CS 385, Lab: Analysis of Algorithms

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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.

```
void function1(int n) {
    for (int i = 1; i <= n; i++) {
        for (int j = i; j <= n; j += 2) {
            cout << "*";
        }
    }
}
```

Answer: $\Theta(n^{2})$

```
void function2(int n) {
    int count = 0;
    for (int i = 1; i * i * i <= n; i++) {
        count++;
    }
    cout << count;
}
```

Answer: $\Theta(\sqrt[3]{n})$

```
void function3(int n) {
    int count = 0;
    for (int i = 1; i * i <= n; i++) {
        for (int j = 1; j + n/2 <= n; j++) {
            for (int k = 1; k <= n; k *= 2) {
                count++;
            }
        }
    }
    cout << count;
}
```

Answer: $\Theta(n * \sqrt{n} * log_{2}(n))$

```
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:$\Theta(nlog^{2}{}_{2}(n))$

```
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)

```
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: $\Theta(n^3)$

```
void function7(int n) {
    for (int i = 1; i <= n; i++) {
        for (int j = 1; j <= n; j += i) {
            cout << "*";
        }
    }
}
```

Answer: $\Theta(n^2)$

```
void function8(int n) {
    int i = 1, s = 1;
    while (s <= n) {
        i++;
        s += i;
        cout << "*";
    }
}
```

Answer: $\Theta(\sqrt{n})$

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? Θ(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? O(n)

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? Θ(1)

__**T**__ T / F $f(n) = 5n^2 + 4n + 8 \in \theta\left(n^2\right)$

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.

$c_2\ tried\ 4\ and\ 5.\ Neither\ work$

$c_2 = 6$

$5n^2 + 4n + 8 \le n^2c_2$

$plug\ in\ c_2 -> 5n^2 + 4n + 8 \le 6n^2$

$Getting\ n_0$

$0 \le 6^2 - 4 * 6 - 8$

$0 \le 4$

$n_0 = 6$

$c_1 = 5$

$c_1n^2 \le 5n^2 + 4n + 8$

$5n^2 \le 5n^2 + 4n + 8\ works$

$n_0 = 6$

$c_1 = 5$

$c_2 = 6$