

## Unit 11 Day 4 Notes on Theoretical vs Experimental Probability

KEY

### Let's think about it!

If you flipped a coin, what is the probability that you get a head?

$$\frac{1}{2}$$

If I flip a coin 20 times, I'd get 10 heads and 10 tails, right? *Let's try it!*

# of Flips	Tally		Probability (%)	
	Heads	Tails	Heads	Tails
20				
30				
50				
Total = 100				

Was the predicted probability the same as the probability you observed? Why or why not?

Theoretical Probability

vs.

Experimental Probability

what we expect

what actually happens

What conclusion can you draw about the probability of flipping a head as the number of coin flips goes up?

More trials  $\rightarrow$  experimental approaches theoretical

### Try It!

Wilma picks a card at random from a standard deck, looks at it, and then replaces it. She does this 100 times.

- a. How many times would you expect her to draw a spade?

$$\downarrow$$
$$\frac{13}{52}$$

$$\frac{13}{52} (100) = \boxed{25 \text{ times}}$$

- b. Is she guaranteed to draw a spade this many times? Explain why or why not!

No. It's just what we expect.

- c. Is this example illustrating experimental or theoretical probability?

Experimental

1) Amanda used a standard deck of 52 cards and selected a card at random. She recorded the suit of the card she picked, and then replaced the card. The results are in the table below.

30 total

Diamonds	7
Hearts	9
Spades	11
Clubs	3

a) Based on her results, what is the experimental probability of selecting a heart?

$$\frac{9}{30} = \frac{3}{10}$$

b) What is the theoretical probability of selecting a heart?

$$\frac{13}{52} = \frac{1}{4}$$

c) Based on her results, what is the experimental probability of selecting a diamond or a spade?

$$\frac{18}{30} = \frac{3}{5}$$

d) What is the theoretical probability of selecting a diamond or a spade?

$$\frac{26}{52} = \frac{1}{2}$$

2) You are playing Monopoly and roll one, six-sided die.

Side	# of times
1	8
2	3
3	9
4	6
5	4
6	6

36 total

a) What is the theoretical probability that the die will land on an even number?

2, 4, 6

$$\frac{3}{6} = \frac{1}{2}$$

b) What was the experimental probability of how many times an even number was actually rolled using the table?

$$3 + 6 + 6 = \frac{15}{36} = \frac{5}{12}$$

c) If you roll a die 36 times, how many times would you expect to roll a "1"?

$$\frac{1}{6} (36) = 6 \text{ times}$$

d) How many times did you roll a "1" in the experiment?

$$8$$

e) What is the theoretical probability for rolling a number greater than 4?

$$\frac{2}{6} = \frac{1}{3}$$

f) What was the experimental probability of rolling a number greater than 4?

$$4 + 6 = \frac{10}{36} = \frac{5}{18}$$

3) You are taking a multiple-choice test. Each of the 5 questions has four answer options - A, B, C, and D.

a) How many ways can your teacher make the answer key?

$$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 = 1024$$

b) Find the theoretical probability that the answer to the first question is "B."

$$\frac{1}{4}$$

c) The answer to the first three questions was "B." How likely is this to happen for three MC questions?

$$P(B) \text{ and } P(B) \text{ and } P(B) \\ \frac{1}{4} \cdot \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{64}$$