

## MA/CSSE 473 Day 02 Summary

### Main ideas from today:

1. Master Theorem review:
2. What are the a, b, and k for binary search?

- Consider the recurrence  $T(n) = aT(n/b) + f(n)$ ,  $T(1)=c$ , where  $f(n) = \Theta(n^k)$  and  $k \geq 0$ ,
- The solution is
  - $\Theta(n^k)$  if  $a < b^k$
  - $\Theta(n^k \log n)$  if  $a = b^k$
  - $\Theta(n^{\log_b a})$  if  $a > b^k$

3. What are the a, b, and k for merge sort?

```
def fib1(n):  
    if n==0:  
        return 0  
    if n==1:  
        return 1  
    return fib1(n-1) + fib1(n-2)  
print fib1(6), fib1(7), fib1(8)
```

4. Analysis of recursive Fibonacci algorithm:

Recurrence for number of operations:

Show by induction that  $T(N) > F(n)$ :

How long to compute  $F(200)$  on an exaflop machine ( $10^{18}$  operations per second)?

Linear algorithm?

Better than linear, using matrices?

5. When we add three 1-digit integers, how many digits can be in the answer? Is this independent of the base (i.e, the same for decimal, binary, hexadecimal, etc.).
6. How does the previous question apply to the analysis of the addition of two  $k$ -bit non-negative integers?
7. What about multiplication of two  $k$ -bit integers?