The Basics of Probability Theory (Section 13.1)

The objectives for this section include:

1. Calculate probabilities by counting outcomes in a sample space.
2. Use counting formulas to compute probabilities.
3. Understand how probability theory is used in genetics.

Probability describes the predictable long-run patterns of random outcomes. For instance, if you toss a fair coin **a single time**, the outcome (heads or tails) is completely random and unpredictable.

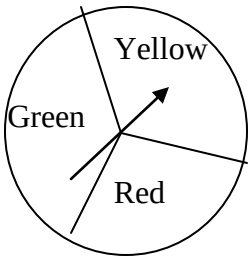
Experiment: is any observation of a random phenomenon.

Outcome: what happens when the experiment is performed. The outcomes for

Sample Space: the set of all possible outcomes.

Event: a subset of the sample space, sometimes referred to as the **Target outcome.** It is the set that includes only the desired (target) outcomes.

1. Class Practice -Write the event as a set of outcomes-You spin the spinner below and it shows at least one yellow on two spins



Theoretical probability does not rely on doing the experiment, but they do require equally likely outcomes. If E is an event in a sample space S with all equally likely outcomes, then the probability of E is given by the formula below.

$$\text{Probability (E)} = \frac{n(E)}{n(\text{S})} = \frac{\text{Number of ways of obtaining the event}}{\text{The size of the sample space}}$$

2. Class Practice – What is the probability of the following: (Write your answer as a fraction in simplest terms)

a. What is the probability of getting exactly one head on three coins?

Hint: If possible list the sample space

b. What is the probability of drawing one card and get a king from a standard deck of cards?

c. What is the probability of drawing five cards and get all diamonds from a standard deck of cards?

3. Class Practice – If you toss a fair coin 24,000 times, how many times would you expect to get heads? _____Tails? _____ Why?

Around 1900, an English statistical named Karl Pearson did toss a coin 24,000 times. He got 12,012 heads.

Write this probability as a fraction, as a decimal, and as a percent. The fraction will be exact, but often the decimal and percent must be rounded off.

	Simplified Fraction	**Rounded Decimal**	**Rounded Percent**
12,012 out of 24,000 =		≈	≈

Empirical/Experimental Probability: reports the actual outcomes of a probability experiment. Probability can be reported as a fraction, a decimal or a percent.

$$\text{Probability (event)} = \frac{\text{number of times } E \text{ occurs}}{\text{total number of times the experiment is performed}}$$

Complete **Quiz Yourself** (2) on p. 724

Basic Properties of Probability where S is the sample space for some experiment and E is an event in S.

1. $\underline{\leq} P(E) \underline{\leq}$
2. $P(\phi) =$
3. $P(S) =$

Complete **Quiz Yourself** (3) on p. 727

The **odds in favor** of an event are the number of favorable: number of unfavorable

Ex. The odds in favor of rolling a 2 on a standard die are 1:5

The **odds against** an event are the number of unfavorable: number of favorable.

Ex. The odds against rolling a 2 on a standard die are 5:1

4. Class Practice

a. If the probability of Professor Harms winning the Halloween race are 12% what are the odds in favor of him winning the race?

b. If the odds against Angie winning the race are 20:3 what is the probability the she will win the race?

Assignment: Read pp. 720-733, Finish Guided Notes
Complete #5, 6, 9, 11, 15, 19, 21, 29, 31, 32, 41, 44, 47, 61, 67, 69 on pp. 733-735