MAT 1160 — WEEK 2

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Spring 2010

Student Responsibilities – Week 2

- **Reading**:
  This week: Textbook, Sections 1.3 & 1.4
  Next week: Textbook, Sections 2.1 & 2.2
- Summarize Sections
- Work through Examples
- Recommended exercises:
  - Section 1.1: evens 2-12, 16-28, 32-44, 51, 54
  - Section 1.2: evens 2-28, 34, 36, 44-48
  - Section 1.3: evens 2-56, 62, 63, 66 (which strategy did you use?)
  - Section 1.4: evens 2-30, 40-68

1.3: Strategies for Problem Solving

Polya's Four–Step Problem Solving Process

1. **Understand the problem**:
   - What are the "givens"?
   - What is it you need to find?
   - How are the "givens" related to the result?
2. **Devise a plan**: how do you get from the "givens" to the result?
3. **Carry out the plan**: be persistent!
4. **Look back and check**: is your answer reasonable?

But it looks so easy when **you** do it!

- Much of life is about solving problems, so the more tools you have in your personal arsenal to solve problems, the better.
- Watching someone else do the work is always going to be easier than doing it yourself — but watching doesn't teach you as much as **doing**.
- Although it does take some intelligence, above all, problem solving takes lots of **practice**. The more problems you work out, the easier it gets.
- Like any other skill, proficiency in problem solving requires **perseverance** and **hard work**.

Who's your daddy?

A very old riddle from the 60's

A doctor was working in an emergency room when a young boy arrived in need of immediate surgery.

The doctor said, "I can't work on this boy, he's my son."

But the doctor was not the boy's father.

How is this possible?

Sometimes it's our assumptions that get us in trouble!

Problem Solving Strategies

How do we devise a problem solving plan?

1. Make a table or chart
2. Look for a pattern
3. Solve a similar but simpler problem
4. Draw a sketch
5. Use inductive reasoning
6. Write an equation and solve it

7. If a formula applies, use it
8. Work backward
9. Guess and check
10. Use trial and error
11. **Use common sense**
12. Look for a "catch" if an answer seems too obvious or impossible

Leonardo Pisano, aka Fibonacci

Problem: A pair of rabbits is put on an island. During the first month, the rabbits produced no offspring, but each month thereafter produced one new pair of rabbits. If each new pair reproduces in the same manner, how many pairs of rabbits will there be at the end of one year?

- What is known or given? What's important?
- What are we trying to determine?
- How should we go about solving the problem?

  What might be a good strategy? (A table will help solve this problem...)

Where's the Answer?

Month	# Pairs at Start	# New Pairs	# Pairs at End
1^{st}	1	0	1
2^{nd}			
3^{rd}			
4^{th}			
5^{th}			
6^{th}			
7^{th}			
8^{th}			
9^{th}			
10^{th}			
11^{th}			
12^{th}	144	89	

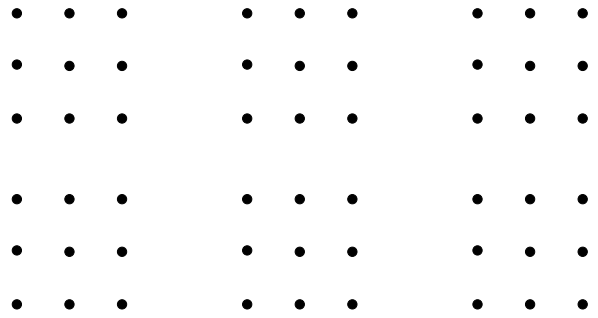
Connect the Dots

Given a 3×3 array of dots, find a way to join the dots with exactly four straight lines without picking up your pen from the paper or tracing over a line that has already been drawn.

- What is known or given?
- What are we trying to do?
- How should we go about solving the problem?

  What might be a good strategy?

Here's six such arrays, give it a try...



Labeling Boxes

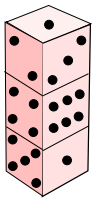
Three boxes have been incorrectly labeled as **Red socks**, **Green socks**, and **Red & Green socks**.

How can we relabel the boxes correctly by taking only **one** sock from **one** box, without looking inside the boxes?

- What is known or given?
- What are we trying to do?
- How should we go about solving the problem?
  What might be a good strategy?

Dice Faces

How many dots are **not** visible in this figure consisting of three stacked dice?

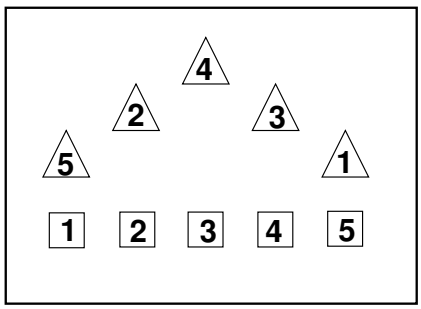


A) 21 B) 22 C) 31 D) 41 E) 53

- What is known or given?
- What are we trying to do?
- How should we go about solving the problem?
  What might be a good strategy?

Matching Triangles and Squares

How can you connect each square with the triangle that has the same number? Lines cannot cross, enter a square or triangle, or go outside the diagram.



What is known? What are we trying to do? What's a good strategy?

Alphametric

If a, b, and c are digits for which

$$\begin{array}{rccc} & 7 & a & 2 \\ - & 4 & 8 & b \\ \hline & c & 7 & 3 \end{array}$$

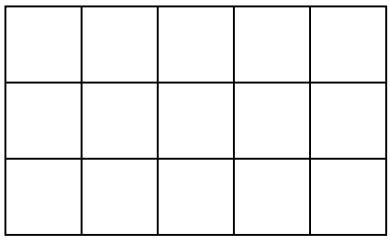
then $a + b + c =$

A) 14 B) 15 C) 16 D) 17 E) 18

- What is known or given?
- What are we trying to do?
- How should we go about solving the problem?
  What might be a good strategy?

Rectangle Counting Puzzle

How many rectangles are in the 3×5 figure shown here?



How can we **systematically** count them?

There are 90 rectangles!

Palindromic Numbers

A **palindrome** is a word or phrase that reads the same backwards as forwards. Examples:

```
MADAM, I'M ADAM
          MADAMIMADAM
A MAN, A PLAN, A CANAL, PANAMA
          AMANAPLANACANALPANAMA
ABLE WAS I ERE I SAW ELBA
          ABLEWASIEREISAWELBA
```

A **palindromic number** is a number whose digits read the same left to right as right to left.

Examples: 383 12321 98766789

Car Odometer

The odometer of a car read 15951 when the driver noticed it was a palindromic number. Two hours later, the odometer showed a new palindromic number (the next possible one). How fast was the car going in those two hours?

- What is known or given?
- What are we trying to do?
- How should we go about solving the problem?

  What might be a good strategy?

Get That Frog Out of My Drinking Water!

A frog is at the bottom of a 20–foot well. Each day it crawls up 4 feet, but each night it slips back 3 feet. After how many days will the frog reach the top of the well?

- What is known or given?
- What are we trying to do?
- How should we go about solving the problem?

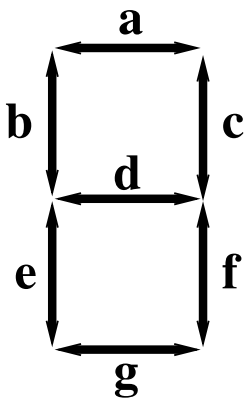
  What might be a good strategy?

1.4 — Calculating, Estimating, and Reading Graphs

- You should be able to **estimate** answers without a calculator, and to know if your (or a given) answer is "in the ball park."
- You should be able to **interpret** graphs such as pie charts, bar graphs, and line graphs.
- Don't forget the **Chapter Test** – it's useful for reviewing the chapter.

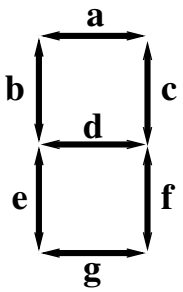
Calculating Answers

Displayed digits on most calculators usually show some or all of the parts in the pattern shown in the figure. For the digits 0 through 9:



1. Which part is used most frequently?
2. Which part is used the least?
3. which digit uses the most parts?
4. Which digit uses the fewest parts?

		Segment						
Digit	Seg'd	a	b	c	d	e	f	g
0								
1								
2								
3								
4								
5								
6								
7								
8								
9								
Total:								



Estimating Answers

1. **Time of a Round Trip** The distance from Seattle, WA to Springfield, MO, is 2009 miles. About how many hours would a round trip from Seattle to Springfield (and back) take a bus that averages 50 miles per hour for the entire trip?

   A. 60 B. 70 C. 80 D. 90

2. **Fifth–Grade Teachers Needed** Charleston Middle School has 155 fifth–grade students. The principal, Cheryl Arabie, has decided that each fifth–grade teacher should have [(a) about / (b) a strict maximum of] 24 students. How many fifth-grade teachers does she need?

   (a - approx) A. 4 B. 5 C. 6 D. 7

   (b - max) A. 4 B. 5 C. 6 D. 7

3. About how many storage cubes holding 18 DVD's each does Chris need to house 204 movies?

   A. 1 B. 10 C. 100 D. 1000

1. The $\sqrt{2}$ is <1 <1.5 > 1.75 >2

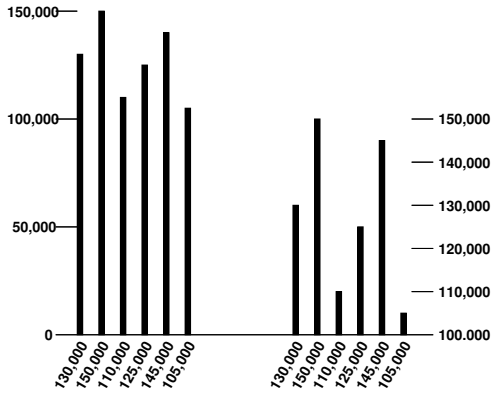
2. The $\sqrt{3}$ is <1 <1.5 < 1.75 >2

3. Coles County has a population of 52,172 and covers 508 square miles. About how many people per square mile live in Coles County?
   A. 10 B. 100 C. 1,000 D. 10,000

4. The Sistine Chapel in Vatican City measures 40.5 meters by 13.5 meters. The best approximation of its area is:
   A. 110 m B. 55 m C. 110 sq m D. 600 sq m

5. In 1998, Terrell Davis of the Denver Broncos rushed for 2008 yards in 392 attemps. His approximate number of yards gained per attempt was:
   A. 1/5 B. 50 C. 5 D. 500

Caveat Regarding Graphs



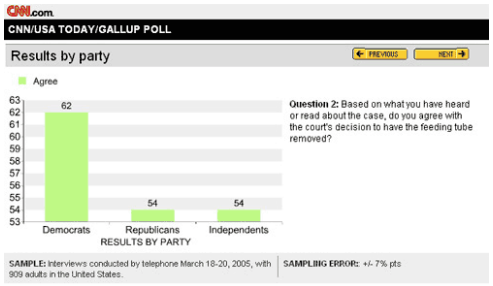
Exaggerated differences — same numbers, different scales

An Example of a Misleading Chart — from CNN

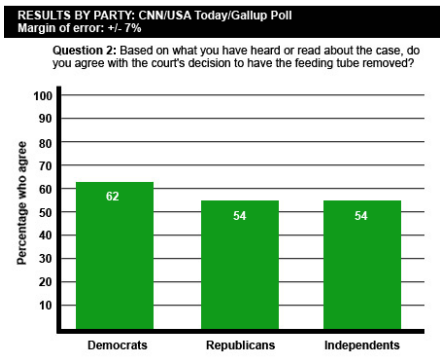
In the midst of the Terri Schiavo Media/Political Frenzy, 2005

"...[I]t wasn't just feckless pundits who were trying to turn this story into some kind of Republican vs. Democrat freak–fest — mainstream media outlets were desperate to get in on the act too.

CNN tried especially hard, even going so far as to produce some dubious graphics indicating that compared to Republicans and Independents, Democrats were overwhelmingly in favor of removing Terri Schiavo's feeding tube:"



Note the scale on this graph. This is a classic example of how to "**lie with statistics**" - that is, to doctor a graph to make it produce an emotional, visual result. Thanks to Media Matters, here's the graph on a scale from 0 to 100:



"Wow... that doesn't have quite the same impact, does it? In fact, if you take into consideration that the margin of error in the poll is 7 percentage points, the results are pretty similar."
From: http://www.democraticunderground.com/top10/05/191.html

US National Debt

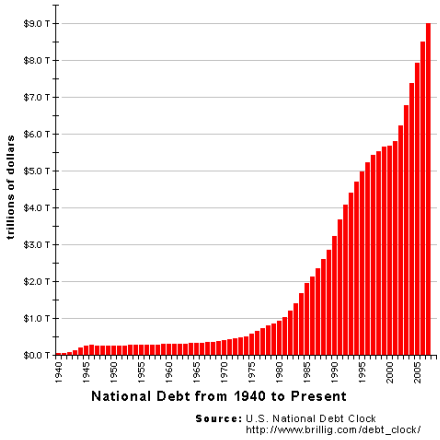
from: brillig.com/debt_clock/
U.S. NATIONAL DEBT CLOCK

The Outstanding Public Debt as of 13 Jan 2010 at 11:17:26 PM GMT is: $ 1 2 , 2 9 5 , 3 0 2 , 4 4 1 , 1 3 4 . 2 0

(12 trillion, 295 billion, 302 million, 441 thousand, 134 dollars)
(and 20 cents)

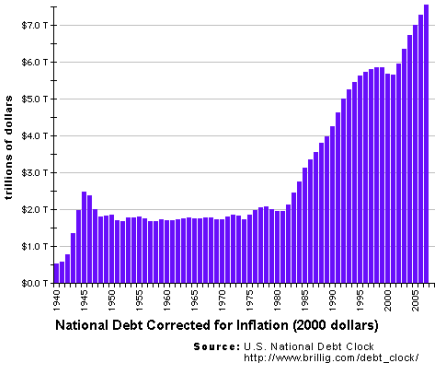
The estimated population of the United States is 307,648,129 so each citizen's share of this debt is $39,965.47.

US National Debt, Chart I



From: www.brillig.com/debt_clock/faq.html

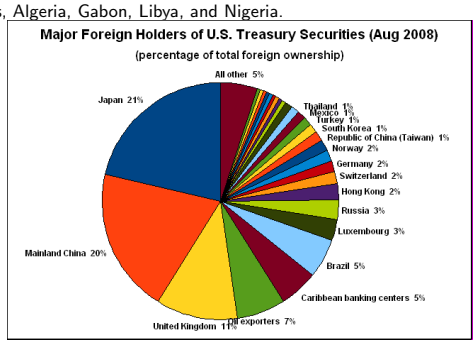
US National Debt, Chart II



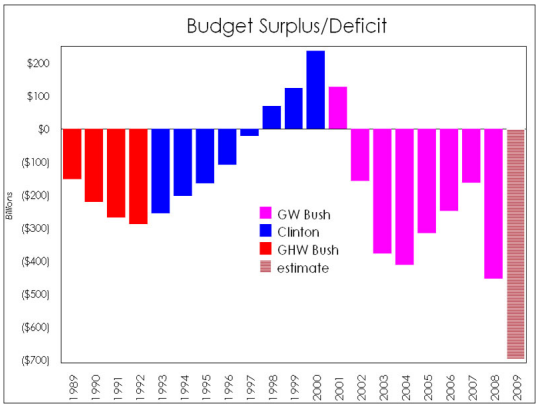
From: www.brillig.com/debt_clock/faq.html

Foreign Ownership of the National Debt (2008)

The two largest creditors are Japan and Mainland China. There is also a large portion owned by Oil exporters including Ecuador, Venezuela, Indonesia, Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, the United Arab Emirates, Algeria, Gabon, Libya, and Nigeria.

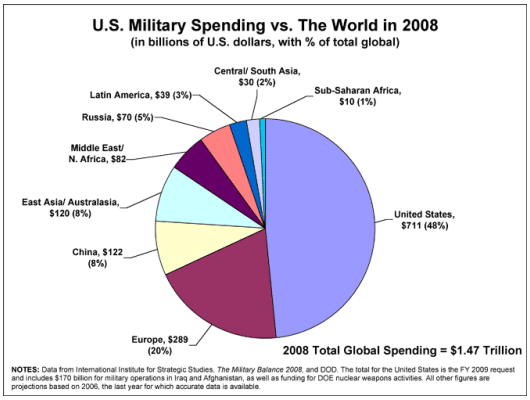


From: http://en.wikipedia.org/wiki/United_States_public_debt#Foreign_ownership



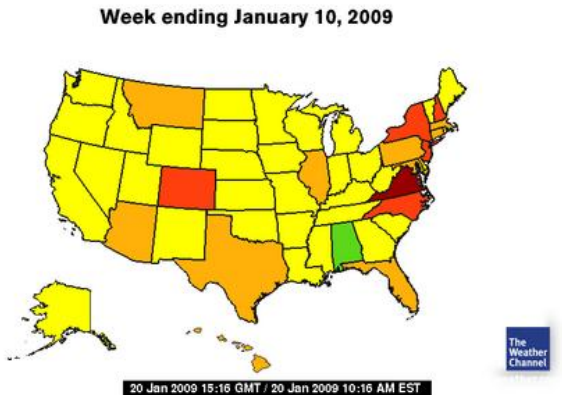
www.academycomputerservice.com/economics/charts.htm

Military Spending Around the Globe



http://www.armscontrolcenter.org/policy/securityspending/articles/fy09_dod_request_global/

Influenza Reports — 1/21/09

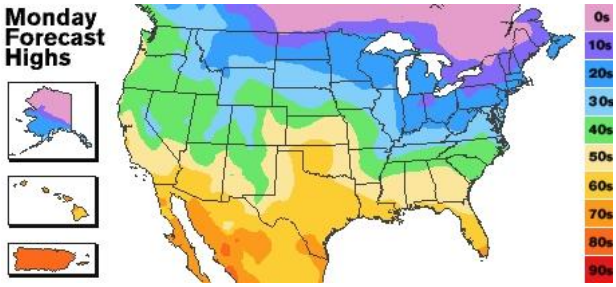


White: No report Yellow: No activity Green: Sporadic
Orange: Local Red: Regional Violet: Widespread

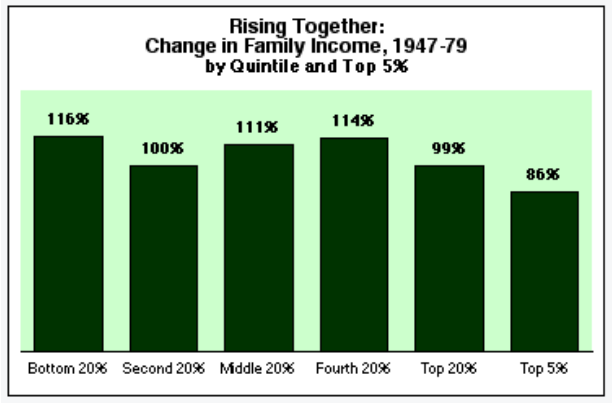
Influenza Reports — 1/13/10

White: No report Yellow: No activity Green: Sporadic
Orange: Local Red: Regional Violet: Widespread

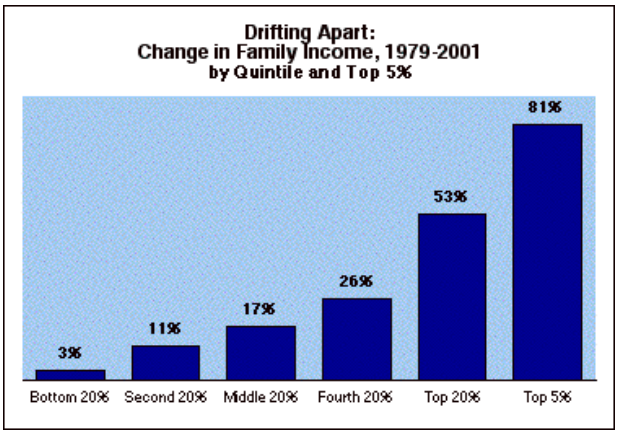
Weather Forecast — 12/27/04



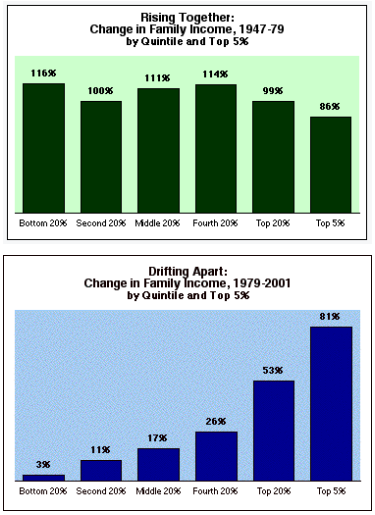
asp.usatoday.com/weather

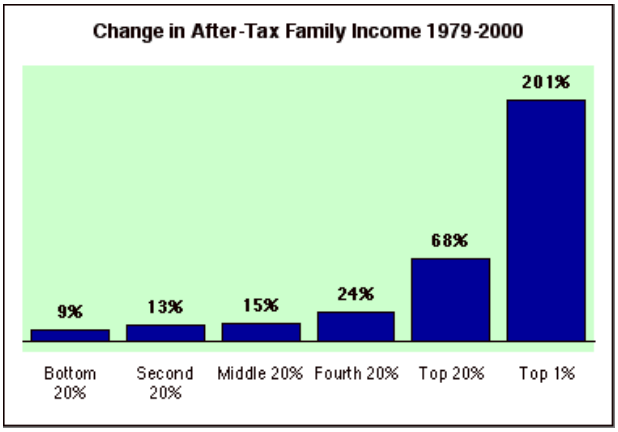


www.faireconomy.org/research/income_charts.html

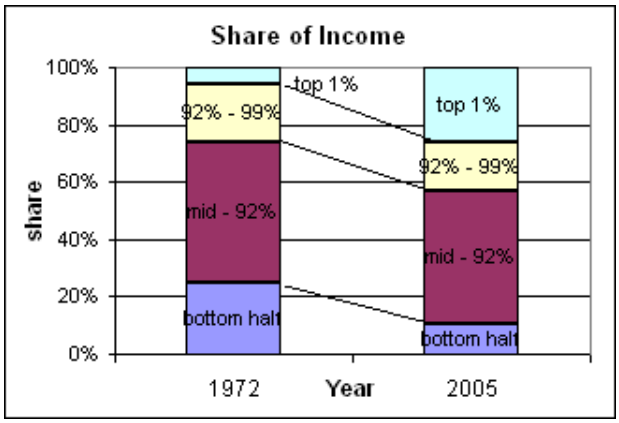


www.faireconomy.org/research/income_charts.html

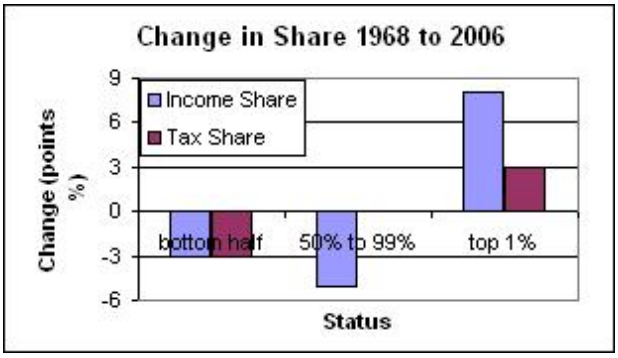




www.faireconomy.org/research/income_charts.html

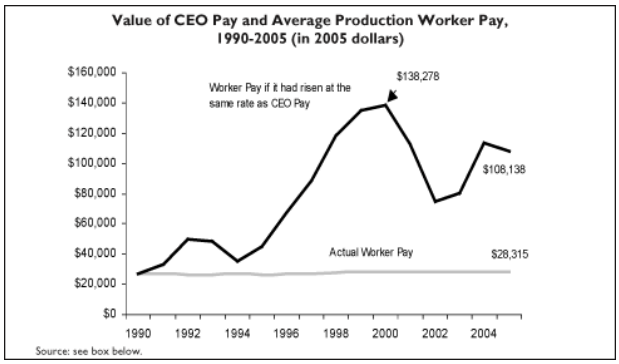


geocities.com/gordonite32/philo/incomes.htm



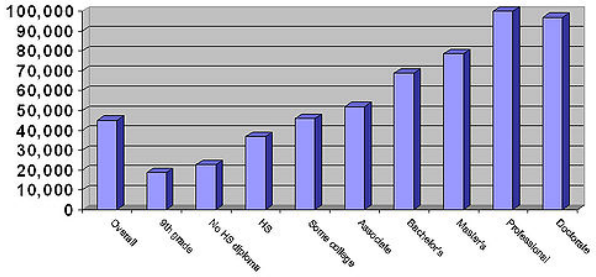
geocities.com/gordonite32/philo/incomes.htm

CEO Pay Raises – Applied to Average Worker

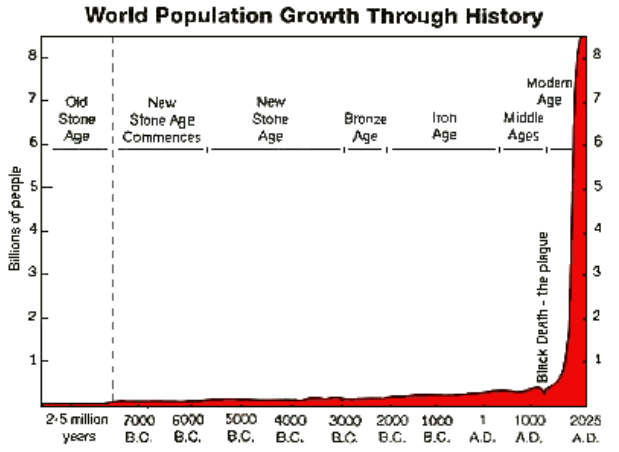


faireconomy.org/news/ceo_pay_charts

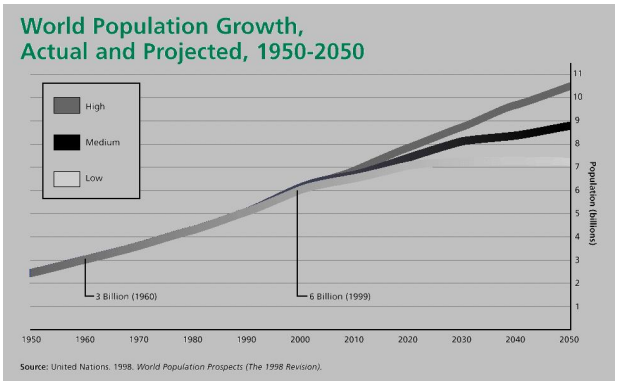
Income Based on Highest Education Attained



en.wikipedia.org/wiki/Household_income_in_the_United_States



www.susps.org/index/html



www.unfpa.org/6billion/pages/worldpopgrowth.htm