

Name: Jessica NoelDate: September 17, 2020Pledge: 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 , , and .

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

Answer: $\Theta(n^2)$

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

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

```
3. 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: $\Theta(n \log(n))$

```
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: $\Theta(n \log^2(n))$

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 << "i*j";
            break;
        }
    }
}
```

Answer: $O(n)$

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 << "i*j";
        }
    }
}
```

Answer: $\Theta(n \log(n))$

8.

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

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

9. Processing Arrays

- 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? $\Theta(n)$
- 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? $\Theta(n)$

- 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? $\Theta(1)$

10. True T/F $f(n) = 5n^2 + 4n + 8 \in \Theta(n^2)$

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.

$$c_1 = 5 \quad c_2 = 6 \quad n_0 = 6$$

$$\text{Lower Bound: } 5n^2 + 4n + 8 \geq 5n^2, (\forall n \geq 1)$$

$$\text{Upper Bound: } 5n^2 + 4n + 8 \leq 6n^2, (\forall n \geq 6)$$