Bellwork Schmellwork!

use your pink sheet to help

1. P(A) = 0.7 , P(A or B) = 0.8 , P(A and B) = 0.3. What is $\boxed{P(B)? = .4}$

$P(A \text{ or } B) = P(A) + P(B) - P(A \& B)$

$.8 = .7 + x - .3$

$.8 = .4 + x$

$-.4 \quad -.4$

$x = .4$

2. P(B| A) = 0.6, P(A and B) = 0.3. What is $\boxed{P(A)? = .5}$

$P(B|A) \times P(A) = P(A \& B)$

$\frac{.6y}{.6} = \frac{.3}{.6}$ $y = .5$

3. What's the probability that, from a deck of cards, you draw a Jack or a heart?

$P(J \text{ or } \heartsuit) = (4/52) + (13/52) - (1/52) = \boxed{.31}$

4. How is that different than the probability that you draw a Jack or an Ace?

$P(J \text{ or } A) = 4/52 + 4/52 - 0 = .15$

Nov 18-1:28 PM

Review Answers

5 $\heartsuit$ 2 $\diamondsuit$

$\frac{13}{52} \cdot \frac{4}{51} \cdot \frac{13}{50}$

5 W R G Y

$\left(\frac{8}{19}\right)\left(\frac{3}{18}\right)\left(\frac{2}{17}\right)\left(\frac{6}{16}\right)$

Nov 18-1:28 PM

NOTES

5.4 Applying Probability Rules

Nov 18-1:28 PM

Learning Objectives

1. Is a "coincidence" truly an unusual event?
2. Probability Model
3. Simulation

Nov 18-1:28 PM

Remember...

We make decisions all of the time!

- Should I wear a seat belt?

- Should I keep smoking?

- Should I go on a diet?

- Should I exercise more today?

- Should I take a vacation?

- Can I afford that shopping trip?

Nov 18-1:28 PM

Remember...

We based these decisions on probability

- What's the chance that my new business will succeed?

- What's the chance that I will get lung cancer if I continue to smoke?

- What's the chance that the collision insurance I'm thinking of buying for my car will really be needed?

Nov 18-1:28 PM

What A Coincidence!

What are the chances that someone else is facing these same circumstances?

An author of our book took a trip to Newfoundland, Canada. When she stopped at a rest stop, she noticed a Georgia license plate (where she's from), so she said hello. The owner of the car happened to be a patient of her physician husband!

How unusual is this?

Nov 18-1:28 PM

What A Coincidence!

I lived in the ASU dorms my freshmen year. While meeting people, I became friends with most of the others in my wing. We talked... A LOT!

Not until a year later, did I find out that one of my dorm friends was on the same cruise that I was back in our senior year of high school for spring break!

How unusual is this?

Nov 18-1:28 PM

Coincidence

How many are there?

Someone you meet that has...

- the same last name as you
- the same birth place
- the same college
- the same high school
- the same profession
- the same birthday
- a common friend
- the same make, model, and year of car

Nov 18-1:28 PM

Coincidence

Think of the HUGE number of coincidences that can occur. It's really not so surprising that on a trip you may bump into someone that you know or have something in common with.

Nov 18-1:28 PM

Law of Large #s

if something has a very large number of opportunities to happen, occasionally it will happen, even if it seems highly unusual

Nov 18-1:28 PM

Coincidence

Events that are rare per person are quite sure to happen with a large group of people

If a certain event happens to one person in a million each day, then we would expect it to happen about 300 times in the U.S. every day and more than 100,000 times every year!

The "one in a million" event regularly occurs, even if we are surprised it happens to us!

Nov 18-1:28 PM

Coincidence

Once we have the data to look at, it's easy to spot patterns: 10 heads in a row, 10 tails in a row, 10 tails followed by 10 heads...

With such a large number of patterns possible, it's not surprising to see some patterns that seem unusual occasionally occur

Nov 18-1:28 PM

Birthdays!

To illustrate this, what is the probability that at least 2 students in a group have the same birthday?

Does anyone in here have the same birthday?

Mine is June 5th!

Nov 18-1:28 PM

Birthdays!

Fun fact:

P(at least one match) = 1 - P(no matches)

In a class of 25, the chances would be 57% of having at least one match.

Nov 18-1:28 PM

Birthdays!

Does this seem higher than expected?

$_{25}C_2 = 300$

How many possible combinations of 2 students from a class of 25?

Nov 18-1:28 PM

Birthdays!

Fun Fact:

- For a class of 50 students, the probability of a match is .97

- For 100 students, it's .9999997

- For 88 students, there is a 50% chance that 3 people share the same birthday

Nov 18-1:28 PM

Lincoln - Kennedy

Let's look at something interesting...

Nov 18-1:28 PM

Probability Model

It's easy to find probability in an idealized situation, but in practice, it can be difficult to tell if outcomes are equally likely or independent

A **probability model** specifies the possible outcomes for a sample space and provides assumptions on which the probability calculations for events composed of these outcomes are based.

This is just an approximation of reality - for example, we ignored February 29th and the option of twins in our birthday demo.

Nov 18-1:28 PM

Sensitivity / Specificity

Sensitivity is a true positive

Specificity is a true negative

TABLE 5.6: Probabilities of Correct and Incorrect Results in Diagnostic Testing

The probabilities in the body of the table refer to the test result, conditional on whether the state (S) is truly present. The sensitivity and specificity are the probabilities of the two types of correct diagnoses.

	DIAGNOSTIC TEST RESULT		
State Present?	**Positive (POS)**	**Negative (NEG)**	**Total Probability**
Yes (S)	Sensitivity P(POS|S)	False negative rate P(NEG|S)	1.0
No (S^c)	False positive rate P(POS|S^c)	Specificity P(NEG|S^c)	1.0

Nov 18-1:28 PM

Simulation

When a probability is difficult to find, we can approximate an answer using a simulation.

To carry out a simulation:

1. Identify the random phenomenon to be simulated
2. Describe how to simulate observations
3. Carry out the simulation many times (at least 1000 times)
4. Summarize results and state the conclusion

Nov 18-1:28 PM

Homework

Homework Worksheet!

Staple it to the back

Nov 18-1:28 PM

Nov 18-1:28 PM