

# More Basics of Mathematica Problems Day I [by Jason]

## Easy Problems

- Implement Factorial
- Implement Fibonacci and compare to the performance of the built in Fibonacci.
- Add a function  $f[a, \dots, b] \rightarrow g[a, b]$
- Add a function to drop the duplicate elements of a list
- Add a function to sort a list
- Implement your own version of the system function Riffle
- Implement a function ExtractKth[expr,k] that will keep every kth element of a structure

## Medium Problems

- Implement a function MyExtract in terms of Part, Map, and Sequence etc which does exactly the same thing as Extract (apart from the operator form). You will need to read the documentation on Sequence since it will be covered in my next lecture. Bonus : look at optional arguments.

## Recurrence Relations

### Part 1

Starting with the recurrence relation:

`RSolve[{a[n] == a[n - 2] + a[n - 1], a[1] == 1, a[2] == 1}, a, n]`

change the equation by adding a 'b' in front of the  $a[n-2]$  term, then evaluating that and then and taking a limit, to find the closed form solution for the  $n^{\text{th}}$  Fibonacci number.

### Part 2

Note the factor  $\frac{1+\sqrt{5}}{2}$ , in your solution. What is that number?

### Part 3

Use FullSimplify to verify that your closed form for the  $n^{\text{th}}$  Fibonacci number is correct for the first 100 values.

### Part 4

What is the difference between consecutive terms for large n?