

Big Picture

Worked with statistics for a while, which we will visit again in another Unit. For now we will discuss probability in some light detail. We will link Probability back to statistics with Normal Distributive Curve.

Context of this Lessons

Finish up with Tree Diagrams. Exploring Expected Values and Venn Diagrams....

To Do Today!

- **Task 0:** HW 4.4 **Last Class**
- **Task 1:** Expectation
- **Task 2:** Expectation Practice
- **Task 3:** Expected Value
- **Task 4:** Expected Value Practice
- **Task 5:** HW 4.5: **Playing for a grade!**




Task 0: Last Class

Each person in your group needs to create a tree diagram for one of the following situations. As a group you need to do all of them.

- 5 A bag contains four red and two blue marbles. Three marbles are selected simultaneously. Determine the probability that:
 - a all are red
 - b only two are red
 - c at least two are red.
- 6 Bag A contains 3 red and 2 white marbles. Bag B contains 4 red and 3 white marbles. One marble is randomly selected from A and its colour noted. If it is red, 2 reds are added to B. If it is white, 2 whites are added to B. A marble is then selected from B. What is the chance that the marble selected from B is white?
- 7 A man holds two tickets in a 100-ticket lottery in which there are two winning tickets. If no replacement occurs, determine the probability that he will win:
 - a both prizes
 - b neither prize
 - c at least one prize.
- 8 A container holds 3 red, 7 white, and 2 black balls. A ball is chosen at random from the container and is not replaced. A second ball is then chosen. Find the probability of choosing one white and one black ball in any order.

$\frac{33}{7}$	$\frac{187}{4950}$	$\frac{4753}{4950}$	$\frac{1}{4950}$
8	c	b	7
$\frac{45}{19}$	$\frac{5}{4}$	$\frac{5}{2}$	$\frac{5}{1}$
6	c	b	5

Task 1: Expectation

Whole Class Data		
 two backs	 back and side	 two sides
.375	.4716	.1534
.3825	.48	.13
.33	.501	.169
.37	.46	.17
Averages over 3785 trials		
0.364375 = 36.4375%	0.47815 = 47.815%	0.1556 = 15.56%
If we performed this experiment 35,000 times, what would we EXPECT for each of the different outcomes using our experimental probabilities?		

Each time a footballer kicks for goal he has a $\frac{3}{4}$ chance of being successful.

In a particular game he has 12 kicks for goal. How many goals would you expect him to score?

If there are n trials of an experiment, and an event has probability p of occurring in each of the trials, then the number of times we **expect** the event to occur is np .

Task 2: Expectation Practice

- 3 a If 3 coins are tossed, what is the chance that they all fall heads?
 b If the 3 coins are tossed 200 times, on how many occasions would you expect them all to fall heads?
- 4 During the snow season there is a $\frac{3}{7}$ probability of snow falling on any particular day. If Udo skis for five weeks, on how many days could he expect to see snow falling?



- 5 If two dice are rolled simultaneously 180 times, on how many occasions would you expect to get a double?

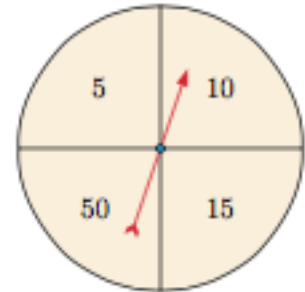
- 6 In a random survey of her electorate, politician A discovered the residents' voting intentions in relation to herself and her two opponents B and C. The results are indicated alongside:

A	B	C
165	87	48

- a Estimate the probability that a randomly chosen voter in the electorate will vote for:
 I A II B III C.
- b If there are 7500 people in the electorate, how many of these would you expect to vote for:
 I A II B III C?

Task 3: Expected Value

When the spinner at right is spun, players are awarded the resulting number of points. What do we expect the “**average**” amount of points per spin to be???



A magazine store recorded the number of magazines purchased by its customers in one week. 23% purchased one magazine, 38% purchased two, 21% purchased three, 13% purchased four, and 5% purchased five.

Find the average number of magazines purchased by customers over a long period.

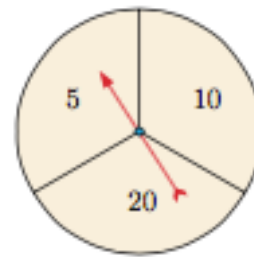
Can we use the below formula and make sense of it in the context of the previous two problems?? ?

For an experiment with outcomes $x_1, x_2, x_3, \dots, x_n$ and associated probabilities p_1, p_2, \dots, p_n , the **expectation** or **expected value** from the experiment is given by

$$\begin{aligned} \text{Expected value} &= x_1p_1 + x_2p_2 + \dots + x_np_n \\ &= \sum x_i p_i \end{aligned}$$

Task 4: Expected Value Practice

- 1 When the spinner alongside is spun, players are awarded the resulting number of points. On average, how many points can we expect to be awarded per spin?



- 2 When Ernie goes fishing, he catches either 0, 1, 2, or 3 fish, with the probabilities shown. On average, how many fish would you expect Ernie to catch per fishing trip?

<i>Number of fish</i>	0	1	2	3
<i>Probability</i>	0.17	0.28	0.36	0.19

- 3 Each time Pam visits the library, she borrows either 1, 2, 3, 4, or 5 books, with the probabilities shown alongside.

<i>Number of books</i>	1	2	3	4	5
<i>Probability</i>	0.16	0.15	0.25	0.28	0.16

On average, how many books does Pam borrow per visit?

- 4 Lachlan selects a ball from a bag containing 5 red balls, 2 green balls, and 1 white ball.

He is then allowed to take lollies from a lolly jar. The number of lollies is determined by the colour of the ball as shown in the table.

<i>Colour</i>	<i>Number of lollies</i>
Red	4
Green	6
White	10

Find the average number of lollies Lachlan would expect to receive.

- 5 When ten-pin bowler Jenna bowls her first bowl of a frame, she always knocks down at least 8 pins.

$\frac{1}{3}$ of the time she knocks down 8 pins, and $\frac{2}{5}$ of the time she knocks down 9 pins.

- Find the probability that she knocks down all 10 pins on the first bowl.
- On average, how many pins does Jenna expect to knock down with her first bowl?



- 1 11.7 points
 2 1.57 fish
 3 3.13 books
 4 5.25 lollies
 5 $\frac{15}{4}$
 6 8.93 pins

Task 5: HW 4.5 Playing for your grade 😊

Your mathematics teacher has decided that instead of a test, you and your classmates will have the option of playing a game! Each student has the choice of picking one of two games, both of which involve flipping a coin ten times.



Source: U.S. Mint

GAME 1

Flip a coin ten times. For each head, the student wins 2 points, but for each tail, the student loses 1 point.

GAME 2

Flip a coin ten times. For each head, the student wins 100 points, but for each tail, the student loses 99 points.

Your grade depends on your final score:

- Lower than -10 and you will receive an F.
- Between -10 to 0 and you will receive a D.
- Between 1 to 10 and you will receive a C.
- Between 11 to 99 and you will receive a B.
- Higher than 100 and you will receive an A.

Which game should you pick in order to get the best grade? For HW you must analyze a game and pick a game. This is where we are starting next class... a debate based off of you analysis.