Announcements

• Reading and RQ due next time
• APT 4 out today, due Oct 18
• Do not discuss exam1 with anyone until it is handed back, likely after fall break
• No Lab this week or next week

• Today:
  – Loops – While, While True
  – Problem Solving

Developing an Algorithm

• http://www.youtube.com/watch?v=AEBbsZK39es

$193, $540, $820, $700, $749. Are these reasonable? Why?

I'm thinking of a number …

• You guess. I'll tell you high, low, or correct
  – Goal: guess quickly, minimal number of guesses
  – Number between 1 and 100…
  – Number between 1 and 1000…

• Can you describe an algorithm, instructions, that would allow someone to use your instructions to play this game correctly. Start with 1 and 100, but ideally your instructions work with 1 and N

bit.ly/101f16-1006-1
Analyzing the *binary search* algorithm

• Is the algorithm correct?
  – Try it, again, and again and …
  – Reason about it: logically, informally, …
• How efficient is the algorithm?
  – How many guesses will it take (roughly, exactly)
  – Should we care about efficiency?
• When do we really care about efficiency?
  – Examples?

Looking for a Needle in a Haystack

• If a computer can examine 10 million names/numbers a second, suppose the list isn't sorted, or I say "yes/no", not "high/low"
  – How long to search a list of 10 million?
  – How long to search a list of a billion?
  – 14 billion pixels in a 2 hour blu-ray movie
• What about using binary search? How many guesses for 1000, $10^6$, $10^9$, $10^{12}$
  – One of the things to remember: $2^{10} = 1024$
Review - Searching for words

- If we had a million words in alphabetical order, how many would we need to look at worst case to find a word?

  If you are clever, cut the number of numbers to look at in half, over and over again.

| 1,000,000 | 976.56 |
| 500,000  | 488   |
| 250,000  | 244   |
| 125,000  | 122   |
|  62,500  |  61   |
|  31,250  |  30   |
|  15,620  |  15   |
|  7812.5  |  7.5  |
|   3906   |  3.75 |
|   1953   |  1.875|

Is number a Prime number?  
Bit.ly/101f16-1006-2

```python
def isPrime(number):
    if number<4:
        return True
    for n in range(4,number):
        if number/n * n == number:
            return False
    return True
```

While loops

- Repetition when you stop a loop based on a condition
  - while CONDITION:
    BODY

  - As long as condition is true, keep executing loop.
  - Must have an update in the body to get closer to condition being false.
Examples for while

• Playing chess
  while (game not over)
    play game
    (game must get closer to ending)

• Finding the 100th prime

Problem: Given a number, want the largest list of unique digits from 1 to x whose sum is less than or equal to the number

• Given 5
  Answer is 1 + 2, list [1,2]

• Given 6
  Answer is 1+2+3, list [1,2,3]
Looping with while
– not sure when to stop

• Playing chess
• Determining the $100^{th}$ prime number

• Another way – while True
  – Must have ways to break out of infinite loop
  – Must have update – gets closer to ending

while condition vs while True

while condition:
  body
  continue
  if condition:
    break
    continue

While condition is true - must update
- must get closer to making condition false
- use break to exit

While True
initialize
while True:
  if something:
    break
  if something2:
    update
    update
Continue or return

Revisit addDigitsTilSum
bit.ly/101f16-1006-5
The 21 Most Important Googlers You've Never Heard Of

Georges Harik and Noam Shazeer created the underlying data that led to AdSense

Harik and Shazeer spent years analyzing data on webpages, trying to understand clusters of words and how they worked together. The data they gathered wound up being used by Google for its AdSense product, which analyzed webpages for words, and then stuck ads on them.