CS 61B Regex, Bits & Algorithmic Analysis Fall 2015

1 Bit Manipulation

- 1. Write 22 in binary.
- 2. Assuming $x_1, x_2, ..., x_n$ are integers. What is $(x_1^{x_2^{\dots} x_n})^{(x_1^{x_2^{\dots} x_n})?}$
- 3. Write an expression to check whether a 32-bit integer is less than 0 using only == and the bit operators.
- 4. What does the following code do?

```
public static int mysteryBit(int n) {
    return n & (n - 1);
}
```

5. Write a program to count the number of 1 bits in an integer. You can use the function in part 5 as a hint.

```
public static int countBits(int n) {
```

}

2 Algorithmic Analysis

- 1. For each of the following function, find the Big-Theta expression for:
 - a) The number of i += 1 or $i \neq = 2$ operations
 - b) The number of j += 1 operations
 - c) The number of print operations
 - d) The runtime of the function

```
public static void printIndices(int n) {
    for (int i = 0; i < n; i += 1) {
        for (int j = 0; j < i; j += 1) {
            System.out.println(i + j);
        }
    }
}
public static void printIndices2(int n) {
    for (int i = 1; i < n; i *= 2) {
        for (int j = 0; j < i; j += 1) {
            System.out.println(j);
        }
    }
}</pre>
```

2. What is the big-Theta running time of the following functions?

```
public int weirdFib(int n) {
    if (n <= 1) {
        return n;
    }
    return weirdFib(n - 1) + weirdFib(n - 1);
}
public static void mystery(int n) {
    if (n == 1) {
        return;
    }
    for (int i = 0; i < n; i += 1) {
        mystery(n-1);
    }
}</pre>
```

3 Regex

Write a Java regular expression to match each of the following sets of binary strings. You may only use the following characters: () |01*

- 1) All binary strings
- 2) Binary strings that begins and ends with 1
- 3) Binary strings that contains at least three 1s
- 4) Binary string that contains at least three consecutive 1s
- 5) Binary string that doesn't contain the substring 110.