Lecture 13: Cost of Sorts

Sort Cost

(define (sort lst cf)
  (if (null? lst) lst
    (let ((best (find-best lst cf)))
      (cons best (sort (delete lst best) cf))))

(define (find-best lst cf)
  (if (= 1 (length lst)) (car lst)
    (pick-better cf (car lst) (find-best (cdr lst) cf))))

Growth Notations

• \(g \in O(f)\) ("Big-Oh")
  \(g\) grows no faster than \(f\) (upper bound)

• \(g \in \Theta(f)\) ("Theta")
  \(g\) grows as fast as \(f\) (tight bound)

• \(g \in \Omega(f)\) ("Omega")
  \(g\) grows no slower than \(f\) (lower bound)

Which one would we most like to know?

Meaning of \(O\) ("big Oh")

\(g\) is in \(O(f)\) iff:

There are positive constants \(c\) and \(n_0\) such that

\[ g(n) \leq cf(n) \]

for all \(n \geq n_0\).

\(O\) Examples

\(g\) is in \(O(f)\) iff there are positive constants \(c\) and \(n_0\) such that \(g(n) \leq cf(n)\) for all \(n \geq n_0\).

Is \(n\) in \(O(n^2)\)? Yes, \(c = 1\) and \(n_0 = 1\) works.

Is \(10n\) in \(O(n)\)? Yes, \(c = .09\) and \(n_0 = 1\) works.

Is \(n^2\) in \(O(n)\)? No, no matter what \(c\) we pick, \(cn^2 > n\) for big enough \(n\) (\(n > c\))
\[ \Omega \text{ ("Omega")}: \text{Lower Bound} \]

\( g \) is in \( O(f) \) iff there are positive constants \( c \) and \( n_0 \) such that \( g(n) \leq cf(n) \) for all \( n \geq n_0 \).

\( g \) is in \( \Omega(f) \) iff there are positive constants \( c \) and \( n_0 \) such that

\[
g(n) \geq cf(n)
\]

for all \( n \geq n_0 \).

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\[ \text{Charge} \]

- Read Chapter 6 and 7 of the course book
- PS4 is due Monday