Handout #1

STAT-IPROB: Introduction to Probability

Into

LESSON OBJECTIVE

When you complete this lesson, you will be able:

- To set up and solve basic probabilty story problems.

- To represent basic probablities as fractions, decimals, percents or ratios.

Talk About . . .

• **Probability All Around Us.** For example: *This lesson covers **probability**: the odds or the likelihood that something will happen.*

You've probably ran into this before if you've ever entered a raffle or bought a lottery ticket.

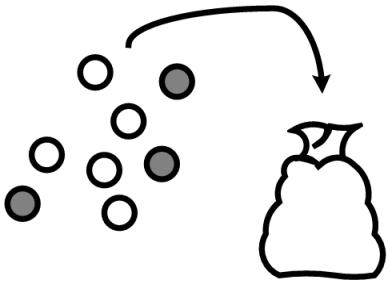
*The probability of winning was your **chance** of winning.*

• **Fractions, Decimals and Percents.** For example: *Working with probability makes heavy use of **fractions**, **decimals**, and **percents**. Always, a probability is expressed as a number **less than or equal to 1**. Therefore, we need fractions and decimals to express these **non-whole** numbers.*

Definitions: Probability

Put 3 grey balls and 5 white balls into a bag and then shake the bag. What's the probability that you'll pick out a grey ball?

Probability: **A number expressing the likelihood that a specific event will occur, expressed as the ratio of the number of actual occurrences to the number of possible occurrences.**



$$\text{Probability} = \frac{\#\text{ of grey balls}}{\#\text{ of balls}} = \frac{3}{8}$$

But remember, there's lots of ways of saying the same thing. You can say:

- What's the probability of that happening.
- What are the odds of that happening.
- What's the chance of that happening.

Probability is defined as:

$$\text{Probability} = \frac{\#\text{ of selected events}}{\#\text{ of total events}}$$

You see, the probability of a thing or an event happening is just the **number of those things or events** divided by the **total number of events or things that will happen**.

Handout #1

STAT-IPROB: Introduction to Probability

Questions

DIRECTIONS

With your tutor's help, try solving the problem to the right. But first **draw a picture to represent the problem!**

Shukri and four of Shukri's friends put their names into a hat. A name is then drawn at random.

Q1 What's the probability that Shukri's name is drawn?

Q2 What's are the odds that Shukri's name is drawn?

Q3 What's the chance that Shukri's name is drawn?

Handout #1

STAT-IPROB: Introduction to Probability

Questions

The probability of something happening is the same as the rate that something will happen.

And you know that a rate can be expressed as a:

- Ratio -- 1 : 4
- Fraction -- 1 / 4
- Percentage -- ex. 25%
- Or Decimal -- ex. 0.25

Q4 You pick a card from a 52-card deck and put it back in the deck. You then pick a card at random from the deck.

What are the odds that you pick your card expressed as a

Ratio:

Fraction:

Decimal:

Percentage:

Q5 You put a red ball into a bag that also contains 7 blue balls. After shaking up the bag, what's the percent chance you pull out the red ball?

Q6 What the chance of pulling out a blue ball expressed as a fraction?

Handout #1

STAT-IPROB: Introduction to Probability

Challenge!

Q7 You put seven yellow balls into a bag. You then shake up the bag. What's the probability of picking out a yellow ball? Report your answer both a fraction and as a percentage (percent chance)?

Q8 What's the percent chance of picking out a red ball?

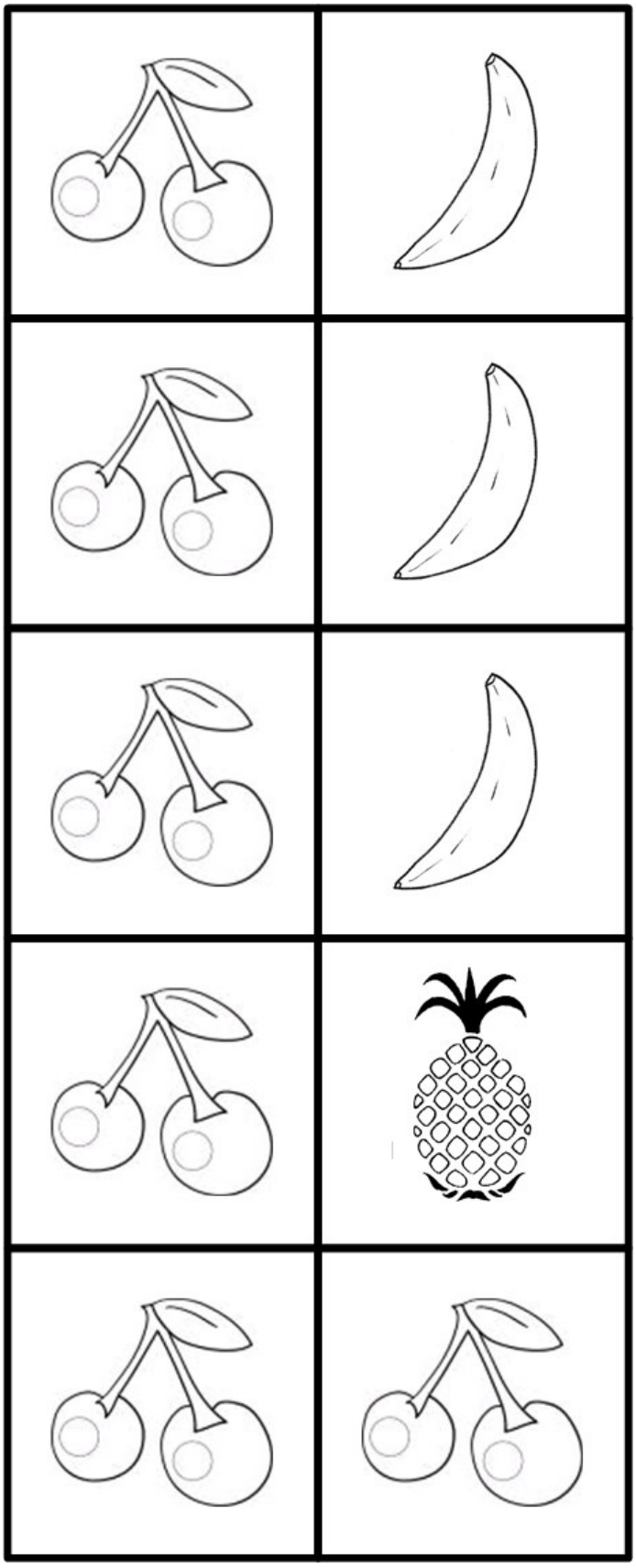
Closure

In your own words, define probability:

Have you ever used or heard of probability before today?

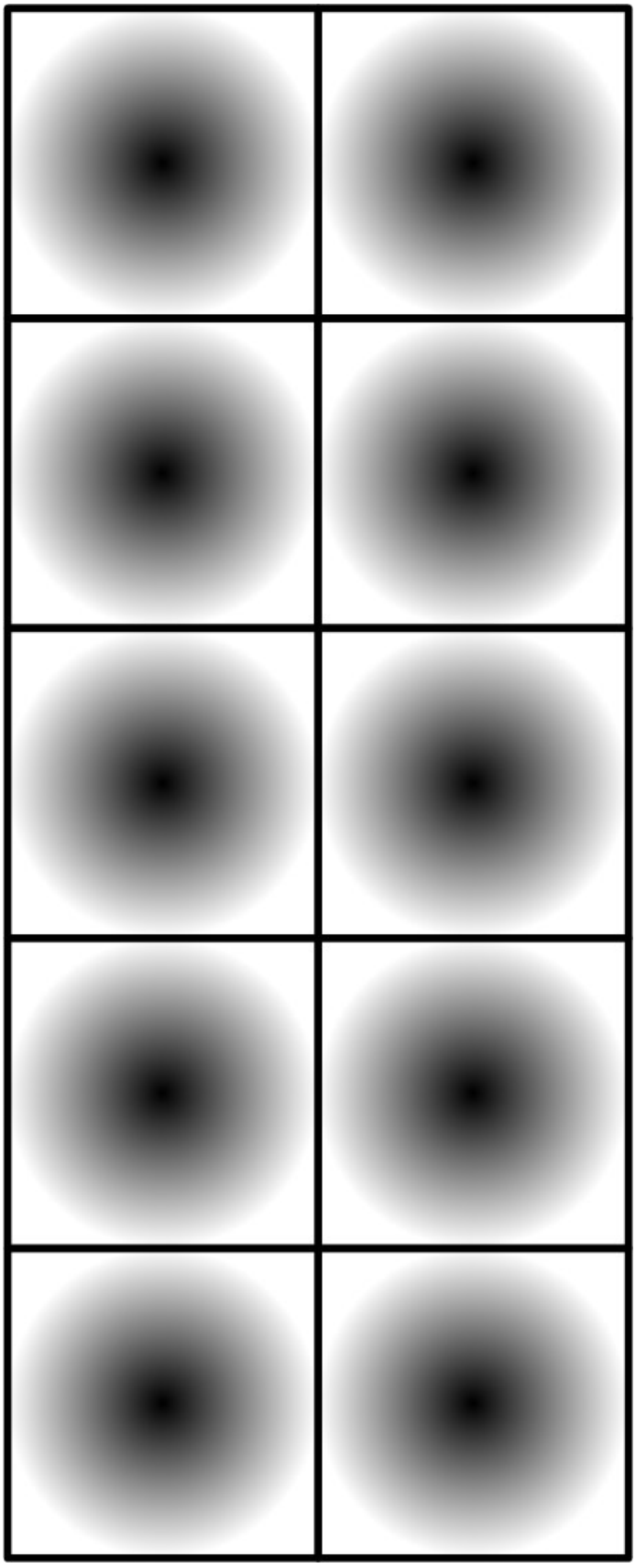
Cutout #1: *Cards For Worksheet #2.*

STAT-IPROB: Introduction to Probability



Cutout #1: *Cards For Worksheet #2.*

STAT-IPROB: Introduction to Probability



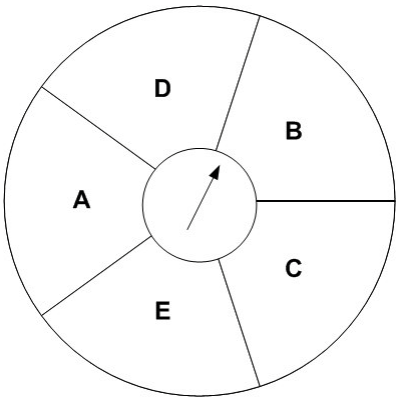
Worksheet #1

STAT-IPROB: Introduction to Probability

Questions

DIRECTIONS

Use the spinner below to answer the problems on this worksheet.



Q1 What's the probability of landing on the letter 'A', expressed as a fraction:

Q2 Expressed as a percentage:

Q3 What's the percent chance of landing the letter 'C':

Q4 What's probability of landing on 'A', 'C', or 'E' expressed as a fraction:

Q5 Expressed as a decimal:

Q6 Expressed as a percentage:

Q7 What's probability of landing on the letter 'Z' expressed as a fraction:

Q8 Expressed as a percentage:

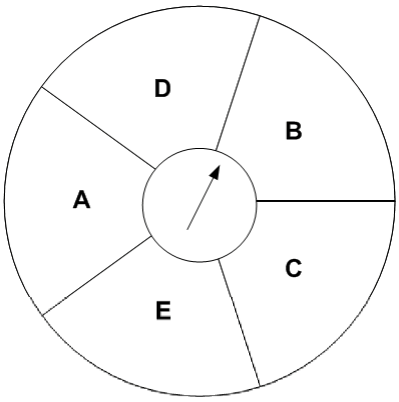
Worksheet #1

STAT-IPROB: Introduction to Probability

Questions

DIRECTIONS

Use the spinner below to answer the problems on this worksheet.



Q1 What's the probability of landing on the letter 'A', expressed as a fraction: **1/5**

Q2 Expressed as a percentage: **20%**

Q3 What's the percent chance of landing the letter 'C': **20%**

Q4 What's probability of landing on 'A', 'C', or 'E' expressed as a fraction: **3/5**

Q5 Expressed as a decimal: **0.6**

Q6 Expressed as a percentage: **60%**

Q7 What's probability of landing on the letter 'Z' expressed as a fraction: **0/5**

Q8 Expressed as a percentage: **0%**

Worksheet #2

STAT-IPROB: Introduction to Probability

Play It

Let's trying tossing a **fair coin**. A fair coin is just a regular coin with two sides: **heads and tails**. It's just like this **quarter** shown below:

Heads

Tails

It's called a fair coin because it's **equally likely** that you'll land on head as land on tail.

Get a fair coin (like a quarter) and toss it a few times with your tutor.

Based on what you know about probability, calculate the **percent** chance that you will toss a 'heads':

Calculate the percent change that you will toss a 'tails':

Express this as a fraction:

Now, let's try four games. For each game, toss your coin four times and record your results:

Trial #	Game #1 Heads or Tails	Game #2 Heads or Tails	Game #3 Heads or Tails
1			
2			
3			
4			

For each game, calculate the percentage of the time you threw heads:

Does this number exactly match your calculated probability above? Talk about this with your tutor.

Worksheet #2

STAT-IPROB: Introduction to Probability

Play It

Now, let's try play two more games, but this time for each game we'll toss the coin 16 times.

Trial #	Game #1 Heads or Tails	Game #1 Heads or Tails
1		
2		
3		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		

NOTE TO TUTOR

Talk with your student about the fact that the calculated probability predicts what will happen when you perform an infinite number of trials. As you perform more and more trials your more likely to get closer to the actual probability. If you perform just a few trials, you may or may not be close to the actual probabilities.

For each game, calculate the percentage of the time you threw heads:

Does this number exactly match the calculated probability? Why or why not?

Is it closer than when you did the games with just 4 trials on the last page?

Worksheet #3

STAT-IPROB: Introduction to Probability

Play It

Let's play a **gambling game**. You need to cut out the pieces provided.

Here's how you play:

*Put shapes face down. Mix them up. Pick a piece out **with your eyes closed**.*

If you pick a cherry, you don't win. If you pick a banana you get twenty five cents ($0.25). If you pick a pineapple you get three dollars ($3.00).

*It costs **$1 to play every round**.*

Okay, but before you start to play, fill in the **probability** chart below by counting a specific type of card and counting the total number of cards. We'll fill in the 'cherry' for you -- but you have to do the rest on your own:

Probability of Cherry		
$0	fraction	6/10
	decimal	0.6
	percent	60%

Probability of Banana		
$0.25	fraction	
	decimal	
	percent	

Probability of Pinneapple		
$3.00	fraction	
	decimal	
	percent	

Play the game 15, 30, and the 60 times. Fill in C, B, or P after each run:

Trial #	Fruit
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Trial #	Fruit
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

Trial #	Fruit
31	
32	
33	
34	
35	
36	
37	
38	
39	
40	
41	
42	
43	
44	
45	

Trial #	Fruit
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	
57	
58	
59	
60	

Results After 15 Trials | ***Total Amount Spent = $15*** | ***Total Amount Won:***

Times You Got Cherry			Times You Got Banana			Times You Got Pineapple		
$0	fraction	/ 15	$0.25	fraction	/ 15	$3.00	fraction	/ 15
	decimal			decimal			decimal	
	percent			percent			percent	

Results After 30 Trials | ***Total Amount Spent = $30*** | ***Total Amount Won:***

Times You Got Cherry			Times You Got Banana			Times You Got Pineapple		
$0	fraction	/ 30	$0.25	fraction	/ 30	$3.00	fraction	/ 30
	decimal			decimal			decimal	
	percent			percent			percent	

Results After 60 Trials | ***Total Amount Spent = $60*** | ***Total Amount Won:***

Times You Got Cherry			Times You Got Banana			Times You Got Pineapple		
$0	fraction	/ 60	$0.25	fraction	/ 60	$3.00	fraction	/ 60
	decimal			decimal			decimal	
	percent			percent			percent	

Q1 After 15 trials, look at how many times you got cherry, banana, and pineapple. How does that compare to the probabilities you calculated to the left?

Worksheet #3

STAT-IPROB: Introduction to Probability

Play It

As you perform more **trials** the **actual percentage** of occurrence gets closer to the **predicted probability** of that event happening.

Let's take a two sided coin. What's the probability of flipping heads? Well, it's:

$\frac{1}{2}$ = 0.5 = 50%

So let's look at three tosses:

Trial #	Side
1	Head
2	Tail
3	Tail

What percent of the time did we get 'heads':

Let's look at 15 tosses:

Trial #	Side
1	Head
2	Tail
3	Tail
4	Head
5	Head
6	Head
7	Tail
8	Head
9	Head
10	Tail
11	Head
12	Tail
13	Tail
14	Head
15	Tail

What percent of the time did we get 'heads':

Q2 Were they the exact same numbers? Were they close? Discuss why or why not with your tutor?

Q3 After 30 trials, look at how many times you got cherry, banana, and pineapple. How does that compare to the probabilities you calculated to the left?

Q4 Were they the exact same numbers? Were they closer than at 15 trials? Discuss why or why not with your tutor?

Q5 After 60 trials, look at how many times you got cherry, banana, and pineapple. How does that compare to the probabilities you calculated to the left?

Q6 Were they the exact same numbers? Were they closer than at 30 trials? Discuss why or why not with your tutor?

Q7 Did you win money or did you lose money? Why do you think that is?

Q8 What is the **average amount of money** you expect to win each round?

Q9 Apply the **average amount of money you expect to win per trial** by 60. Is this close to what you won?

Worksheet #3

STAT-IPROB: Introduction to Probability

Play It

Let's play a **gambling game**. You need to cut out the pieces provided.

Here's how you play:

*Put shapes face down. Mix them up. Pick a piece out **with your eyes closed**.*

If you pick a cherry, you don't win. If you pick a banana you get twenty five cents ($0.25). If you pick a pineapple you get three dollars ($3.00).

*It costs **$1 to play every round**.*

Okay, but before you start to play, fill in the **probability** chart below by counting a specific type of card and counting the total number of cards. We'll fill in the 'cherry' for you -- but you have to do the rest on your own:

Probability of Cherry		
$0	fraction	6/10
	decimal	0.6
	percent	60%

Probability of Banana		
$0.25	fraction	3/10
	decimal	0.3
	percent	30%

Probability of Pinneapple		
$3.00	fraction	1/10
	decimal	0.1
	percent	10%

Play the game 15, 30, and the 60 times. Fill in C, B, or P after each run:

Trial #	Fruit
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Trial #	Fruit
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

Trial #	Fruit
31	
32	
33	
34	
35	
36	
37	
38	
39	
40	
41	
42	
43	
44	
45	

Trial #	Fruit
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	
57	
58	
59	
60	

Results After 15 Trials | ***Total Amount Spent = $15*** | ***Total Amount Won:***

Times You Got Cherry			Times You Got Banana			Times You Got Pineapple		
$0	fraction	/ 15	$0.25	fraction	/ 15	$3.00	fraction	/ 15
	decimal			decimal			decimal	
	percent			percent			percent	

Results After 30 Trials | ***Total Amount Spent = $30*** | ***Total Amount Won:***

Times You Got Cherry			Times You Got Banana			Times You Got Pineapple		
$0	fraction	/ 30	$0.25	fraction	/ 30	$3.00	fraction	/ 30
	decimal			decimal			decimal	
	percent			percent			percent	

Results After 60 Trials | ***Total Amount Spent = $60*** | ***Total Amount Won:***

Times You Got Cherry			Times You Got Banana			Times You Got Pineapple		
$0	fraction	/ 60	$0.25	fraction	/ 60	$3.00	fraction	/ 60
	decimal			decimal			decimal	
	percent			percent			percent	

Q1 After 15 trials, look at how many times you got cherry, banana, and pineapple. How does that compare to the probabilities you calculated to the left?

Worksheet #3

STAT-IPROB: Introduction to Probability

Play It

As you perform more **trials** the **actual percentage** of occurrence gets closer to the **predicted probability** of that event happening.

Let's take a two sided coin. What's the probability of flipping heads? Well, it's:

$\frac{1}{2}$ = 0.5 = 50%

So let's look at three tosses:

Trial #	Side
1	Head
2	Tail
3	Tail

What percent of the time did we get 'heads':

Let's look at 15 tosses:

Trial #	Side
1	Head
2	Tail
3	Tail
4	Head
5	Head
6	Head
7	Tail
8	Head
9	Head
10	Tail
11	Head
12	Tail
13	Tail
14	Head
15	Tail

What percent of the time did we get 'heads':

Q2 Were they the exact same numbers? Were they close? Discuss why or why not with your tutor?

Q3 After 30 trials, look at how many times you got cherry, banana, and pineapple. How does that compare to the probabilities you calculated to the left?

Q4 Were they the exact same numbers? Were they closer than at 15 trials? Discuss why or why not with your tutor?

Q5 After 60 trials, look at how many times you got cherry, banana, and pineapple. How does that compare to the probabilities you calculated to the left?

Q6 Were they the exact same numbers? Were they closer than at 30 trials? Discuss why or why not with your tutor?

Q7 Did you win money or did you lose money? Why do you think that is?

Q8 What is the **average amount of money** you expect to win each round?

Money Per Round = 0.6 × $0 + 0.3 × $0.25 + 0.1 × $3.00 = $0.375 = $0.38

Q9 Apply the **average amount of money you expect to win per trial** by 60. Is this close to what you won?

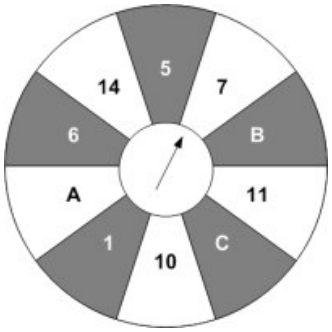
$0.38 × 60 = $22.80

Worksheet #4

STAT-IPROB: Introduction to Probability

Questions

Use the spinner below to answer the problems on this worksheet.



Q1 What's the probability of landing on a number, expressed as fraction:

Q2 Expressed as a decimal:

Q3 Expressed as a percentage:

Q4 What's the percent chance of landing on a grey number:

Q5 If you land grey, what's the percentage chance you're on a number:

Q6 What's the probability expressed as a fraction in lowest form:

Q7 You land on a number. What's the probability that you land on grey:

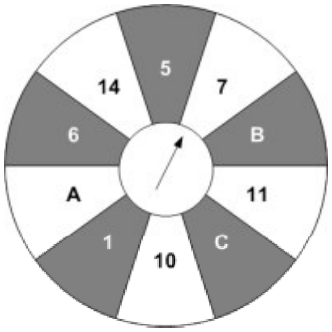
Q8 What's the percent chance you land on a white number:

Worksheet #4

STAT-IPROB: Introduction to Probability

Questions

Use the spinner below to answer the problems on this worksheet.



Q1 What's the probability of landing on a number, expressed as fraction: **7/10**

Q2 Expressed as a decimal: **.70**

Q3 Expressed as a percentage: **70%**

Q4 What's the percent chance of landing on a grey number: **30%**

Q5 If you land grey, what's the percentage chance you're on a number: **60%**

Q6 What's the probability expressed as a fraction in lowest form: **3/5**

Q7 You land on a number. What's the probability that you land on grey: **3/7**

Q8 What's the percent chance you land on a white number: **40%**

Worksheet #5

STAT-IPROB: Introduction to Probability

Questions

Q1 At any given time, what's the probability that the last digit on a digital clock reads '5'? Answer both as a decimal and as a percent:

Q2 Pick a letter from the alphabet at random. What's the probability that you picked 'Q'?

Q3 What's the probability that your birthday will land on a Sunday?

Q4 What's the probability that you were born between 2:00PM and 8:00PM?

You can express a probability as a **fraction**, **decimal**, or percent.

For example, let's take the following problem:

Take a person at random. What's the probability that their birthday is in March.

Well, how many months in a year are there? **12**. So we can express the probability as a:

Fraction:

$$\frac{\mathbf{1}}{\mathbf{12}}$$

Decimal:

$1 \div 12 = 0.08\overline{3} = 0.083$

Percent

0.083 = 8.3% chance

For the following problems, express your answer as a ***fraction, decimal, and percent***.

Round your decimals to the **nearest thousandth**.

Round your percents to the nearest **tenth of a percent**.

Worksheet #5

STAT-IPROB: Introduction to Probability

Questions

You can express a probability as a **fraction**, **decimal**, or percent.

For example, let's take the following problem:

Take a person at random. What's the probability that their birthday is in March.

Well, how many months in a year are there? **12**. So we can express the probability as a:

Fraction:

$$\frac{1}{12}$$

Decimal:

$1 \div 12 = 0.08\overline{3} = 0.083$

Percent

0.083 = 8.3% chance

For the following problems, express your answer as a ***fraction, decimal, and percent***.

Round your decimals to the **nearest thousandth.**

Round your percents to the nearest **tenth of a percent**.

Q1 At any given time, what's the probability that the last digit on a digital clock reads '5'? Answer both as a decimal and as a percent:

1/10 | 0.1 | 10% chance.

Q2 Pick a letter from the alphabet at random. What's the probability that you picked 'Q'? **1/26 | 0.038 | 3.8% chance.**

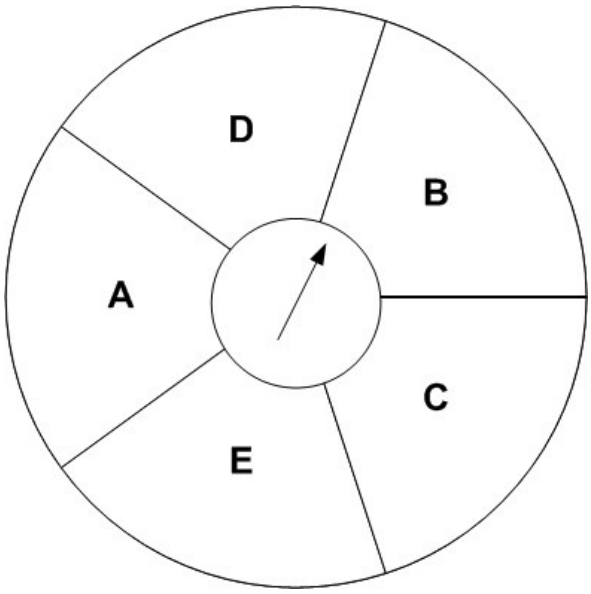
Q3 What's the probability that your birthday will land on a Sunday? **1/7 | 0.143 | 14.3% chance.**

Q4 What's the probability that you were born between 2:00PM and 8:00PM? **6/24 = 1/4 | 0.25 | 25% chance.**

Quiz #1

STAT-IPROB: Introduction to Probability

Use the spinner below to answer the problems on this worksheet.



Q1 What's the probability of landing on the letter 'B', expressed as a fraction:

Q2 What's the probability of landing on the letter 'C' expressed as a decimal:

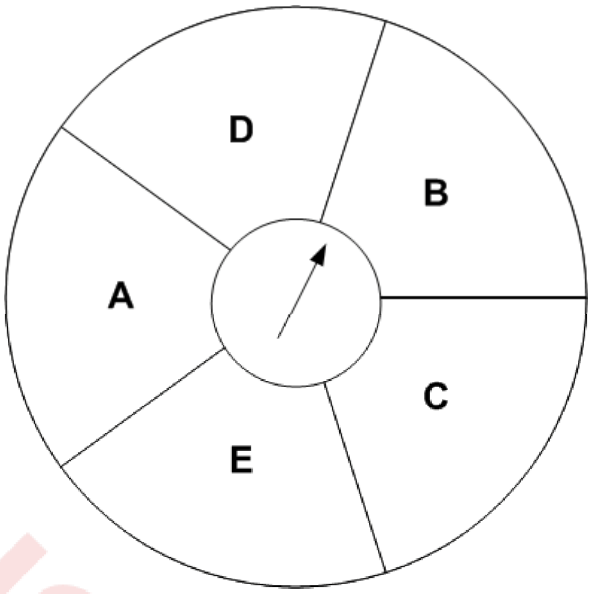
Q3 What's the probability of landing on the letter 'A' expressed as a percentage:

Q4 What's probability of landing on 'A' or 'C' expressed as a percentage:

Quiz #1

STAT-IPROB: Introduction to Probability

Use the spinner below to answer the problems on this worksheet.



Q1 What's the probability of landing on the letter 'B', expressed as a fraction: **1/5**

Q2 What's the probability of landing on the letter 'C' expressed as a decimal: **0.2**

Q3 What's the probability of landing on the letter 'A' expressed as a percentage: **20%**

Q4 What's probability of landing on 'A' or 'C' expressed as a percentage: **40%**

Quiz #2

STAT-IPROB: Introduction to Probability

Q1 A bag of hard candies contains 2 grape candies, 3 orange candies, and 1 lime candy. What is the probability of picking a lime candy?

A. 1 out of 5

B. 2 out of 5

C. 1 out of 6

D. 3 out of 6

Q2 A letter is chosen at random from the following word:

What's the probability of choosing the letter 'u'?

A. 2/9

B. 1/9

C. 4/5

D. 3/9

Quiz #2

STAT-IPROB: Introduction to Probability

Q1 A bag of hard candies contains 2 grape candies, 3 orange candies, and 1 lime candy. What is the probability of picking a lime candy?

A. 1 out of 5

B. 2 out of 5

C. ***1 out of 6*** ✓

D. 3 out of 6

Q2 A letter is chosen at random from the following word:

What's the probability of choosing the letter 'u'?

A. ***2/9*** ✓

B. 1/9

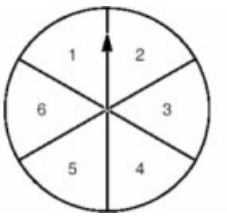
C. 4/5

D. 3/9

Quiz #3

STAT-IPROB: Introduction to Probability

Q1 On the spinner shown below, what is the probability of spinning a number less than 3?



A. 0

B. 1/2

C. 1/6

D. 1/3

Q2 You have a key ring with five keys on it. Two of the keys are for your apartment. What is the probability of selecting an apartment key if you choose one key without looking?

A. 5% chance

B. 40% chance

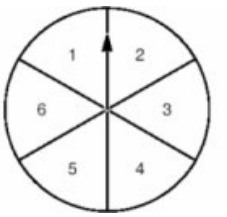
C. 100% chance

D. 50% chance

Quiz #3

STAT-IPROB: Introduction to Probability

Q1 On the spinner shown below, what is the probability of spinning a number less than 3?



A. 0

B. 1/2

C. 1/6

D. ***1/3*** ✓

Q2 You have a key ring with five keys on it. Two of the keys are for your apartment. What is the probability of selecting an apartment key if you choose one key without looking?

A. 5% chance

B. ***40% chance*** ✓

C. 100% chance

D. 50% chance