ArrayList

- Constructors

```
ArrayList lst1 = new ArrayList();
ArrayList lst2 = new ArrayList(int initialSize);
ArrayList<String> strList = new ArrayList();
```

- Parameterized type
  – use if you know the type of the list and the list type is not mixed
- Methods

```
size()                    // Returns the num of items held.
add(Object o)             // Appends o to end.
add(int idx, Object o)    // Inserts o at pos idx.
remove(int idx)           // Removes item at pos idx.
get(int idx)              // Gets items at idx. No removal.
set(int idx, Object o)    // Replaces item at idx with o.
clear()                   // Removes all items.
isEmpty()                 // true if empty.
toArray()                 // returns an array that contains
                          // the contents of the list
```

Removing items from ArrayList while iterating

- When an item is removed from an `ArrayList`, the list shrinks and the indices are renumbered behind the removed item
- Why doesn't this removal work?

```
for (int i=0; i<lst.size(); i++) {
   lst.remove(i);
}
```

- Must remove from the back to the front

```
for (int lst.size()-1; i>=0; i--) {
   lst.remove(i);
}
```

Word class

```
class Word {                 String getWord() {
  String word;                 return word;
  int freq;                  }

  Word (String word) {       int getFreq() {
    this.word = word;          return freq;
    freq = 1;                }
  }
                             String toString() {
  void inc() {                 return "<"+word+",
    freq++;                "+freq+">";
  }                          }
                           }
```

Filter

```
String raw;
String delimiters = " ,.?!;:-\'\"()*![]{}|\\~`@#$%^&";
String[] fileText, words, uniqueWords;
int[] freqs;

void setup() {
 fileText = loadStrings("EliotLoveSong.txt");
  println("Read " + fileText.length + " lines.");

  raw = join(fileText, " ");
  raw = raw.toLowerCase();

  words = splitTokens(raw, delimiters);
  println("Found " + words.length + " words.");

  freqs = makeUnique(words);
  println("Found "+uniqueWords.length+" unique words.");
}
```

Filter

```
String raw;
String delimiters = " ,.?!;:-\'\"()*![]{}|\\~`@#$%^&";
String[] fileText, words,
ArrayList<Word> uniqueWords;

void setup() {
 fileText = loadStrings("EliotLoveSong.txt");
  println("Read " + fileText.length + " lines.");

  raw = join(fileText, " ");
  raw = raw.toLowerCase();

  words = splitTokens(raw, delimiters);
  println("Found " + words.length + " words.");

  makeUnique(words);
  println("Found "+uniqueWords.size()+" unique words.");
}
```

makeUnique

```
void makeUnique(String[] words) {
  uniqueWords = new ArrayList();

  for (int i=0; i<words.length; i++) {
    int idx = contains(words[i], uniqueWords);

    if (idx < 0) {
      uniqueWords.add(new Word(words[i]));
    }
    else {
      uniqueWords.get(idx).inc();
    }
  }
}
```

```
int contains(String t, ArrayList<Word> lst) {
  for (int i=0; i<lst.size(); i++) {
    if (t.equals(lst.get(i).getWord()))
      return i;
  }
  return -1;
}
```

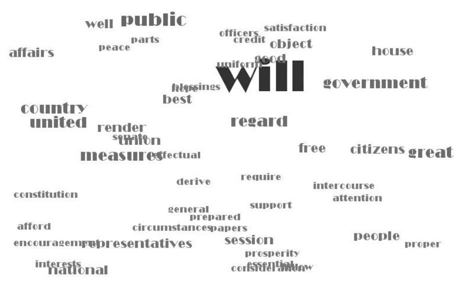
Stop words removal

- The most common short function words
  - the, is, a, at, which, on, etc
  - usually filtered out
- Usually given in a additional file and read in
- The list is not unique or definitive

```
fileText = loadStrings("stopwords.txt");
stopwords = new ArrayList(fileText.length);

for (int i=0; i < fileText.length; i++) {
  stopwords.add(fileText[i].toLowerCase());
}
```

makeUnique without stop words

```
void makeUnique(String[] words) {
  uniqueWords = new ArrayList();

  for (int i=0; i < words.length; i++) {
   if (!stopwords.contains(words[i])) {
      int idx = contains(words[i], uniqueWords);

      if (idx < 0) {
        uniqueWords.add(new Word(words[i]));
      }
      else {
        uniqueWords.get(idx).inc();
      }
    }
  }
}
```



Sorting

- Any process of arranging items in sequence
- Build-in **`sort()`**
  - Works on arrays of simple types, i.e. `int`, `float` and `String`
  - `float[] a = {3.4, 3.6, 2, 0, 7.1};`
  - `a = sort(a);`
  - `String[] s = {"deer", "elephant", "bear", "aardvark", "cat"};`
  - `s = sort(s, 3);`
- Convenient, but not very flexible
- Recall that we have an `ArrayList<Word>`

Implement your own sort

- Many sorting algorithms
- Bubble Sort
  - Looks at items in successive pairs
  - Swap if in the wrong order
- Selection Sort
  - Scan a list start to end and find the value that should come first
  - Swap that item into the first position
  - Repeat scanning and swapping starting at the second position in the list
- Insertion Sort

Example: Text Processing & Visualization

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These questions are not new. War, in one form or another, appeared with the first man. At the dawn of history, its morality was not questioned; it was simply a fact, like drought or disease - the manner in which tribes and then civilizations sought power and settled their differences. Over time, as codes of law sought to control violence within groups, so did philosophers, clerics, and statesmen seek to regulate the destructive power of war. The concept of a "just war" emerged, suggesting that war is justified only when it meets certain preconditions: if it is waged as a last resort or in self-defense; if the forced used is proportional, and if, whenever possible, civilians are spared from violence.

For most of history, this concept of just war was rarely observed. The capacity of human beings to think up new ways to kill one another proved inexhaustible, as did our capacity to exempt from mercy those who look different or pray to a different God. Wars between armies gave way to wars between nations - total wars in which the distinction between combatant and civilian became blurred. In the span of thirty years, such carnage would twice engulf this continent. And while it is hard to conceive of a cause more just than the defeat of the Third Reich and the Axis powers, World War II was a conflict in which the total number of civilians who died exceeded the number of soldiers who perished.

In the wake of such destruction, and with the advent of the nuclear age, it became clear to victor and vanquished alike that the world needed institutions to prevent another World War. And so, a quarter century after the United States Senate rejected the League of Nations - an idea for which Woodrow Wilson received this Prize - America led the world in constructing an architecture to keep the peace: a Marshall Plan and a United Nations, mechanisms to govern the waging of war, treaties to protect human rights, prevent genocide, and restrict the most dangerous weapons.

In many ways, these efforts succeeded. Yes, terrible wars have been fought, and atrocities committed. But there has been no Third World War. The Cold War ended with jubilant crowds dismantling a wall. Commerce has stitched much of the world together. Billions have been lifted from poverty. The ideals of liberty, self-determination, equality and the rule of law have haltingly advanced. We are the heirs of the fortitude and foresight of generations past, and it is a legacy for which my own country is rightfully proud.

....

Let us live by their example. We can acknowledge that oppression will always be with us, and still strive for justice. We can admit the intractability of depravation, and still strive for dignity. We can understand that there will be war, and still strive for peace. We can do that - for that is the story of human progress; that is the hope of all the world; and at this moment of challenge, that must be our work here on Earth.

Text Processing & Visualization

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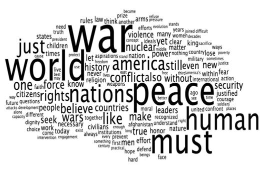

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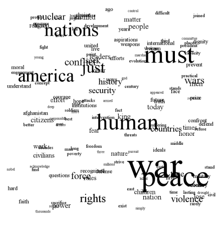

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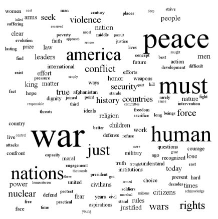

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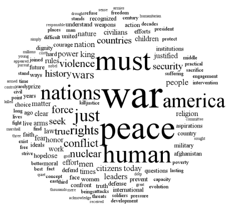

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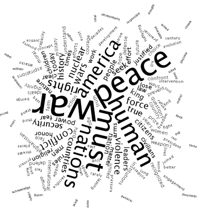

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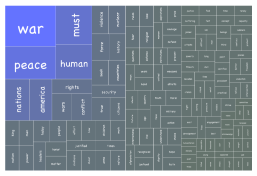
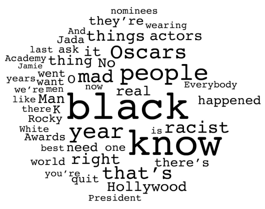
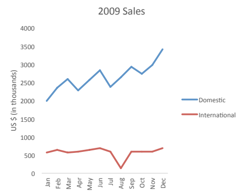


Chris Rock @ Oscars



Sales Data (US $ in thousands)

Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Domestic	1983	2343	2593	2283	2574	2838	2382	2634	2938	2739	2983	3413
International	574	636	573	593	644	679	593	139	599	583	602	690

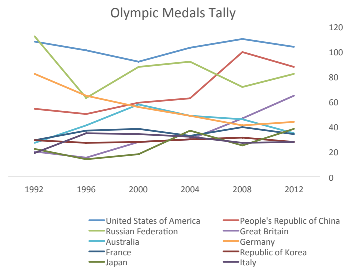


4/25/16 Permeating Data Visualization in CS Courses 20

Top Medals in Olympics by Country (1992-2012)

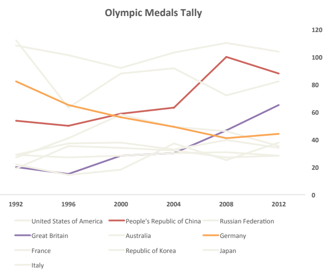
Country	2012	2008	2004	2000	1996	1992
United States of America	104	110	103	92	101	108
People's Republic of China	88	100	63	59	50	54
Russian Federation	82	72	92	88	63	112
Great Britain	65	47	30	28	15	20
Australia	35	46	49	58	41	27
Germany	44	41	49	56	65	82
France	34	40	33	38	37	29
Republic of Korea	28	31	30	28	27	29
Japan	38	25	37	18	14	22
Italy	28	27	32	34	35	19

Top Medals in Olympics (1992-2012)



Top Medals in Olympics (1992-2012)

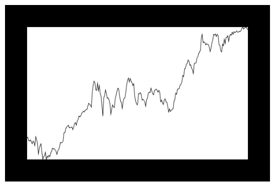
Focus on
- Germany
- China
- Great Britain



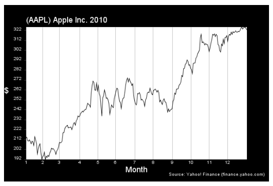
Example: Visualizing Time Series

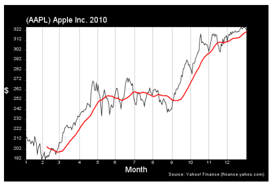
Raw Data

```
1,4,2010,213.43,214.50,214.01,17633200
1,5,2010,214.60,215.59,214.38,21496600
1,6,2010,214.38,215.23,210.97,19720000
1,7,2010,211.75,212.00,210.58,17040400
1,8,2010,210.30,212.00,211.98,15986100
…
12,27,2010,322.85,325.44,324.68,8922000
12,28,2010,325.91,326.66,325.47,6283000
12,29,2010,326.22,326.45,325.29,5826400
12,30,2010,325.48,325.51,323.66,5624800
12,31,2010,322.95,323.48,322.56,6911000
```

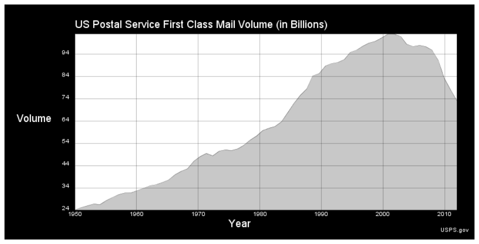


Visualizing Time Series

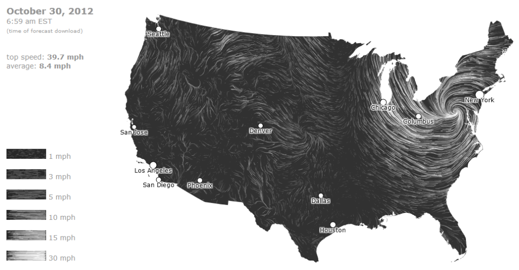




Visualizing Time Series



Data Visualization - Horizons


October 30, 2012
6:59 am EST
(time of forecast download)
top speed: 39.7 mph
average: 8.4 mph
Seattle
San Jose
Denver
Chicago
Columbus
New York
Los Angeles
San Diego
Phoenix
Dallas
Houston
1 mph
3 mph
5 mph
10 mph
15 mph
30 mph