Discrete Random Variables

- Topics: Probability Distributions

- Objective: Students will be able to calculate how many permutations or combinations can be made given a specific situation and find the probability of that event happening.

- Standards: CCSS Math: 7.SP.C.8, HSS.CP.B.9, 7.SP.C.5, 7.SP.C.6, 7.SP.C.7, 7.SP.C.7b, AP Stats: VAR-5 (EU), VAR-5.A (LO), VAR-5.A.1 (EK), VAR-5.A.2 (EK), VAR-5.A.3 (EK)

Probability Distribution

Definition: A ***probability distribution*** is a list of all of the possible outcomes of a random variable *along with* their corresponding probability values.

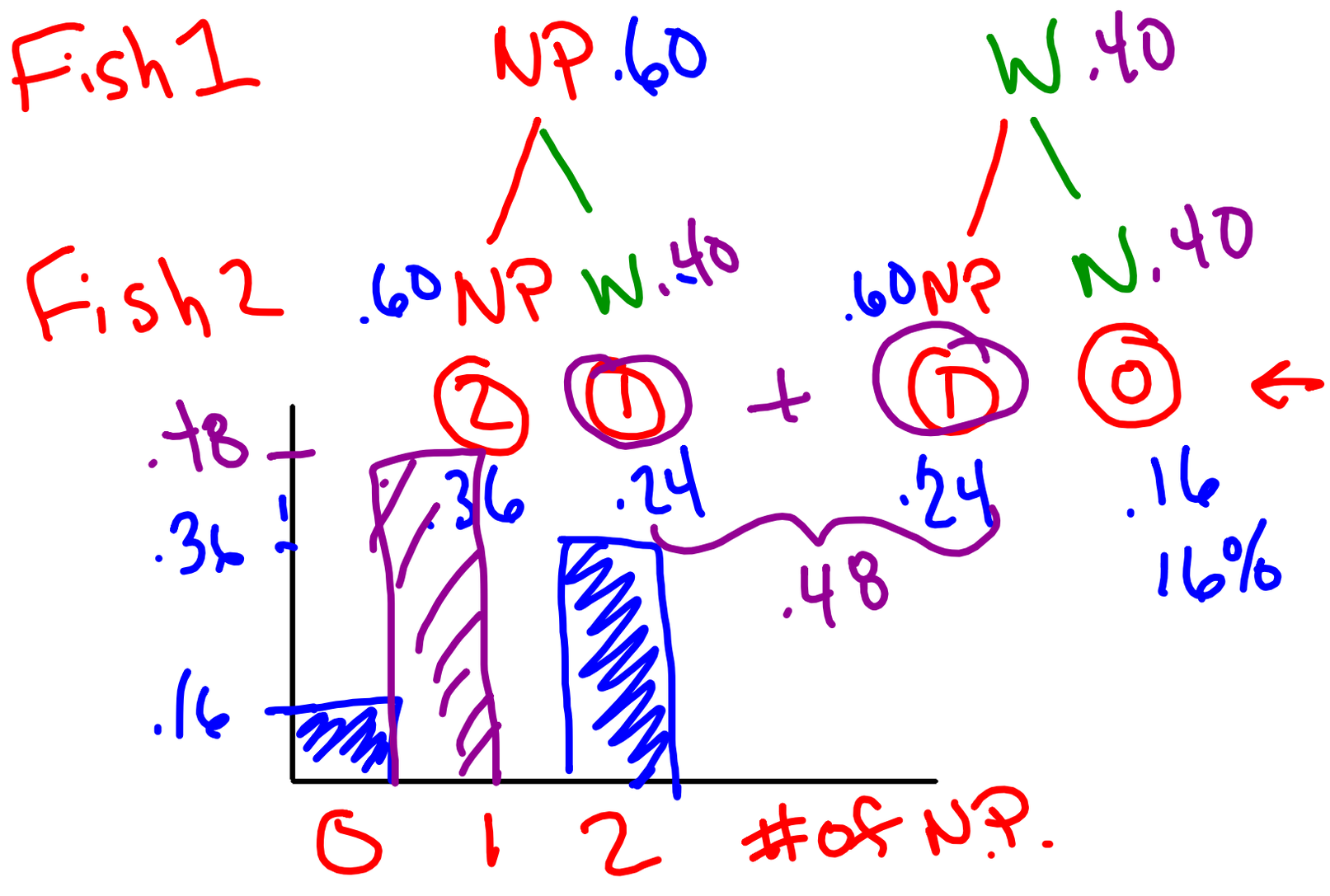
Example: What are the outcomes and the corresponding probabilities of rolling a six-sided die?

Outcome	1	2	3	4	5	6
Probability	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$

Constructing Probability Distribution

Example 1: Elena loves to go fishing in northern Minnesota. Each time she catches a fish is independent, and there is a 60%chance it is a northern pike and a 40% chance it is a walleye each time.

If X is a random variable that represents the number of northern pike Elena catches if she catches 2 fish, calculate the probability distribution for all possible values of X.



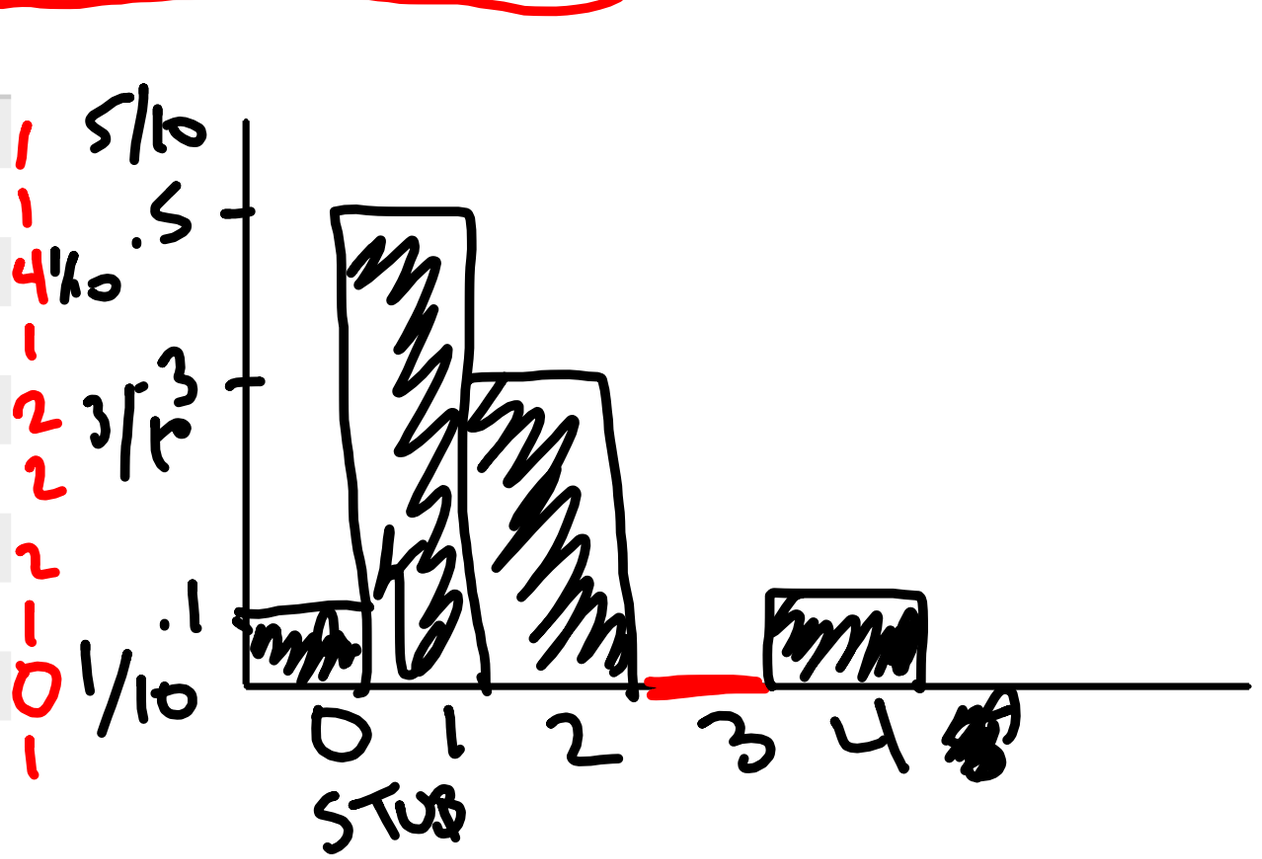
Constructing Probability Distribution

Example 2: James is doing research on men's facial hair. To do so, he takes families with 4 men and categorizes each man as having no facial hair, some stubble, or a beard.

His results are shown in the table below. "N" represents a man with no facial hair, "S" represents a man with stubble, and "B" represents a bearded man.

Make a relative frequency plot that shows the proportion for each possible number of men with stubble in a group.

Group	Facial hair
1	NSBB
2	BSNN
3	SSSS
4	NBSN
5	NSBS
6	NSSB
7	BSSN
8	NNSB
9	NNBB
10	NBSN



Probability Models

Definition: The sum of the probabilities of all outcomes must equal 100% or 1, as a decimal.

Example: The probabilities of the outcomes of flipping a coin are as follows:

Outcome	Head	Tail	
Probability	50%	+ 50%	Sum= 100%

Probability Models

Example 1: Justin, Cam, and Ben are playing a board game where exactly one player will win. Ben estimates that Justin has a 20% chance of winning each game and that Cam has a 50% chance of winning each game.

What is the probability that Ben will win the board game?

J = 20%

C = 50%

B = 30% ←

100%

Probability Models

Example 2: Melissa bought many lottery tickets to try to figure out the probability of her losing, getting her money back, or winning. She counted that she had 57 tickets that lost, 12 tickets where she got her money back, and 42 tickets that won.

Use the observed frequencies to create a probability model for the outcome of one lottery ticket.

Fraction

Input your answers as fractions or as decimals rounded to the nearest hundredth.

L 57/111

MB 12/111

W 42/111

111 Total Tickets

Probability with Discrete Random Variables

Example 1: The American Community Survey is completed by the US Census Bureau to obtain information about households in the US. One variable of interest is how many people reside in each household (vacant households were recorded as having zero people). Based on data from 2014, here is the partially completed probability distribution of H, the number of people residing in a randomly selected US household:

Find the missing probability in the table.

P(H=0)= 0.12

H	0	1	2	3	4	5+
$P(H)$	?	0.24	0.30	0.14	0.11	0.09

0.12

1.00
- .09
- .11
- .14
- .30
- .24
0.12

Probability with Discrete Random Variables

Example 2: Hugo plans to buy packs of baseball cards until he gets the card of his favorite player, but he only has enough money to buy at most 4 packs. Suppose that each pack has probability 0.20 of containing the card Hugo is hoping for.

Let the random variable X be the number of packs of cards Hugo buys.

Find the P(X > 2)= .640

$X = \#$ of packs	1	2	3	4
$P(X)$	0.2	0.16	0.128	0.512

.512
+.128
.640

Displaying and Comparing Quantitative Data

You should be working on the following skills:

1. Constructing probability distributions
2. Probability models
3. Probability with discrete random variables