Instructions

1. This assignment is to help you prepare for Quiz 0 (to be held at the beginning of class on Thursday, August 30).

2. Your answers to the programming questions here and in Quiz 0 can be implemented in C, C++, Java, Perl, or Python. Ask the instructors if you want to use a language not in this list.

3. This assignment is optional, and you don’t need to submit anything for it.

4. Solutions will be posted on the course website before the quiz.

Problem 1: Some math

(a) If I roll three fair dice (each has six faces, labeled \{1, \ldots, 6\}, with equal probability), what is the probability that at least one of them is a 6?

(b) Find the value of $x$ that maximizes $f(x) = x^m(1 - x)^n$.

Problem 2: Parentheses

(a) Write a program that reads in lines of text, and, for each line, prints \texttt{yes} if the parentheses are balanced, and \texttt{no} otherwise.

Sample Input

```plaintext
(1/(2+3))
(1/(2+3)))
)))((
```

Correct Output

```plaintext
yes
no
no
```

What is the time and space complexity of your algorithm?
(b) Now extend your program to match both parentheses and square brackets.

Sample Input

(1/[2+3])
(1/[2+3])

Correct Output

yes
no

What is the time and space complexity of your algorithm now?

**Problem 3: Word Frequency**

Write a program that takes some text as input, and, for each unique word (NLP people say, each word type), outputs a line containing the number of occurrences of the word, followed by the word itself. The lines should be sorted by decreasing frequency. For example:

Sample Input

Beautiful is better than ugly.
Explicit is better than implicit.
Simple is better than complex.
Complex is better than complicated.
Flat is better than nested.
Sparse is better than dense.

Correct Output

6 than
6 is
6 better
1 ugly.
1 nested.
1 implicit.
1 dense.
1 complicated.
1 complex.
1 Sparse
1 Simple
1 Flat
1 Explicit
1 Complex
1 Beautiful