

COS 126 Precept

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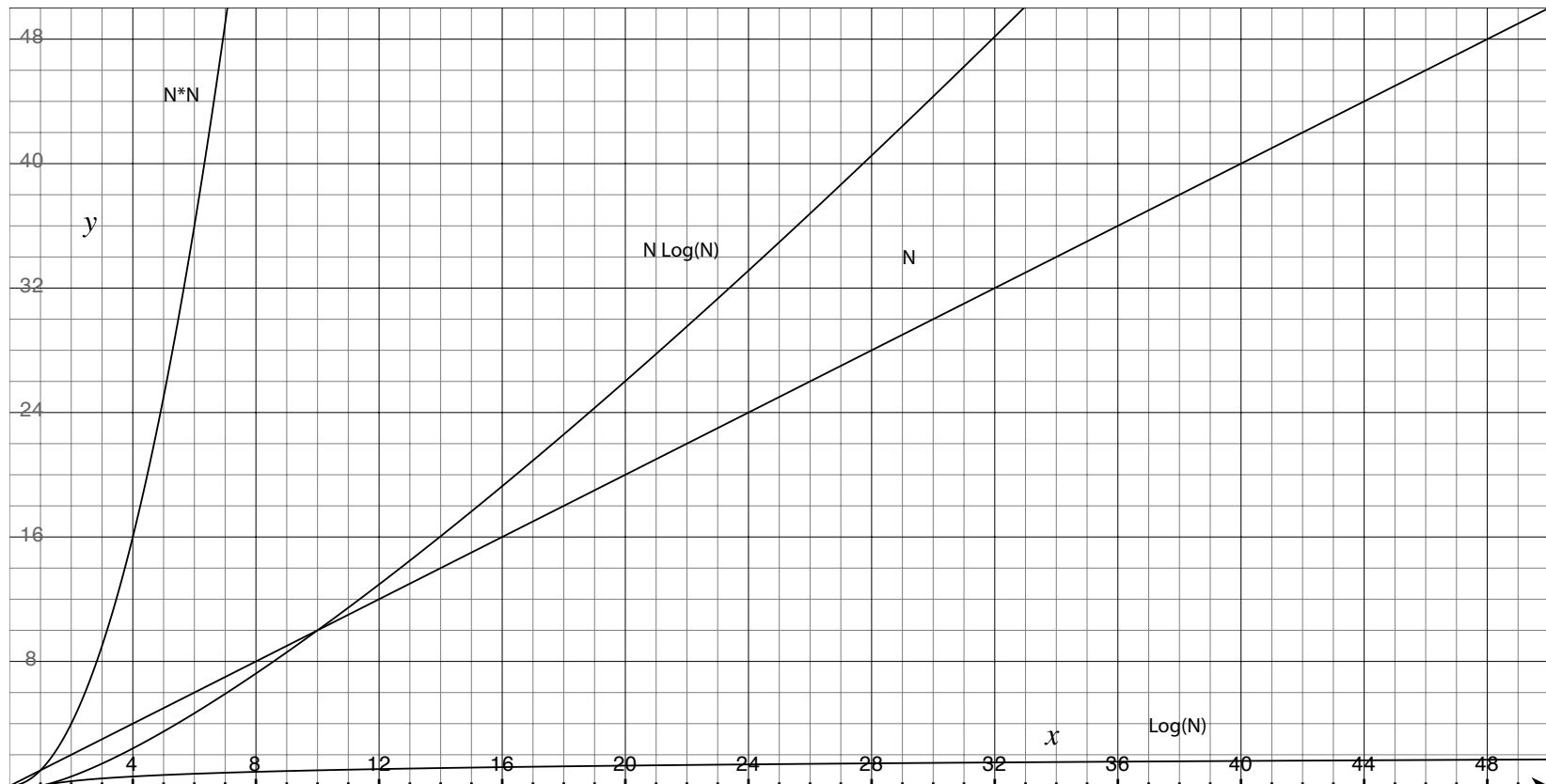
Outline

- ▶ Questions from Lecture
- ▶ Guitar Hero remix
- ▶ Analysis of Algorithms/Performance




Order of Growth

- ▶ How does a program's running time change as the size of the input grows?



Order of Growth Classifications



Increasing Time as function of Input (N)	
	1
	$\text{Log}(N)$
	N
	$N * \text{Log}(N)$
	N^2
	N^3
	2^N
	$N!$



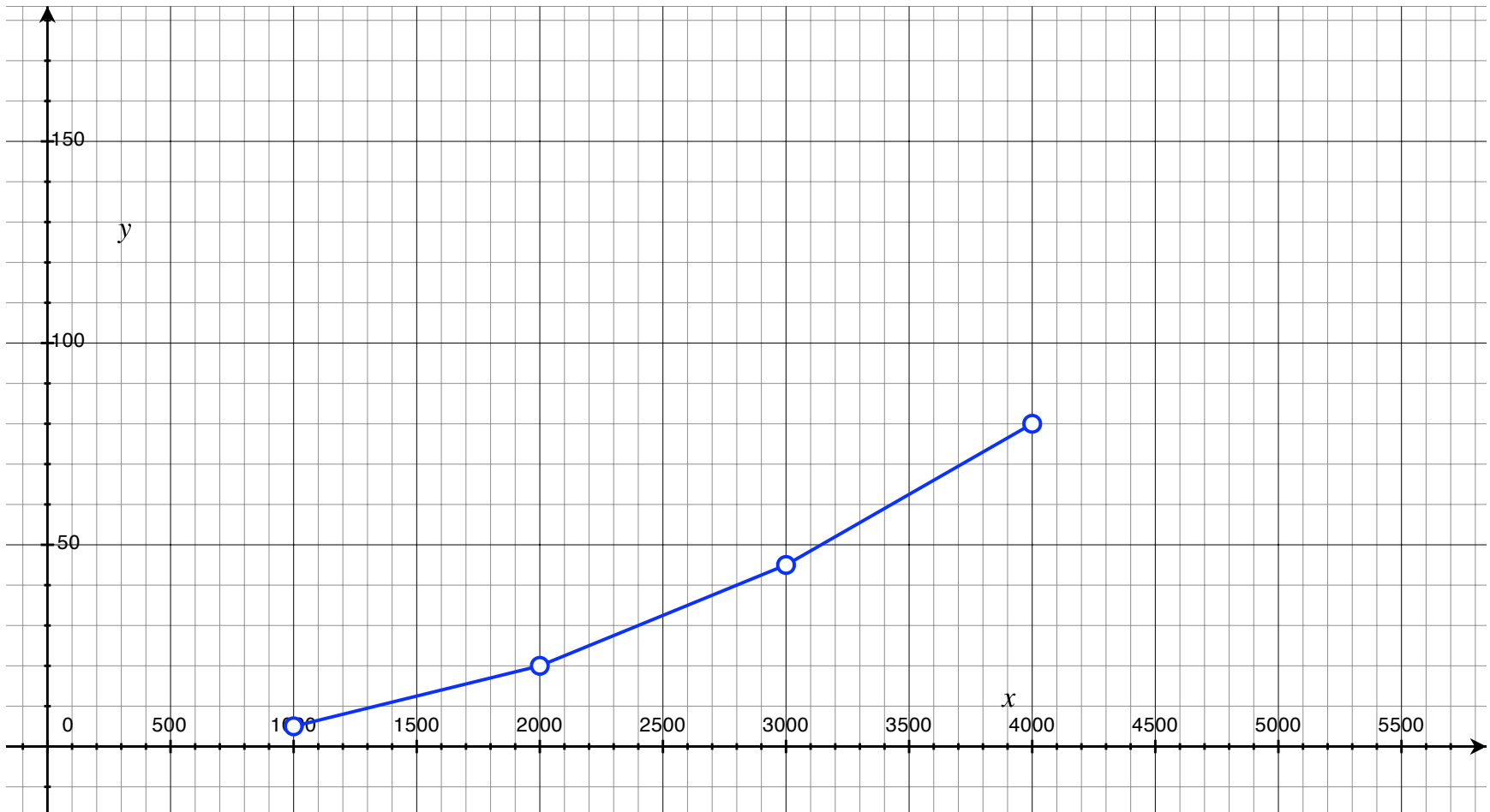
Doubling Hypothesis

- ▶ What happens to running time if we double the size of the input?
 - ▶ Will use this on TSP assignment (in readme)
- ▶ Example: What is running time if

Input Size	Running Time (s)
N	5
2*N	20
4*N	45
8*N	80



Graph of Data Points



Empirical Analysis

- ▶ Measure how long program takes to run
- ▶ Use inputs of varying data sizes
- ▶ Fitting a curve

- ▶ Note: not 100% precise in practice

- ▶ But how do we measure running time?
 - ▶ `StopWatch.java`



Mathematical Analysis

- ▶ Analyze the code
 - ▶ N-Body Force Calculation
 - ▶ Another Example

```
// return number of distinct triples (i, j, k) such that a[i] + a[j] + a[k] = 0
public static int count(int[] a) {
    int N = a.length; int cnt = 0;
    for (int i = 0; i < N; i++) {
        for (int j = i+1; j < N; j++) {
            for (int k = j+1; k < N; k++) {
                if (a[i] + a[j] + a[k] == 0) {
                    cnt++;
                }
            }
        }
    }
    return cnt;
}
```



Empirical Analysis

- ▶ String Concatonation

