

Name \_\_\_\_\_ which class? M 12 & T/Th 11-12:15 OR M 4 & T/Th 3:30-4:45

## expected value and simulations: an introduction to probability

Dr. Sarah's MAT 1010: Introduction to Mathematics

goals:

- utilize technology to answer real-world questions and interpret results
- critically analyze the role of probability and chance in real world situations
- communicate statistics and probability information using a variety of representations, including numerical, visual and tables, in written documents.

An expected value is the weighted average of the probabilities and is often used in making predictions (and decisions). For instance, your course grade is such a weighted average:

$$.05 \times \text{Effective Class Engagement} + .30 \times \text{Effective ASULearn Engagement} + .50 \times \text{Exams} + .15 \times \text{Project}$$

1. How many people were in lab when we performed the penny experiment?
2. How many heads in a row did you obtain, if any?
3. Were the number of people left standing statistically expected?      circle one:      yes      no
4. Explain why or why not and if it wasn't the expected value, how close were we?

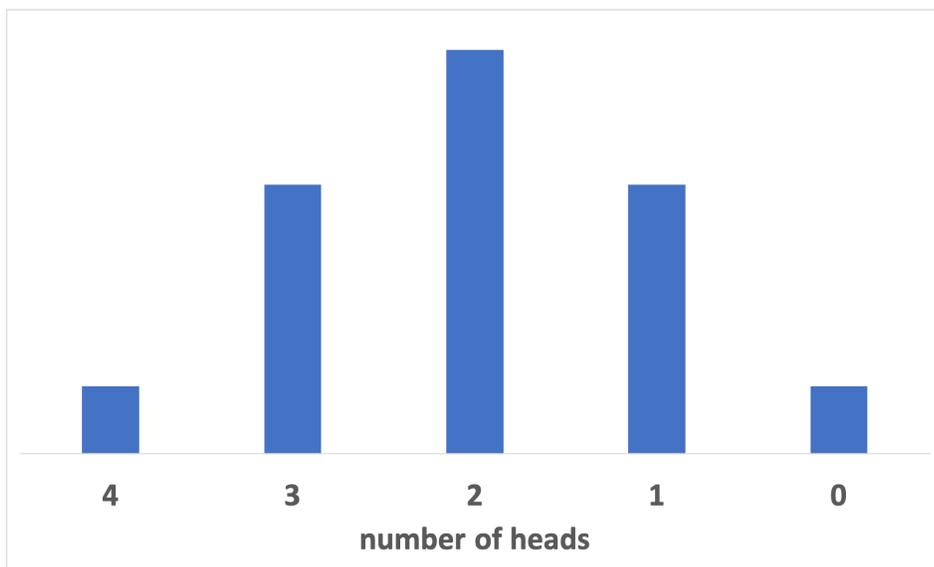
In a simulation, we can have a computer mimic real-life scenarios so that we can quickly understand the likelihood of an event happening.

5. Go to <https://www.random.org/coins/>, select a coin from a country other than the United States, and write down what country and coin you selected.
6. Next to Flip change the number 2 to 4 and Flip Coin(s). Circle which outcome you obtained:  
HHHH    HHHT    HHTH    HTHH    THHH    HHTT    HTHT    HTTH    THHT    THTH  
TTHH    HTTT    THTT    TTHT    TTTH    TTTT
7. How many total heads were in the outcome from your simulation. Write your response here and put a tally mark under that response up front at the board, like  $\backslash$  (or  $\text{||||}$  if you are the 5th person in one of the tally groupings).
8. Using the sixteen equally likely outcomes that are listed in #6, count how many outcomes have each number of heads, and fill in:  
4 heads: 1 outcome    3 heads: \_\_\_\_\_    2 heads: \_\_\_\_\_    1 head: \_\_\_\_\_    0 heads: \_\_\_\_\_  
Check that the sum of these responses add to all 16 of the outcomes.

9. Start by filling in the first two columns of this table. Once the class has completed the board activity and I've annotated the totals, complete the last two columns.

heads	outcomes from #8	probability (divide by 16)	expected people on front board (probability × total people who responded)	actual people
4	1	$\frac{1}{16} = .0625$		
3				
2				
1				
0				
add column	16	1		

10. Look at this visual representation of the relative proportions of expected people for each number of heads. For each bar label just above it whether the actual people on the front board was above, below, or matching what we would expect for each head count (i.e. compare the last 2 columns of the above table—if the actual was greater, write “above”...).



11. Next, back in the simulation, read about the Coin Flipper—where does the randomness in the coin flipping generator come from—how does this relate to the earth/universe?

12. Change Flip to 100. Count the number of heads you obtain and compare to the expected value (which is 50% of 100).