4.2: Theoretical Probability

Group Activity

1. Using the prize wheel below, make a theoretical probability model and then use it to find the probabilities below.

	Sub	Drink	Cookies	Chips	BOGO	Mystery Prize
Probability						

2. If you spin the wheel once, what's the probability that you get

a. chips or a drink?

b. not the mystery prize?

c. a drink or not BOGO?

3. Find the following odds:

a. The odds of winning the mystery prize.

b. The odds against winning the mystery prize.

c. The odds against winning a sandwich.

4. If you get to spin the wheel repeatedly, would that be like drawing with or without replacement?

a. If you get to spin 3 times, what is the chance you would get 3 bags of chips?

b. If you get to spin twice, what is the chance you will get two BOGO's?

5. The t-shirts for your school group just arrived: 5 red small, 5 orange small, 10 red medium, 10 orange medium, 15 red large, 15 orange large, 10 red extra-large, 10 orange extra-large.

If you grab one t-shirt at random, what is the probability that

a. it is a small or an extra-large?

b. it is extra-large or orange?

c. it is not small or medium?

d. it is not small or red?

6. If five people come up and you draw 5 shirts at random, what is the probability that

a. they are all red larges?

b. there is at least one orange extra-large?

4.3: Expected Value

Group Activity

7. a. Calculate the expected value of the Subway prize wheel. Let's say the mystery prize is a $20 gift card.

	Sub	Drink	Cookies	Chips	BOGO	Mystery Prize
Prize Value	$4.25	$1.60	$1.30	$0.99	$4.25	
Probability	$\frac{2}{13}$	$\frac{2}{13}$	$\frac{2}{13}$	$\frac{4}{13}$	$\frac{2}{13}$	$\frac{1}{13}$

b. What does the expected value mean in this example? Explain it in a complete sentence.

8. Based on historical data, an auto insurance company estimates that a particular customer has a 1.5% likelihood of having an accident in the next year, with the average insurance payout being $10,000.

If the company charges this customer an annual premium of $500, what is the company's expected value of this insurance policy?

a. Make a probability table.

Possibilities	Accident	No Accident
Payout		
Probability		

b. Calculate the expected value for the company.

9. A company estimates that 7% of their products will fail after the original warranty period but within 2 years of the purchase, with a replacement cost of $250.

If they want to offer a 2-year extended warranty, what price should they charge so that they'll break even (in other words, so the expected value will be 0)

a. Make a probability table.

b. Calculate the expected value and answer the question.

More Practice:

Beginning in October, 2015, **Powerball**® became an even larger combined large jackpot game and cash game. Every Wednesday and Saturday night at 10:59 p.m. Eastern Time, we draw five white balls out of a drum with 69 balls and one red ball out of a drum with 26 red balls.
Source: http://www.powerball.com/powerball/pb_prizes.asp

Powerball - Prizes and Odds

Match	Prize	Odds
5 + Powerball	Grand Prize	1 in 292,201,338.00
5	$1,000,000	1 in 11,688,053.52
4 + Powerball	$50,000	1 in 913,129.18
4	$100	1 in 36,525.17
3 + Powerball	$100	1 in 14,494.11
3	$7	1 in 579.76
2 + Powerball	$7	1 in 701.33
1 + Powerball	$4	1 in 91.98
Powerball	$4	1 in 38.32

The overall odds of winning a prize are 1 in 24.87.
The odds presented here are based on a $2 play (rounded to two decimal places).

1.a. If the current Powerball grand prize amount is $90 million, calculate the expected winnings per ticket:

b. Calculate the expected profit or loss for the ticket-holder per Powerball ticket: