Announcements

Project 1b is due Monday
* Notice that the reading sequence jumps to Chapter 17 for Monday

Algorithms

Algorithms are a familiar idea. Our goal is to learn to specify them right so someone or something else does the work.

Previous Algorithms

Algorithm, a precise, systematic method to produce a specified result
* We have seen algorithms already...
  * Placeholder technique is an algorithm with an easy specification:
    longStringWithShortStringInit ← placeholder
    ShortString ← c
    placeholder ← longStringWithShortStringInit

Every process is an algorithm -- debugging.

Properties of Algorithms

For an algorithm to be well specified it must have...
* Inputs specified
* Outputs specified
* Definiteness
* Effectiveness
* Finiteness

Programs vs Algorithms

A program is an algorithm specialized to a particular situation
* Algorithm:
  longStringWithShortStringInit ← placeholder
  ShortString ← c
  placeholder ← longStringWithShortStringInit
* Program:
  j, j ← #
  j ← c
  # ← j, j

Alphabetize CDs

1. Use Artist_of to refer to the name of group
2. Decide which end of the rack is to be the start of alphabetic sequence, and call the first slot alpha
3. Call the slot next to alpha, beta
4. If Artist_of the CD in the alpha slot is later in the alphabet than the Artist_of the CD in the beta slot, interchange the CDs, otherwise continue on
5. If a slot follows the beta slot, begin calling it the beta slot and go to step 4, otherwise continue on
6. If two slots follow the alpha slot, begin calling the next one the alpha slot and the one following it the beta slot, and go to step 4; otherwise stop
Abstraction

We have studied abstraction as a method of removing an idea or process from a situation ... abstract

Beta sweep -- while alpha points to a fixed slot, beta sweeps through slots following alpha, interchanging as necessary

* The beta sweep is a concept removed based on our understanding of the operation of the algorithm

The Beta Sweep

By abstracting we can analyze parts of an algorithm ...

* The beta sweep has 4 properties:
  * Exhaustive -- it considers all CDs after alpha
  * Non-redundant -- no slot pair is checked twice
  * Progressive -- the alphabetically earliest CD considered so far is always in the alpha slot
  * Effective -- at completion, the alphabetically earliest CD from alpha to end is in alpha slot

The properties are specific only to Alphabetize CDs

Alpha Sweep

The alpha sweep...

Process of sweeping through all of the CDs (but the last) performing the beta sweep

* Exhaustive -- considers all but last CD
* Non-redundant -- a slot is alpha only once
* Progressive -- when beta sweep completes the alphabetically next CD in alpha
* Complete -- when last beta sweep is done the last slot’s CD is later than next to last slot
* Effective -- the alpha sweep alphabetizes

Summary

We figure out most algorithms on our own, abstracting from specific cases

Also we abstract parts of an algorithm or program to understand them

* Thinking of how the program works and reasoning about properties that it has allows us to know why it works ... and then we can let the computer do it