Performance Objective: To Learn the Fundamentals of Probability: Calculation, Sample Space, and Theoretical/Experimental Probability

Homework #9PR1 – NYA p.96 #1, 7 – 12, 22, 24, 43, 47 – 50 p.107 #1 – 5

Do Now: Draw a tree diagram showing the outcomes for flipping two coins.

State Test Prep: How many different outcomes are there for taking the sum when you roll two dice?

a) 11 b) 12 c) 36 d) 72

The Basics

Suppose you toss a coin as an experiment.
There are two equally likely results or outcomes possible (heads or tails).
The set of all possible outcomes of an experiment is the sample space.
You are interested in the chance of a particular event occurring (flipping heads).
The probability of an event is a number between 0 and 1 (inclusive) that tells you how likely something is to happen.

Simple Calculation

$P(\text{event}) = \dfrac{\#\text{ of outcomes in an event}}{\#\text{ of outcomes in a sample space}}$	P(Impossible Event) = 0.0
	P(Definite Event) = 1.0
The complement of an event: If P(event x) = y, then P(NOT event x) = 1 – y	
Probability is always a value from 0 to 1. It can be expressed as a fraction, ratio, decimal, or a percent.	

Experimental Probability Versus Theoretical Probability

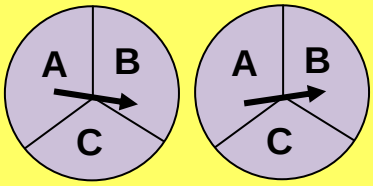
Experimental probability yields a value based on data collected from trials; it does not use the formula above.
A skateboard company inspected 1000 of its manufactured products. No defects were found in 992 of them. What is the percentage that a randomly selected skateboard has no defects?

Example A1: Tossing a coin

1. How many possible outcomes are there?	
2. What are the possible outcomes?	
3. Are they equally likely?	
4. What are their probabilities?	

Example A2: Spinning two spinners

1. List the sample space (all possible outcomes).
2. How many possible outcomes are there?
3. In how many outcomes does spinner 1 land on A and spinner 2 land on B? What is the probability?
4. In how many outcomes does one spinner land on C and the other on B? What is the probability?
5. In how many outcomes does spinner 2 land on C?



Spinner 1 Spinner 2

Example A3: One–on–One Basketball

Ally, Bob, Carol, and Doug are playing 1–on–1 basketball. To decide the two players for each game, they put their names into a hat and pull out two at random. *Hint: You choose a pair at a time.*

1. List all the pairs of name that include Ally.
2. List all the possible pairs that include Bob, but not Ally (already listed in 1)
3. Now list all the pairs that include Carol, but not Ally or Bob.
4. How many pairs (games) are there? Any overlooked?
5. What is the probability Bob and Carol play in the first game?
6. Ed joins them. How many games are added? New total?
7. What is the probability Doug will play in the first game?

Example B1: Rolling a Die

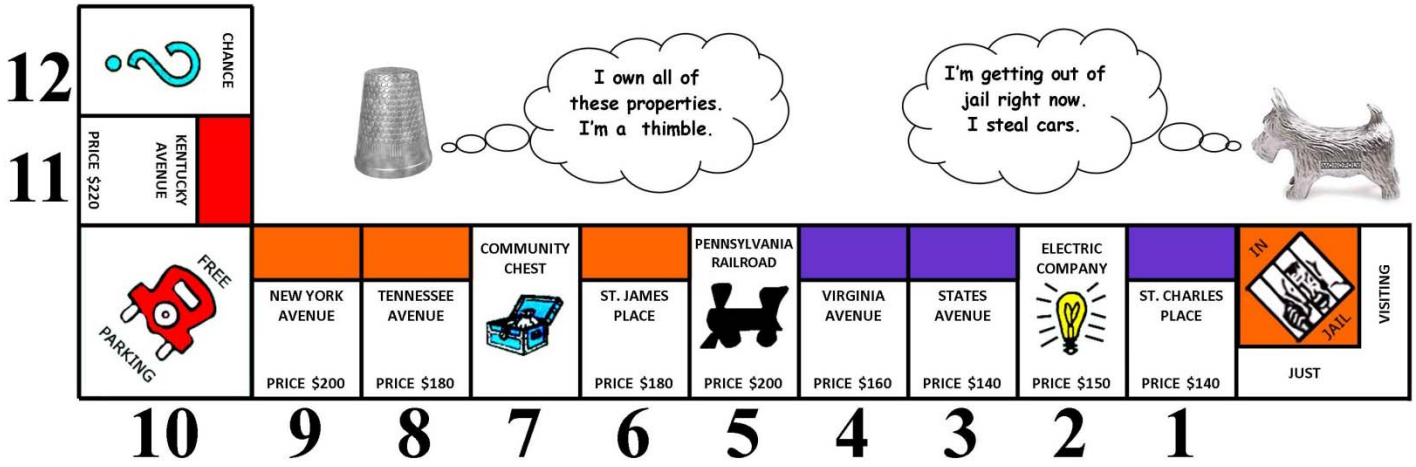
Jason and Alexander are playing a game with a number cube (6–sided die). If Jason rolls a 3 or more on his next roll he will win.

1. List the outcomes in the sample space.
2. What are the outcomes of the event "3 or more"?
3. What is P(Jason Wins) *or* P(3 or more)?

Example B2: Guessing a Person's Birthday

1. What is the probability that you can guess the month? P(correct month)
2. What assumption must you make for #1?
3. What's the probability that you can guess the day of the month? P(right day)
4. Is there any special condition or assumption for #3?

Practice: MONOPOLY



P(1) =	P(7) =
P(2) =	P(8) =
P(3) =	P(9) =
P(4) =	P(10) =
P(5) =	P(11) =
P(6) =	P(12) =

Presented above is a fairly common situation in Monopoly. The dog is about to get out of jail and roll the dice for its turn. The thimble is an owner of the red, orange, and light purple monopolies (all the properties of that color) in the area of the jail and free parking spaces, and has yet to build houses or hotels.

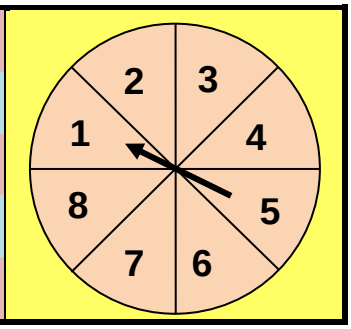
You as the thimble must decide where to build the houses and hotels, in order to get as much money as possible from the dog. Where would you build?

Sum	*Probability*	*Outcomes*
2	1/36	(1,1)
3	2/36 or 1/18	(1,2) (2,1)
4	3/36 or 1/12	(1,3) (2,2) (3,1)
5	4/36 or 1/9	(1,4) (2,3) (3,2) (4,1)
6	5/36	(1,5) (2,4) (3,3) (4,2) (5,1)
7	6/36 or 1/6	(1,6) (2,5) (3,4) (4,3) (5,2) (6,1)
8	5/36	(2,6) (3,5) (4,4) (5,3) (6,2)
9	4/36 or 1/9	(3,6) (4,5) (5,4) (6,3)
10	3/36 or 1/12	(4,6) (5,5) (6,4)
11	2/36 or 1/18	(5,6) (6,5)
12	1/36	(6,6)

Fast Practice: Be Careful

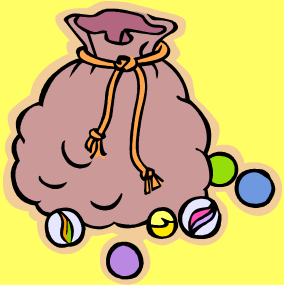
The Spinner: 1 spin

a) P(2) =	f) P(>1) =
b) P(8) =	g) P(<10) =
c) P(even) =	h) P(4 and 5) =
d) P(odd or < 5) =	i) P(red) =
e) P(1 or 8) =	j) P(3 and odd) =



The Marble Bag: The bag contains 3 red, 2 green, and 3 blue marbles.

a) List the sample space	f) P(red or green) =
b) P(red) =	g) P(green or black) =
c) P(green) =	h) P(marble) =
d) P(blue) =	i) P(red and blue) =
e) P(yellow) =	j) P(red or blue or green) =



Word Problem Practice

1. P(13 male children) = 1/8192. What is the probability of not having all male children?
2. Which has the greatest probability of occurring?
   a) Tossing heads on a coin toss. b) Tossing heads or tails on a coin toss.
   c) Rolling a 6 on a six-sided die. d) Not rolling a 6 on a six-sided die.
3. What is the probability of drawing a red sock out of a blue drawer containing only red socks?
4. What is the probability of going to math class on New Year's Day?
5. What is the probability of a person's birthday being on the 4th of July?

Mutually Exclusive Events: Tap Into Your Common Sense!

Two events are <u>mutually exclusive</u> if both cannot happen at the same time.

Mutually Exclusive: P(A or B) = P(A) + P(B) Note: P(A and B) = 0

Not Mutually Exclusive: P(A or B) = P(A) + P(B) – P(A and B)

1. Pick one card from the deck. Event A = red queen, Event B = any 2. What is P(A or B)? Are these events mutually exclusive?
2. Roll one die. Event A = rolling a number > 5, Event B = rolling an odd number. What is P(A or B)? Are these events mutually exclusive?
3. Roll one die. Event A = rolling a 2, Event B = rolling an even number. What is P(A or B)? Are these events mutually exclusive?