- Problem Set 3 (reviewed Oct 28 - Nov 2):
  - Chapter 10, pages 290-291: problems 1 and 2
  - Chapter 11, pages 320-322: problems 3, 4, 8, and 9
- Note: beginning Oct 31, the Monday 4-4:50 section will be led by Michael Sharifi (office hours Wednesdays 1-1:50 in Sequoyah 235)
- No class Wednesday, Nov 2 (but discussion sections will meet)

Chapter 12: Economics of Information

A. Probabilities

Suppose we flip a coin 10 times

Count 3 heads, 7 tails

fraction of heads = 0.30

Try a second time

Count 6 heads, 4 tails

fraction of heads = 0.60

Third trial:
fraction of heads = 0.50

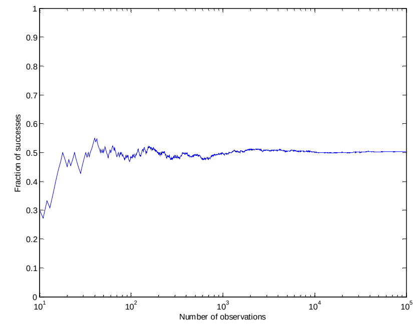
Suppose we try 100 coin flips and count the fraction of heads:

- Trial 1 = 0.48
- Trial 2 = 0.54
- Trial 3 = 0.56

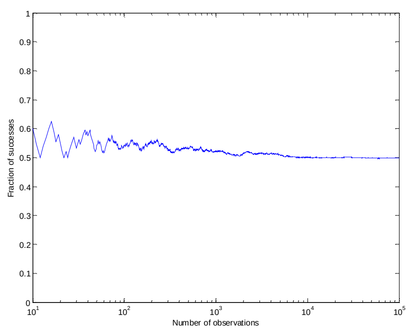
Fraction of heads as a function of the number of coin flips

	number of observations				
	10	100	1,000	10,000	100,000
Trial 1	0.3000	0.4800	0.4970	0.5012	0.5039
Trial 2	0.6000	0.5400	0.5230	0.5010	0.4980
Trial 3	0.5000	0.5600	0.5430	0.5079	0.4989
Trial 4	0.6000	0.5700	0.5300	0.5011	0.5001

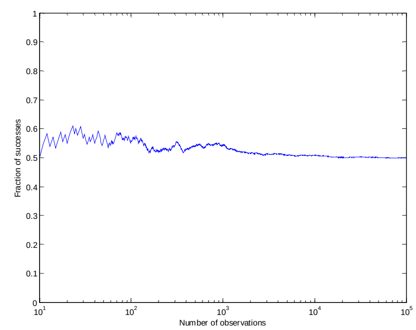
Fraction of successes as a function of number of observations
(True probability = 0.5, Trial 1)



Fraction of successes as a function of number of observations
(True probability = 0.5, Trial 2)



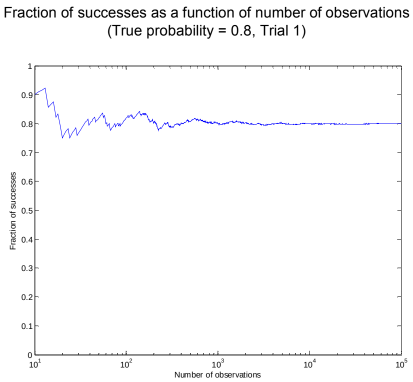
Fraction of successes as a function of number of observations
(True probability = 0.5, Trial 3)



Conclusions:

- When I flip a coin a finite number of *n* times, I don't know for sure the fraction of heads
- If *n* is very big, the fraction is going to be very close to 1/2

What's the fraction of successes look like if true probability of success is 0.8?



Law of Large Numbers:

If I repeat the same random experiment a very large number of times, the fraction of times a certain event occurs tends toward a fixed number called the probability of that event

Chapter 12: Economics of Information

A. Probabilities

B. Expected value

Suppose I repeated a risky gamble 100 times:

- 60 times (60%) I ended up losing $20
- 40 times (40%) I ended up winning $50

(1) How much total did I end up with?

(60)(-20) + (40)(+50) = +$800 total

(2) How much did I earn on average?

$$\frac{\$800 \text{ total earnings}}{100 \text{ total gambles}} = \frac{\$8 \text{ earnings}}{\text{gamble}}$$

Notice that we can calculate average earnings by multiplying each outcome by the fraction of times it occurred:

(-$20)(0.60) + ($50)(0.40) = $8

Suppose that for some other gamble:

- 30 times (30%) I lost $20
- 20 times (20%) I lost $40
- 50 times (50%) I won $60

Then my average outcome per gamble is:

(-$20)(0.3) + (-$40)(0.2) + ($60)(0.5)

= -$6 - $8 + $30

= +$16

Definition:

If a random variable has probability

p_1 of taking on the value A_1

p_2 of taking on the value A_2

⋮

p_M of taking on the value A_M

then the expected value is defined to be

$(p_1 \times A_1) + (p_2 \times A_2) + \ldots + (p_M \times A_M)$

Law of Large Numbers: if there is a large enough number of observations, the actual average value should be close to the expected value.

Chapter 12: Economics of Information

A. Probabilities

B. Expected value

C. Risk aversion

Consider again a gamble like one we considered earlier

- 60% probability of losing $20
- 40% probability of winning $50

expected value =

(-$20)(0.6) + ($50)(0.4) = +$8

Should I take this gamble?

If I only get to play once, maybe not a good idea--

- can't afford to lose $20

If I was going to play a large number of times, maybe OK

- count on Law of Large Numbers eventually giving me a profit

- Different people might give different answers to whether they'll take this gamble depending on their attitude toward risk
- Someone who would sometimes say "no" to a gamble with a positive expected value is said to be risk averse
- Someone who would say "yes" to any gamble with positive expected value is said to be risk neutral

The more risk averse you are, the higher the expected value must be before you're willing to take the gamble

We can also talk about risk aversion in terms of how much a risky project is worth to you

Consider following project:

- with probability 1/2 you get $5
- with probability 1/2 you get $10
- Expected value is (1/2)(5) + (1/2)(10) = $7.50

How much would you be willing to pay for this project?

- with probability 1/2 you get $5
- with probability 1/2 you get $10
- Expected value is (1/2)(5) + (1/2)(10) = $7.50

Obviously it's worth paying at least $5 for this project

It's not worth paying more than $10 for this project

If you were risk neutral, you'd be willing to pay exactly $7.50

If you pay $7.50, your net payoff = $5.00 - $7.50 = -$2.50 with probability 1/2

= $10.00 - $7.50 = +$2.50 with probability 1/2

(1/2)(-2.5) + (1/2)(2.5) = 0

It's a fair gamble if you pay exactly $7.50 for the project

- with probability 1/2 you get $5
- with probability 1/2 you get $10
- Expected value is (1/2)(5) + (1/2)(10) = $7.50

If you were risk neutral, you'd be willing to pay exactly $7.50

If you were risk averse, you'd be willing to pay less than $7.50

The more risk averse you are, the closer your willingness to pay would be to $5.00 than to $7.50

Can also talk about investment decisions over time

- I invest an amount (say $1) today
- I get back some amount (1 + x) next year
- x is my rate of return on the investment
- $x > 0$ means I made money
- $x < 0$ means I lost money

- If there are different possible values (x_1, x_2,..., x_M) that return could might be with associated probabilities (p_1, p_2,..., p_M), the expected return is calculated as

$$p_1x_1 + p_2x_2 + \dots + p_Mx_M$$

Chapter 12: Economics of Information

A. Probabilities

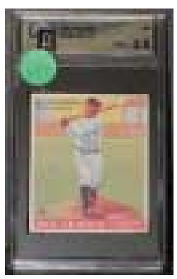
B. Expected value

C. Risk aversion

D. Value of information

Example: Babe Ruth 1933 Goudey baseball card

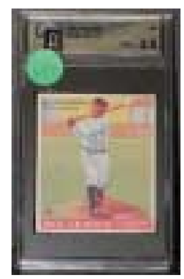
Option 1: put ad in local classifieds, sell to someone in San Diego for $500



Option 2: auction on ebay, sell to price specified by second-highest bidder

Say highest bid is $900, second-highest is $800

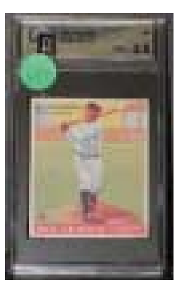
Seller receives $800 minus $40 fee to ebay



Surplus to seller:
$800 - $500 - $40 = $260

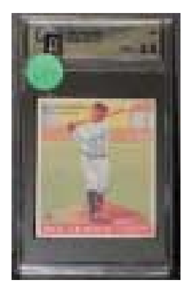
Surplus to buyer:
$900 - $800 = $100

Total surplus generated by ebay:
$260 + $100 + $40 = $400



Using ebay generated a surplus, but what did ebay produce?

Answer: ebay produced the information that there was a seller in San Diego and a buyer in Toronto



broker: someone who gets paid a commission for bringing a buyer and seller together

- stocks and bonds
- real estate

Sales person:

May help provide you with information about which product is best for you

Examples:

- computers
- sports equipment
- hardware

Free rider problem:

Once information is known, it may be possible to use or disseminate without paying for it

Example: obtain detailed information for computer salesperson, then buy online

In some cases, laws may protect the broker to make sure she gets paid (e.g., real estate)

In other cases, the existence of the free-rider problem would lead us to expect that too little information is supplied by the private market