

EECS 281, Week 1: Wednesday

Hello world! Each week, I will try to bring a handout similar to this one in an effort to make it easier for you to follow along. If you'd like, you can take more detailed notes separately, but I will usually post notes (along with slides and code) on my website (maximal.io) as well.

Asymptotics

Name	Big O	Big Omega	Big Theta
Notation	$f(n) \in O(g(n))$	$f(n) \in \Omega(g(n))$	$f(n) \in \Theta(g(n))$
Informal meaning	Order of growth of $f(n)$ is less than or equal to $g(n)$	Order of growth of $f(n)$ is greater than or equal to $g(n)$	Order of growth of $f(n)$ is $g(n)$
Example family	$O(N^2)$	$\Theta(N^2)$	$\Omega(N^2)$
Family members	$\frac{N^2}{2}, 2N^2 + 1, \log(N)$	$\frac{N^2}{2}, 2N^2 + 1, e^N$	$\frac{N^2}{2}, 2N^2 + 1, N^2 + 183N + 5$

CAEN

To configure GCC, execute

```
cd
cat >> .bash_profile
module load gcc/5.1.0
```

then press Control-D.

Valgrind

Getopt

Vector

Deque

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Boyer-Moore majority vote algorithm

Suppose you are given a vector of values, and want to determine whether or not it has a majority element (one that occurs more than half the time). You can use Boyer-Moore Majority Vote Algorithm. It is stated as follows (adapted from Wikipedia):

```
Create an element most and a counter count with count = 0
For each element x of the input sequence:
    If count = 0, then assign most = x and count = 1
    else if most = x, then assign count = count + 1
    else assign count = count - 1
```

This will determine a possible majority element. You must then count how many times most actually occurs. If it occurs more than half the time, you can then report that most is a majority element, otherwise you cannot.

Implement mooresVoting below.

```
/**
 * Changes most to be a potential majority element.
 * Returns true if most is a majority element,
 * otherwise returns false.
 * The .size() of the data vector must be at least 1.
 */
template <typename T>
bool mooresVoting(const vector<T> &data, T &most) {

}
}
```

When finished, take a picture of your code and email it to maximal@umich.edu.