CIS351

Homework 6-Algorithm Analysis

For each of the methods below:

- Determine how the input size should be measured.
- Determine the BigO complexity.

Listing 1

Count *all* arithmetic operations.

```
public static int someFunc1(int[] numbers) {
  int sum = 0;

  for (int num : numbers) {
    sum += num;
    for (int i = 0; i < 20; i++) {
      sum += i;
    }
  }
  return sum;
}
```

- Input size?
- BigO complexity?

Answer:

Listing 2

Count *all* arithmetic operations.

```
public static int fun(int[] numbers) {
  int sum = 0;

  for (int i = 0; i < numbers.length; i++) {
    for (int j = i; j < numbers.length; j++) {
      sum += numbers[i] * numbers[j];
    }
  }
  return sum;

}
```

- Growth function?
- BigO complexity?

Answer:

Listing 3

Read the following pseudocode carefully, and count assignments to `s`.

```
PROCEDURE DoStuff(numbers1, numbers2)
  s <- 0

  FOR x IN numbers1 DO
    FOR y IN numbers2 DO
       IF x < y DO
         RETURN 0
       ELSE
         s <- s + x
       ENDIF
     ENDFOR
  ENDFOR

  FOR x IN numbers2 DO
    s <- s + x
  ENDFOR

  RETURN s
```

- Input size?
- BigO complexity?

Answer:

Listing 4

Count *all* arithmetic operations.

```
  public static int fun2(String sentence) {

    int[] counts = new int[sentence.length()];

    for (int i = 0; i < sentence.length(); i++) {
      for (int j = i; j < sentence.length(); j++) {
        if (sentence.charAt(i) == sentence.charAt(j)) {
          counts[i] += 1;
        }
      }
    }

    int howMany = 0;
    for (int count : counts) {
      if (count > 1) {
        howMany++;
      }
    }
    return howMany;
  }
```

- Input size?
- BigO complexity?
- Question: Have we chosen the best basic operation here? Can you think of a different choice that would simplify the analysis, but lead to the same BigO complexity class?

Answer:

Listing 5

Use incrementing `sum` as the basic operation. For the sake of simplicity, you may assume that the length of numbers is a power of 2.

```
 public static int fun4(int[] numbers) {
  int sum = 0;
  for (int i = numbers.length - 1; i >= 1; i /= 2) {
    for (int j = 0; j < numbers.length / 2; j++) {
      sum++;
    }
  }
  return sum;
}
```

- BigO complexity?

Answer:

Submission Instruction

Make a report with all the answers corresponding to the above 5 problems.

1. **Submit the PDF version of the report in Blackbaord**
2. **Make sure the report has your name in BLOCK LETTERS**
3. **Handwritten answers will NOT be accepted**