steps

3.
```
void function3(int n) {
    int count = 0;
    for (int i = n/2; i <= n; i++) {
        for (int j = 1; j + n/2 <= n; j++) {
            for (int k = 1; k <= n; k *= 2) {
                count++;
            }
        }
    }
    cout << count;
}
```
Answer: ___$\theta((n/2)^2 \log n)$_

4.
```
void function4(int n) {
    int count = 0;
    for (int i = n/2; i <= n; i++) {
        for (int j = 1; j <= n; j *= 2) {
            for (int k = 1; k <= n; k *= 2) {
                count++;
            }
        }
    }
    cout << count;
}
```
Answer: __$\theta((n/2) (\log n)^2)$__

5.
```
void function5(int n) {
    if (n % 2 == 0) {
        return;
    }
    for (int i = 1; i <= n; i++) {
        for (int j = 1; j <= n; j++) {
            cout << "*";
            break;
        }
    }
}
```
Answer: _____$O(n^2)$_____

6.
```
void function6(int n) {
    int count = 0;
    for (int i = 1; i <= n/2; i++) {
        for (int j = 1; j <= n/3; j++) {
            for (int k = 1; k <= n/4; k++) {
                count++;
            }
        }
    }
    cout << count;
}
```
Answer: _____$\theta(n^3)$_____

7.
```
void function7(int n) {
    for (int i = 1; i <= n; i++) {
        for (int j = 1; j <= n; j += i) {
            cout << "*";
        }
    }
}
```
Answer: ___$\theta(n^2)$_

8.
```
void function8(int n) {
    int i = 1, s = 1;
    while (s <= n) {
        i++;
        s += i;
        cout << "*";
    }
}
```
Answer: __$\theta(n)$___

9. Processing Arrays
   a. Suppose you have an unsorted array of integers of length n and want to sum all the elements inside it. What is the running time of your algorithm? __O(n)___
   b. Suppose you have an unsorted array of integers of length n and want to determine if all the values inside are positive. What is the running time of your algorithm? worst: O(n) best: O(1)
   c. Suppose you have a sorted array of integers of length n and want to determine the median value. What is the running time of your algorithm? __O(n/2)__(half is median.. length/2)

10. _TRUE_ T / F $f(n) = 3n^2 + 4n + 2 \in \theta(n^2)$
    If true, prove it by giving *integral* values for the required constants c_1, c_2, and n_0. Choose the tightest values possible for the c_1 and c_2 constants. If false, show the contradiction.

True.

$3n^2+4n+2 \leq cn^2$ for $n \geq n_0$

$3 + \frac{4}{n} + \frac{2}{n^2} \leq c$

$f(n) = 3n^2+4n+2$

$c_1 n^2 \leq f(n) \leq c_2 n^2$

c_1:

$3 + \frac{4}{n} + \frac{2}{n^2} \geq c_1$

As $n \to \infty$

$4/n \to 0$ and $\frac{2}{n^2} \to 0$

So 3 is tightest value of c_1

c_2:

$3 + \frac{4}{n} + \frac{2}{n^2} \leq c_2$

As $n \to \infty$ $\frac{4}{n} \to 0$ and $\frac{2}{n^2} \to 0$

max val when $n = n_0$

$c_2 = 3 + \frac{4}{n} + \frac{2}{n^2}$

$= 3 + \frac{4}{n_0} + \frac{2}{n_0^2}$

$n_0 = 1$

$= 3 + \frac{4}{1} + \frac{2}{1^2} = 9$

$c_1 = 3 \quad c_2 = 9 \quad n_0 = 1$