

# COMP9020 Week 4 Recap and Administrivia

# Week 4 Recap

- Matrices
- Big-O,  $\Omega$  and  $\Theta$
- Recursion

# “Big-O” Asymptotic Upper Bounds

## Definition

Let  $f, g : \mathbb{N} \rightarrow \mathbb{R}_{\geq 0}$ . We say that  $g$  is *asymptotically less than*  $f$  (or:  **$f$  is an upper bound of  $g$** ) if there exists  $n_0 \in \mathbb{N}$  and a real constant  $c > 0$  such that for all  $n \geq n_0$ ,

$$g(n) \leq c \cdot f(n)$$

Write  $O(f(n))$  for the class of all functions  $g$  that are asymptotically less than  $f$ .

# Alternative definition

## Fact

$$f(n) \in O(g(n)) \quad \text{if and only if} \quad \lim_{n \rightarrow \infty} \frac{f(n)}{g(n)} < \infty.$$

# Properties

## Fact

*Suppose  $f(n) \in O(g(n))$ ,  $g(n) \in O(h(n))$  and  $j(n) \in O(k(n))$ .  
Then:*

- $f(n) \in O(h(n))$
- $f(n) + j(n) \in O(g(n) + k(n))$
- $f(n) \cdot j(n) \in O(g(n) \cdot k(n))$

# Need to know for this course

- Basic Matrix operations:  $A + B$ ,  $A \cdot B$ ,  $A^T$
- Big-O vs Big- $\Omega$  vs Big- $\Theta$
- How to define things recursively