# CSC148 fall 2013

## sorting big-oh
## week 9

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# Outline

more big-oh

# running time analysis

algorithm's behaviour over large input (size $n$) is common way to compare performance

- constant: $c \in \mathbb{R}^+$ (some positive number)
- logarithmic: $c \log n$
- linear: $cn$ (probably not the same $c$)
- quadratic: $cn^2$
- cubic: $cn^3$
- exponential: $c2^n$
- horrible: $cn^n$ or $cn!$

# case: $\lg n$

this is the number of times you can divide $n$ in half before reaching 1.

- refresher: $a^b = c$ means $\log_a c = b$.
- this runtime behaviour often occurs when we "divide and conquer" a problem (e.g. binary search)
- we usually assume $\lg n$ (log base 2), but the difference is only a constant:

$$2^{\log_2 n} = n = 10^{\log_{10} n} \Longrightarrow \log_2 n = \log_2 10 \times \log_{10} n$$

- so we just say $\mathcal{O}(\lg n)$.

# hierarchy

Since big-oh is an **upper-bound** the various classes fit into a hierarchy:

$$\mathcal{O}(1) \subseteq \mathcal{O}(\lg n) \subseteq \mathcal{O}(n) \subseteq \mathcal{O}(n^2) \subseteq \mathcal{O}(n^3) \subseteq \mathcal{O}(2^n) \subseteq \mathcal{O}(n^n)$$

# selection sort (review?)

idea: for each position in the list, select the minimum item from that position on

# merge sort

idea: divide the list in half, (merge) sort the halves, then merge the sorted results

# quick sort

idea: choose a pivot; decide where the pivot goes with respect to the rest of the list, repeat on the partitions...

# scaling:

How well do these various sorts perform as the size of the problem (list length) increases? Time and compare.

# term test #2

- Same time as lecture, but in EX300 (A–L) and EX310 (M–Z)
- You are responsible for lecture examples, assignment 2, labs, and exercises. That's where I'll look for suitable questions.
- Topics include, but not limited to: binary trees, linked lists, binary search trees, recursion on trees and lists, big-oh analysis