CS 385, Lab: Analysis of Algorithms

Name:

Natalie Zoladkiewicz

Date: 09/22/23

Pledge:

I pledge my honor that I have abided by the Stevens Honor System

Give the asymptotic complexity of the following functions. Choose the most appropriate notation from among , , and . Give only a single answer for each question (giving more than one answer will result in a zero for that question).

1.
```
void function1(int n) {
  for (int i = 1; i <= n; i++) {
    for (int j = i; j <= n; j += 2) {
      cout << "*";
    }
  }
}
```
Answer: $\Theta(n^2)$

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: $\Theta(n^{\frac{3}{2}}\log_2(n))$

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: $\Theta(n \cdot (\log_2 n)^2)$

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: $O(n)$

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: $\Theta(n \log n)$

8.
```
void function8(int n) {
  int i = 1, s = 1;
  while (s <= n) {
    i++;
    s += i;
    cout << "*";
  }
}
```

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

9. Processing Arrays
   a. Suppose you have an unsorted array of integers of length and want to sum all the elements inside it. What is the running time of your algorithm? $\Theta(n)$
   b. Suppose you have an unsorted array of integers of length 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 and want to determine the median value. What is the running time of your algorithm? $\Theta(1)$

10. True or False: Answer: True

Then, if true, prove it by giving integer values for the required constants 5, 6 and 6. Choose the tightest values possible for the and constants. If false, show a contradiction.