5.1 What is Probability with work

5.1 What is Probability?

Essential Questions:

How do I determine the probability of a certain situation with other factors impacting it?

Focus Points:

- Assign probabilities to events.
- Explain how the law of large numbers relates to relative frequencies.
- Apply basic rules of probability in everyday life.
- Explain the relationship between statistics and probability.

Oct 25-11:32 AM

Probability is a numerical measure between 0 and 1 that describes the likelihood that an event will occur. Probabilities closer to 1 indicate that the event is more likely to occur. Probabilities closer to 0 indicate that the vent is less likely to occur.

Oct 25-11:38 AM

P(A), read "P of A," denotes the probability of event A.

If P(A) = 1, event A is certain to occur.

If P(A) = 0, event A is certain to not occur.

Oct 25-12:52 PM

Probability Assignments

1. A probability assignment based on **intuition** incorporates past experience, judgment, or opinion to estimate the likelihood of an event.

2. A probability assignment based on **relative frequency** uses the formula

$$\text{Probability of event} = \text{relative frequency} = \frac{f}{n}$$

where f is the frequency of the event occurrence in a sample of n observations

3. A probability assignment based on **equally likely outcomes** uses the formula

$$\text{Probability of event} = \frac{\text{Number of outcomes favorable to event}}{\text{Total number of outcomes}}$$

Oct 25-12:53 PM

Example 1: Probability

Consider each of the following events, and determine how the probability is assigned.

a) A sports announcer claims that Sheila has a 90% chance of breaking the world record in the 100-yard dash.

intuition

b) Henry figures that if he guesses on a true-false question, the probability of getting it right is 0.50.

50/50 equally likely

c) The Right to Health lobby claims that the probability of getting an erroneous medical laboratory report is 0.40, based on a random sample of 200 laboratory reports, of which 80 were erroneous.

$\frac{80}{200}$ $\frac{f}{n}$ relative frequency %

Oct 25-1:02 PM

LAW OF LARGE NUMBERS

In the long run, as the sample size increases and increases, the relative frequencies of outcomes get closer and closer to the theoretical (or actual) probability value.

ie: flipping a coin once, will you ever get 50%

Oct 25-1:18 PM

5.1 What is Probability with work

A **statistical experiment** or **statistical observation** can be thought of as any random activity that results in a definite outcome.

An **event** is a collection of one or more outcomes of a statistical experiment or observation. ie: rolling a ~~coin~~ die

A **simple event** is one particular outcome of a statistical experiment. ie: rolling a 2

The set of all simple events constitutes the **sample space** of an experiment. ie: 1, 2, 3, 4, 5, 6

Oct 25-1:21 PM

The **sum** of the probabilities of all simple events in a sample space must equal 1.

ie: rolling a die: $\boxed{\frac{1}{6}+\frac{1}{6}+\frac{1}{6}+\frac{1}{6}+\frac{1}{6}+\frac{1}{6}=1}$

The **complement of event A** is the event that A *does not occur*. A^c designates the complement of event A.

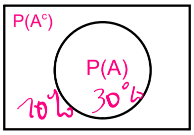
1. $P(A) + P(A^c) = 1$
2. P(event A does *not* occur) = $P(A^c) = 1 - P(A)$

ie: rolling a 2 on a fair die: $\boxed{1)\ \frac{1}{6}+\frac{5}{6}=1 \quad 2)\ 1-\frac{1}{6}=\frac{5}{6}}$

Oct 25-1:24 PM

Example 2: Complement of an Event

The probability that a college student who has not received a flu shot will get the flu is 0.45. What is the probability that a college student will *not* get the flu if the student has not had the flu shot?



B = Getting the flu

$P(B) = .45$

$P(B^c) = 1 - .45 = \boxed{.55}$

Oct 25-1:34 PM

SUMMARY: Important Facts about Probability

1. A statistical experiment or statistical observation is any random activity that results in a definite outcome. A simple event consists of one and only one outcome of the experiment. The sample space is the set of all simple events. An event A is any subset of the sample space.
2. The probability of an event A is denoted by P(A).
3. The probability of an event is a number between 0 and 1. The closer to 1 the probability is, the more likely it is the event will occur. The closer to 0 the probability is, the less likely it is the event will occur.
4. The sum of the probabilities of all simple events in a sample space is 1.
5. Probabilities can be assigned by using intuition, relative frequencies, or the formula for equally likely outcomes.
6. The complement of an event A is denoted by A^c. So, A^c is the event that A does not occur.
7. $P(A) + P(A^c) = 1$

Oct 25-1:36 PM

PROBABILITY RELATED TO STATISTICS

Probability: we know the ENTIRE population

Given 3 green marbles, 5 red marbles, and 4 white marbles in a bag, draw 6 marbles at random from the bag. What is the probability that none are red?

Statistical: we know only SAMPLES from an unknown population

Draw a random sample of 6 marbles from a bag of marbles and observe the colors. Make a conjecture about the colors and numbers of marbles in the bag and possible population

Oct 25-1:43 PM

HW: pg. 198: 3, 5, 7, 11, 17, 19, 21, 23

3. a) 1 b) 0

5. No, the probability was stated for drivers in the age range from 18 to 24. We have no information for other age groups.

7. 627/1010 ≈ 0.62

11. a) MMM, MMF, MFM, MFF, FMM, FMF, FFM, FFF

b) P(MMM) = 1/8. P(at least one female) = 1 - P(MMM) = 7/8

17. a) P(0) = 15/375, P(1) = 71/375, P(2) = 124/375, P(3) = 131/375, P(4) = 34/375

b) Yes.

19. a) P(6a - 12p) = 290/966, P(12p - 6p) = 135/966, P(6 - 12a) = 319/966, P(12a - 6a) = 222/966

b) YES

21. proof b) 2/17 or 0.118 c) 3/8 or 0.375

23. a) 0.46 b) 0.43 c) 0.20 d) 0.57

Oct 25-1:48 PM