Present Wednesday: 26, 59, 60

9:55 Ashley B Mae B Aspyn B Abby B Kelly Bu Timothy C
11:00 Katie G Courtney Ha Sarah H Tyler H Melissa H Samantha H

Homework:

12.5 # 1, 5, 7, 9, 11, 13-15, 17, 27, 28
Present #11, 13, 28

9:55 Cory Cu., Kaitlin, Amber, Alyssa, Molly, Kaitlin He.
11:00 Courtney Ho., Jennifer, Taylor, Elizabeth, Kamry, Caitlyn Mc.

Warm-up #1:

The Champions of the NFC and AFC meet every year in the Superbowl. The NFC has won the coin toss (to determine who gets the ball first) in 14 straight Superbowls.

What is the probability (and what are the odds) of such a streak?

$P(E) = \frac{1}{2^{14}} = \frac{1}{16,384} = .00006104$

$\approx .006\%$

odds: 1 to 16,383

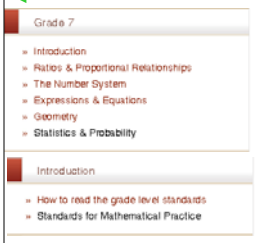
(Odds against: 16,383 to 1)

Project 1: Counting & Probability

The Common Core Standards for Mathematics

Two types of standards:

* Content (listed by grade-level for K-8; by subject in HS)
* Process ("mathematical practice standards"; common across all grade levels)



See Grade 7 Standards

See Mathematical Practice Standards (in the CCSM introduction; also in the overview / introduction of *every* grade level)

Resources: NCTM's *Navigations* and *Illuminations* Series (Navigating through Data Analysis and Probability in Grades PK-2; 3-5; 6-8.)

Some websites with probability applets

http://www.shodor.org/interactivate/activities/

(click either "probability" or "discrete" for Project 1)

http://www.shodor.org/interactivate/activities/ExpProbability/

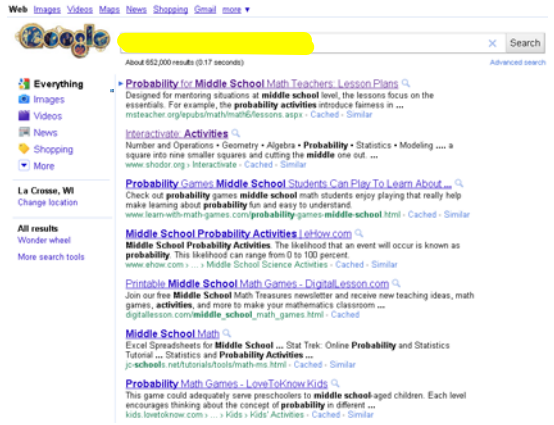
http://www.shodor.org/interactivate/activities/RacingGameWithTwoDie/

Some websites with probability applets

http://nlvm.usu.edu/en/nav/vlibrary.html

Some websites with probability applets

Google: "probability activities for middle school"



12.5 - Expected Value

Warm-up #2: A carnival game uses the spinner below.

Payouts are as follows:

30% **Red pays $0** → $0

50% **Blue pays $1** → $50

20% **Green pays $5** → $100

1. How much should they expect to pay out if 100 people play? $150
2. What is a 'fair price' to play this game? $\frac{\$150}{100} = \$1.50$ per game

Avg. payout per game:

$$\frac{(30\% \times 100) \times \$0 + (50\% \times 100) \times \$1 + (20\% \times 100) \times \$5}{100}$$

$$= \frac{100(30\% \times \$0 + 50\% \times \$1 + 20\% \times \$5)}{100}$$

Expected Value:

The **expected value** of a random variable is a long-run average of its outcomes, weighted by their probabilities.

Expected value can be calculated by multiplying each possible value by its probability and then adding up the products.

Simple Example: The probability of scoring x points in a carnival game is as follows. What is the expected number of points earned per game?

x		p		
0	×	.15	=	0.0 pts
2	×	.50	=	1.0 pts
5	×	.10	=	0.5 pts
10	×	.20	=	2.0 pts
50	×	.05	=	2.5 pts
		1.00		6.0 pts/game

Note: This table showing all possible values of x with their associated probabilities p is called the 'distribution of the random variable'.

Playing the Lottery

In a state lottery, a player chooses four digits (0-9) in a specific order. (Numbers like 0051 and 0120 are possible). The lotto selects four digits randomly, and...

* any player who matches all four digits wins $6,000.
* any player who matches 3 digits wins $100.
* a player matching 0, 1, or 2 digits wins $0.

What is a fair cost to play this game?

value	probability
$6000	$1/10{,}000$
$100	$C(4,3)/10{,}000$
$0	?

M X M M
X M M M
M M X M
M M M X

Expected value: $(\$6000)\frac{1}{10000} + (\$100)\frac{4}{10000} + \$0(?)$

$= .60 + .04 = \$.64$

Insurance Company

An insurance company insures an $8000 car for an annual premium of $740, with a $500 deductible. If the company spends $20 per year to service such a policy, the probability of a total loss is 0.6%, and we assume that either a total loss or no loss will occur, what is the insurance company's expected profit on this policy?

Purchase Extended Warranty?

I recently purchased a $99 gas grill from a retail store. The store offered to sell me an Extended Service policy for $10, meaning they will repair the grill for free if any major problem develops during the first year.

Suppose the probabilities and costs of various repairs levels are listed below. Should I have purchased the Extended Service policy?

Repair cost	Probability
none	0.925
$0-20	0.04
$20-40	0.02
$40-60	0.01
$60-99	0.005
>$99	zero

Remember: To calculate expected value, you must include all possible values in your calculation. (Note that a value with probability 0 is not 'possible').

Analyzing Monopoly

Monopoly is a board game played using two dice. Players roll both dice to determine how many squares they move on a given turn.

If you land on someone else's property, you must pay a certain amount of rent.

Analyzing Monopoly

Calculate the expected cost of your next turn if you are...