bash today, C tomorrow

- Quick reprise: debugging, performance
- What's homework 2B? (yes, it's posted)
- Some looks at solutions to 2A

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Debugging

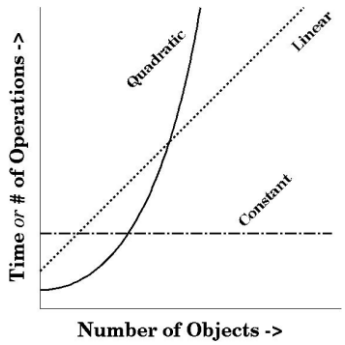
- "Debugging is important, especially since the shell is so sensitive to details. I recommend two things: (a) trying your commands individually in the command-line as you're trying to build your shell scripts; and (b) assigning and echoing 'unnecessary' variables in your scripts that can be used to help see what's happening step-by-step."
- When things don't work, what do you do?

Performance

- I'm not worried about performance (within a little bit of reason) on 2A. Bill Wulf, who served as president of the National Academy of Engineering for over a decade, once said something like: "More mistakes are made by premature optimization than for any other reason including sheer ignorance."
  - OK, maybe it doesn't work right, but at least it's really fast.
  - Well, if it doesn't have to work right, I can make it even faster!

Algorithmic complexity

- When dealing with a lot of data, what is usually most important about performance is the underlying algorithmic complexity
  - *Very roughly*, how many times do you need to touch each data item
- Examples
  - Finding a number in an unsorted list: linear search
  - Finding a number in a sorted list: linear or binary search
  - Sorting a list: $O(N^2)$ vs. O(N log N)
- HW2: if you touch every entry in the dictionary many times for each input string, that might be a problem – there are 479,829 entries



Performance: one more thing

- Once you get the algorithmic complexity "right", there can still be many ways to improve performance
- A classic example is that some arithmetic operations are faster to execute than others but are equivalent
  - `x*2` vs. `x+x`
  - vs. `left-shift x`
    - `001101010 => 011010100 [106*2= 212]`
- Another classic example is that some operations are faster than others to execute – for example, creating ("forking") a new process in Unix is generally more expensive than computing in the same process
- These, however, require some actual knowledge about the costs factors you face – without that (or at least significant experience), you're likely to guess wrong about what is costly

Questions?