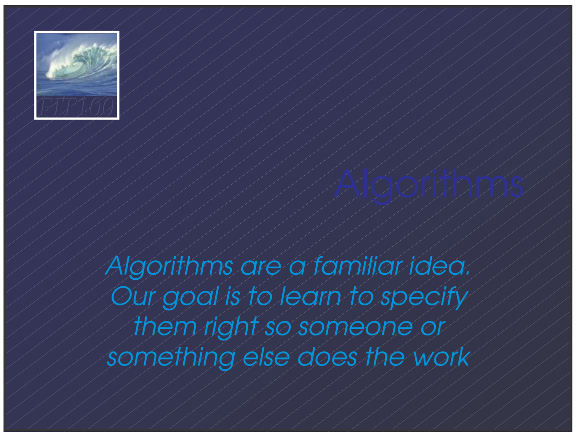
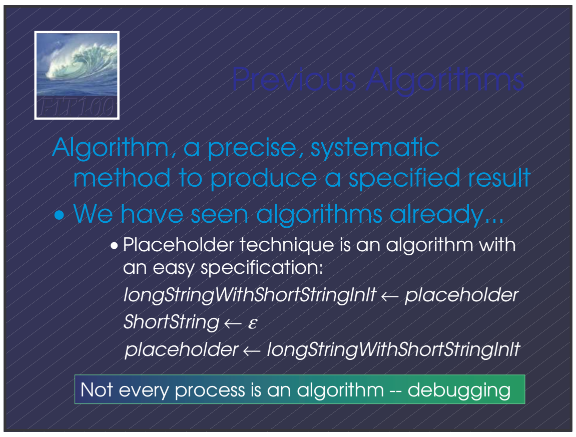


Algorithms

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

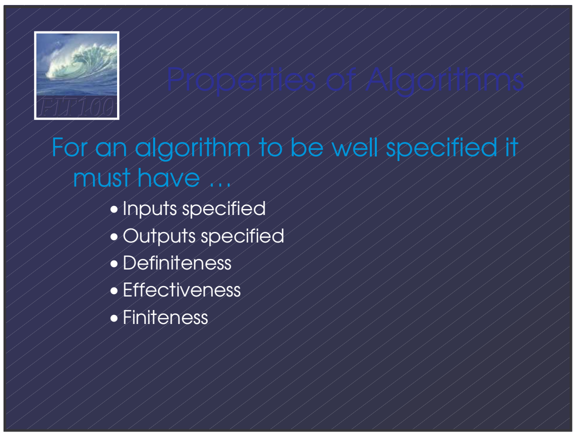
- We have seen algorithms already…
  - Placeholder technique is an algorithm with an easy specification:

    longStringWithShortStringInIt ← *placeholder*

    ShortString ← ε

    placeholder ← *longStringWithShortStringInIt*

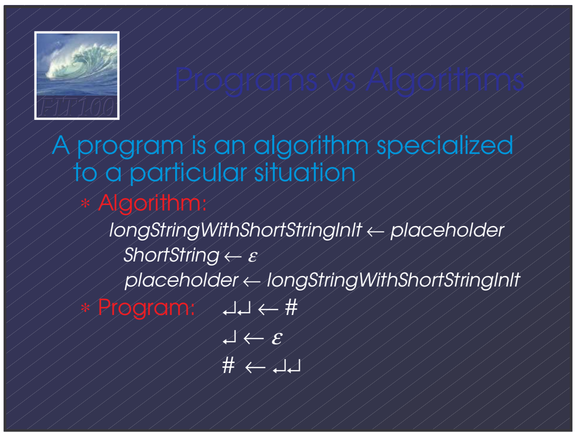
Not every process is an algorithm -- debugging



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*

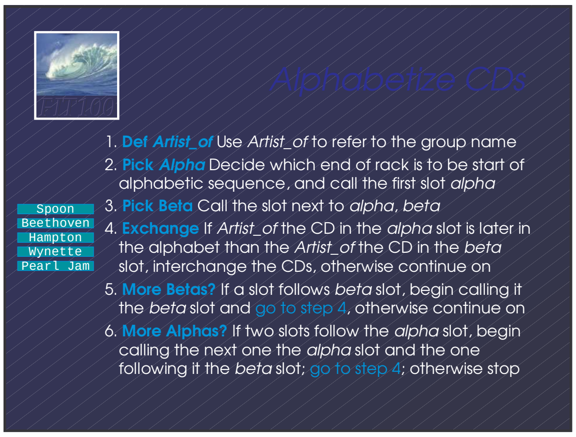
  ShortString ← ε

  placeholder ← *longStringWithShortStringInIt*

- Program: ↵↵ ← #

  ↵ ← ε

  # ← ↵↵

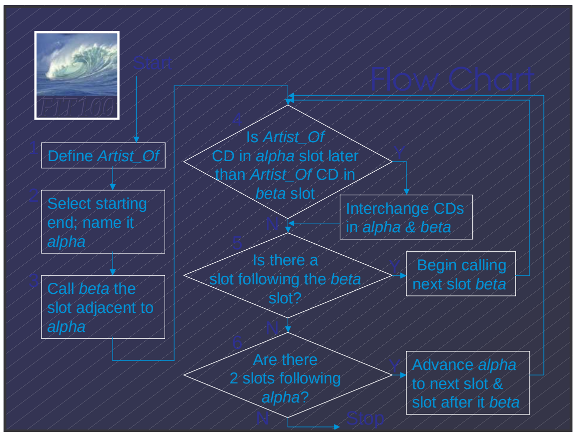


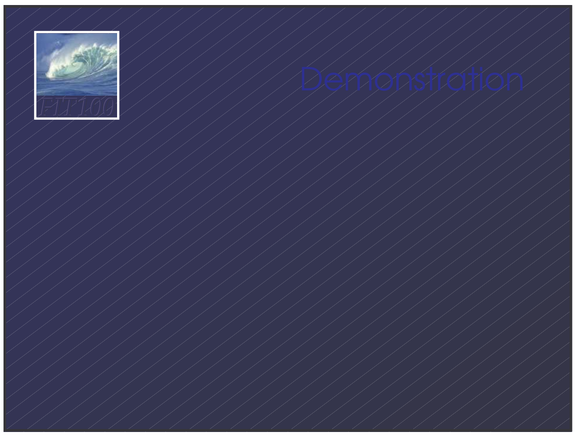
Alphabetize CDs

```
Spoon
Beethoven
Hampton
Wynette
Pearl Jam
```

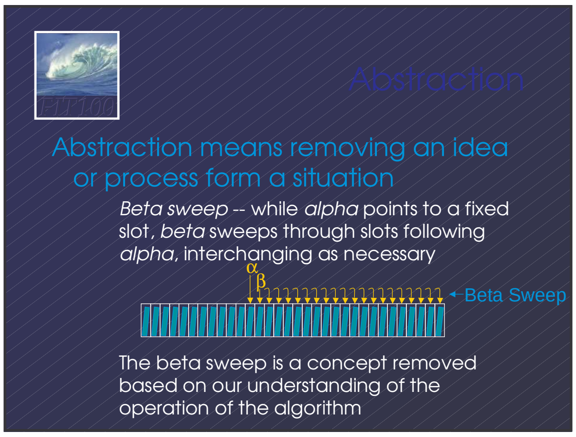
1. **Def *Artist_of*** Use *Artist_of* to refer to the group name
2. **Pick *Alpha*** Decide which end of rack is to be start of alphabetic sequence, and call the first slot *alpha*
3. **Pick Beta** Call the slot next to *alpha*, *beta*
4. **Exchange** If *Artist_of* the CD in the *alpha* slot is later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

Flow Chart


Start
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
Interchange CDs in alpha & beta
N
5
Is there a slot following the beta slot?
Y
Begin calling next slot beta
N
6
Are there 2 slots following alpha?
Y
Advance alpha to next slot & slot after it beta
N
Stop



Demonstration



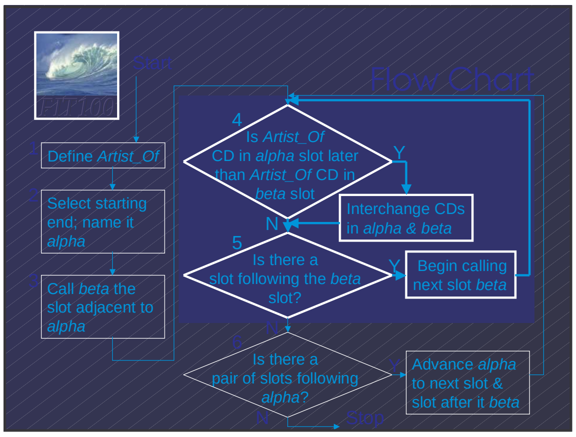
Abstraction

Abstraction means removing an idea or process form a situation

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

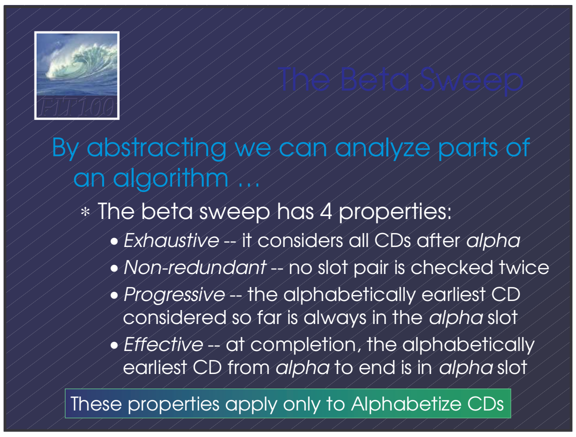
α
β
Beta Sweep

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



Flow Chart

Start
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
Interchange CDs in *alpha & beta*
N
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

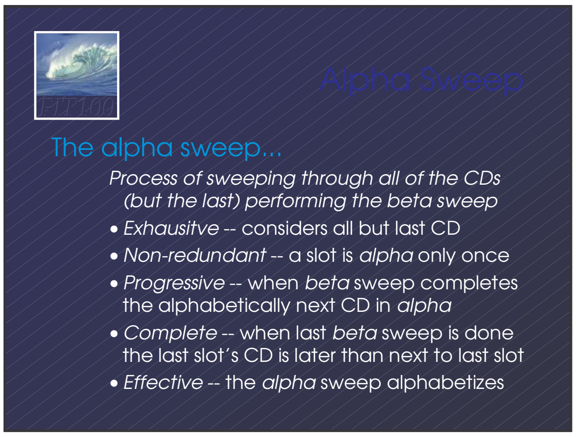


The Beta Sweep

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 apply only to Alphabetize CDs

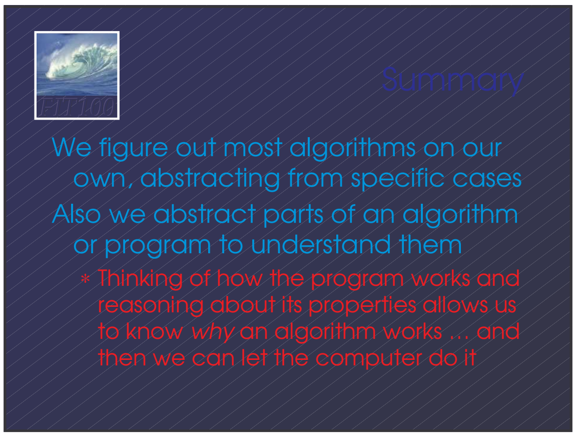


Alpha Sweep

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



Summary

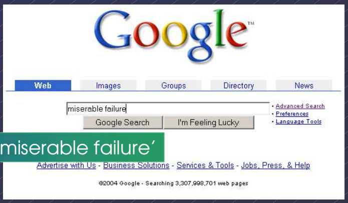
We figure out most algorithms on our own, abstracting from specific cases

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

- Thinking of how the program works and reasoning about its properties allows us to know *why* an algorithm works … and then we can let the computer do it

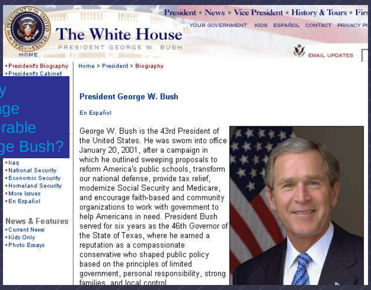
In Sunday's Paper…

Google Bombing: To sabotage Google's page-rank system


Google
Web
Images
Groups
Directory
News
miserable failure
Google Search
I'm Feeling Lucky
Advanced Search
Preferences
Language Tools
Advertise with Us - Business Solutions - Services & Tools - Jobs, Press, & Help
©2004 Google - Searching 3,307,998,701 web pages

Ask Google for `miserable failure'

George W Bush?



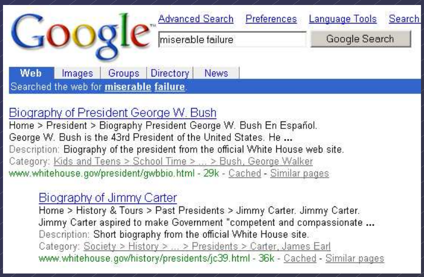
President George W. Bush

En Español

George W. Bush is the 43rd President of the United States. He was sworn into office January 20, 2001, after a campaign in which he outlined sweeping proposals to reform America's public schools, transform our national defense, provide tax relief, modernize Social Security and Medicare, and encourage faith-based and community organizations to work with government to help Americans in need. President Bush served for six years as the 46th Governor of the State of Texas, where he earned a reputation as a compassionate conservative who shaped public policy based on the principles of limited government, personal responsibility, strong families, and local control

The most highly ranked Web page for words 'miserable failure' is George Bush?

Sample Query



Searched the web for **miserable failure**.

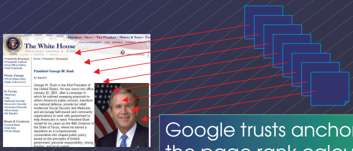
Biography of President George W. Bush
Home > President > Biography President George W. Bush En Español.
George W. Bush is the 43rd President of the United States. He **...**
Description: Biography of the president from the official White House web site.
Category: Kids and Teens > School Time > ... > Bush, George Walker
www.whitehouse.gov/president/gwbbio.html - 29k - Cached - Similar pages

Biography of Jimmy Carter
Home > History & Tours > Past Presidents > Jimmy Carter. Jimmy Carter.
Jimmy Carter aspired to make Government "competent and compassionate **...**
Description: Short biography from the official White House site.
Category: Society > History > ... > Presidents > Carter, James Earl
www.whitehouse.gov/history/presidents/jc39.html - 36k - Cached - Similar pages

What's Happening?

Many pages make their anchor text `miserable failure' and make the anchor link to the Bush biography

<a href="http://whitehouse.gov/gwbbio.html">miserable failure</a>



Google trusts anchor text in the page rank calculation