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 ← ε

    placeholder ← *longStringWithShortStringInIt*

Not 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 ← ε

  placeholder ← *longStringWithShortStringInIt*

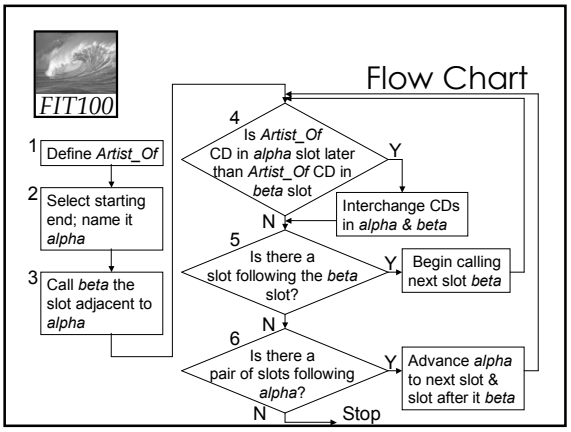
* Program: ↵↵ ← #

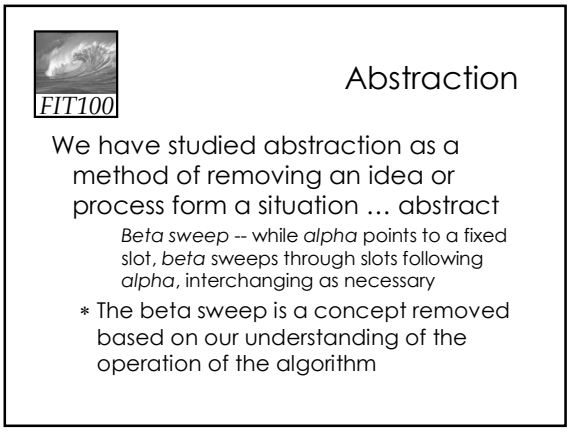
  ↵ ← ε

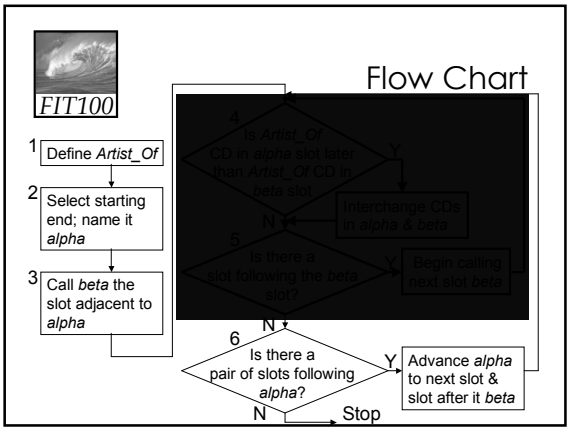
  # ← ↵↵

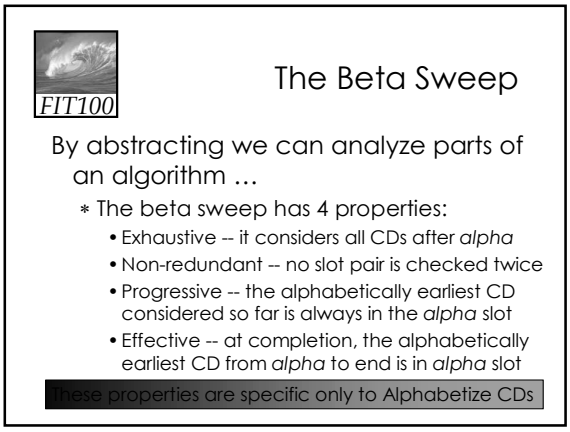
Alphabetize CDs

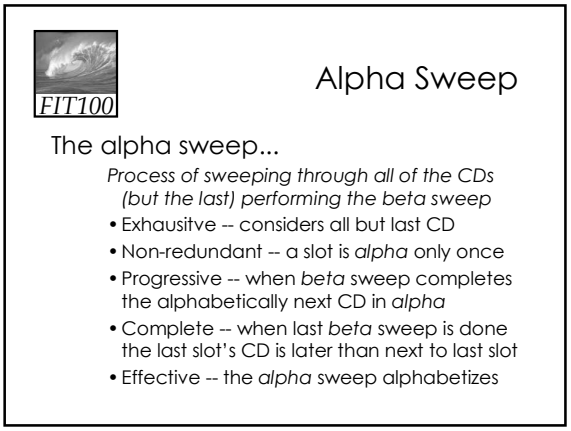
1. Use *Artist_of* to refer to the name of group
2. Decide which end or the rack is to be the start of alphabetic sequence, and call the first slot *alpha*
3. Call the slot next to alpha, *beta*
4. If *Artist_of* the CD in the *alpha* slot is later in the alphabet than the *Artist_of* the CD in the *beta* 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

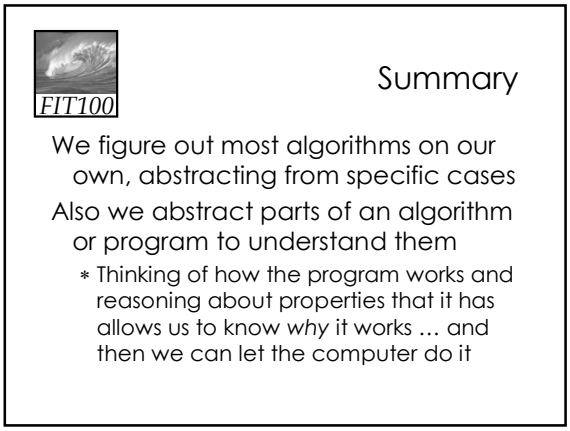

FIT100
Flow Chart
1
Define Artist_Of
2
Select starting end; name it alpha
3
Call beta the slot adjacent to alpha
4
Is Artist_Of CD in alpha slot later than Artist_Of CD in beta slot
Y
N
Interchange CDs in alpha & beta
5
Is there a slot following the beta slot?
Y
Begin calling next slot beta
N
6
Is there a pair of slots following alpha?
Y
Advance alpha to next slot & slot after it beta
N
Stop


FIT100
Abstraction
We have studied abstraction as a method of removing an idea or process form 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


FIT100
Flow Chart
1
Define Artist_Of
2
Select starting end; name it alpha
3
Call beta the slot adjacent to alpha
6
Is there a pair of slots following alpha?
Y
Advance alpha to next slot & slot after it beta
N
Stop


FIT100
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
These properties are specific only to Alphabetize CDs


FIT100
Alpha Sweep
The alpha sweep...
Process of sweeping through all of the CDs (but the last) performing the beta sweep
Exhausitve -- 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


FIT100
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