Chapter 10 Probability and Statistics

Notetaking Organizer

1–7. Sample answers are given.

1.

$P(\text{event}) = \dfrac{\text{number of times the event occurs}}{\text{total number of trials}}$

Experiment: an investigation or a procedure that has varying results

Outcomes: the possible results of an experiment

Event: a collection of one or more outcomes

Experimental Probability

Probability that is based on repeated trials of an experiment

Example: You flip a coin 100 times. You flip heads 52 times and tails 48 times. The experimental probabilites are

$P(\text{heads}) = \dfrac{52}{100} = 0.52 = 52\%$, and

$P(\text{tails}) = \dfrac{48}{100} = 0.48 = 48\%$.

How can I find the probability of an event without doing an experiment?

2.

$P(\text{event}) = \dfrac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$

Outcomes: the possible results of an experiment

Event: a collection of one or more outcomes

Favorable outcomes: the outcomes of a specific event

Theoretical Probability

The ratio of the number of favorable outcomes to the number of possible outcomes, when all possible outcomes are equally likely

Example: You flip a coin. The theoretical probability of flipping heads and the theoretical probability of flipping tails is

$P(\text{heads}) = \frac{1}{2}$, and

$P(\text{tails}) = \frac{1}{2}$.

What if the possible outcomes are *not* equally likely?

3.

$m \times n = \text{total}$

(event M) × (event N) = (M followed by N)

Outcomes: the possible results of an experiment

Event: a collection of one or more outcomes

Sample space: the set of all possible outcomes of one or more events

Fundamental Counting Principle

A way to find the total number of possible outcomes of an event; can use a table or a tree diagram.

An event *M* has *m* possible outcomes. An event *N* has *n* possible outcomes. The total number of outcomes of event *M* followed by event *N* is $m \times n$.

Example:
The total number of possible outcomes of rolling a number cube and flipping a coin is

$6 \times 2 = 12.$

(number cube) × (coin) = (total)

How do I use the Fundamental Counting Principle to find the probability of more than two events?

4.

$P(A \text{ and } B) = P(A) \bullet P(B)$

- $P(A \text{ and } B)$: probability of both events
- $P(A)$: probability of first event
- $P(B)$: probability of second event

$P(A \text{ and } B \text{ and } C) = P(A) \bullet P(B) \bullet P(C)$

A *compound event* consists of two or more events.

Choosing *with* replacement means the events are indepenent.

Independent Events

Events are *independent events* if the occurence of one event *does not* affect the likelihood that the other event(s) will occur.

The probability of two or more independent events is the product of the probabilities of the events.

Example: A spinner has three equal sections numbered 1, 2, and 3. You spin it twice. What is the probability of spinning a 1 both times?

$P(1 \text{ and } 1) = P(1) \bullet P(1)$

$= \frac{1}{3} \bullet \frac{1}{3}$

$= \frac{1}{9}$

What if the occurence of one event *does* affect the likelihood of the other?

5.

$P(A \text{ and } B) = P(A) \bullet P(B \text{ after } A)$

- $P(A \text{ and } B)$: probability of both events
- $P(A)$: probability of first event
- $P(B \text{ after } A)$: probability of second event after first event occurs

A *compound event* consists of two or more events.

Choosing *without* replacement means the events are dependent.

Dependent Events

Events are *dependent events* if the occurence of one event *does* affect the likelihood that the other event(s) will occur.

The probability of two dependent events *A* and *B* is the probability of *A* times the probability of *B* after *A* occurs.

Example: You have 5 red cards and 5 blue cards. You randomly choose one card. Without replacing the first card, you randomly choose a second card. What is the probability that both cards are red?

$P(\text{red and red})$

$= P(\text{red}) \bullet P(\text{red after red})$

$= \frac{5}{10} \bullet \frac{4}{9}$

$= \frac{2}{9}$

How do you use probability to make predictions?

6.

Population → Sample → Interpretation → Inference

An *unbiased sample* is representative of a population. It is selected at random and is large enough to provide accurate data.

A *biased sample* is not representative of a population. One or more parts of the population are favored over others.

Sample

Part of a population

The results of an *unbiased sample* are proportional to the results of the population. So, you can use unbiased samples to make predictions about the population.

Biased samples are not representative of the population. So, you should not use them to make predictions about the population because the predictions may not be valid.

Example:
Population: All of the seventh-grade students in your school
Unbiased sample: 100 seventh-grade students selected randomly during lunch
Biased sample: The seventh-grade students at your lunch table

How do you select an unbiased sample from a large population?

7.

Mean: the sum of the data divided by the number of data values

Median: For a data set with an odd number of ordered values, the median is the middle value. For a data set with an even number of ordered values, the median is the mean of the two middle values.

Interquartile range (IQR): the difference between the third quartile and the first quartile

Mean Absolute Deviation (MAD): an average of how much data values differ from the mean

Population

An entire group of people or objects

To compare two populations, use the mean and the MAD when both distributions are symmetric. Use the median and the IQR when either one or both distributions are skewed.

You do not need to have all the data from two populations to make comparisons. You can use random samples to make comparisons.

An inference about a population is more precise if you use multiple samples.

How can you tell whether a distribution is skewed or symmetric?