

7A: Fundamentals of Probability

Due at the beginning of next class

Three Types of Probabilities, Theoretical, Empirical, Subjective**Theoretical Probability– Based on counting equally likely outcomes**

Example 1. You have a quarter, a dime, and a nickel. You toss them in the air, and record whether they land on heads or tails.

- a. Draw a tree to see the possible outcomes.
- b. Can you think of a way to multiply to find the number of outcomes? (Multiplication Principle)

- c. What is the probability of getting 3 heads?
- d. exactly 1 head?

Theoretical Probability Model: We are interested in the number of heads, so we will list the possible outcomes for the number of heads, along with the probability of getting each.

Number of Heads				
Probability				

- e. What is the probability of getting 1 or 2 heads?
- f. What is the probability of getting fewer than 2 heads?
- g. What is the probability of not getting 2 heads (**Complement**)?
- h. What is the probability of getting **at least one** head? (**Complement of none**)

Empirical Probability (Relative Frequency) – Based on observations or an experiment
 15% of the parts sampled were found to be defective, so there is a 15% chance that a randomly selected part will be defective.

Subjective Probability – Based on intuition, experience or feeling

What's the chance you will go to the party on Friday?

Relationship between Odds and Probability

Example 2. A team is given odds of winning of 4:7. What is the chance they will win? Lose?

Gambling Odds: “odds on” means “odds against”

Example 3. At a horse race, the odds on My Little Pony are given as 8 to 1. What is the probability of My Little Pony winning and losing? The 8 to 1 odds mean that for every \$1 you bet on My Little Pony, you get \$8 if you win. If you bet \$10 and My Little Pony wins, how much do you win?

7B: Combining Probabilities

Example 4. You have 10 prizes in a bag and people are going to draw them at random. Two are yellow erasers, one is a yellow calculator, three are green calculators and four are red erasers. First, let’s find the individual probabilities:

$$\begin{array}{llll} P(YE) = & P(YC) = & P(GC) = & P(RE) = \\ P(\text{Calculator}) = & P(\text{Eraser}) = & P(\text{Red}) = & P(\text{Yellow}) = \\ & & & P(\text{Green}) = \end{array}$$

“Or” Events (Single Draw)		“And” Events (Multiple Draws)	
Add $P(A \text{ or } B) = P(A) + P(B)$	Add Be careful not to double count the intersection	Multiply $P(A \text{ and } B) = P(A) \cdot P(B)$	Multiply Change the probability for each draw

“Or” Events

a. What is the probability of drawing a yellow or green item?

b. What is the probability of drawing a red item or an eraser?

“And” Events

c. If we put the items back in each time, (draw with replacement), what is the probability of drawing three red erasers in a row?

d. If we do not put the marbles back in each time, (draw without replacement), what is the probability of drawing three red erasers in a row?