5.3 - Conditional Probability & Independence

Notes provided by E. Kelly Pendleton from Ardrey Kell High School, including:

-conditional probability
-independence
-tree diagrams & the general multiplication rule

adjust as you wish
I usually do slides #2-8 in one day and #9-15 the next day
email elizabethk.pendleton@cms.k12.nc.us if you need the flipchart version

5.3 - Conditional Probabilities (Part 1)

P(A | B) = the probability of A given B happens

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

Ex). The two-way table below represents the distribution of gender & their movie genre preferences.

	Comedy	Drama	Action	Romance	Totals
Male	50	40	60	25	175
Female	50	70	25	50	195
Totals	100	110	85	75	370

a) Find P(Male | Comedy)

b) Find P(Comedy | Male)

c) Find P(Drama | Female)

d) Find P(Drama OR Action | Male)

Independent Events

Events A and B are said to be independent if P(A|B) = P(A).
-B occurring should not affect the probabiity of A.

Multiplication Rule for Independent Events
P(A and B) = P(A)*P(B)

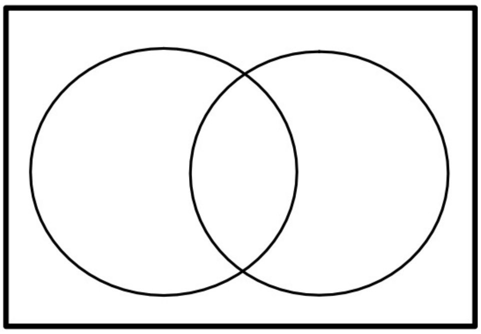
Multiplication Rule for Dependent Events
P(A and B) = P(A)*P(B|A)

Complete the Google form:

tinyurl.com/tableprobability

At a certain university, 38% of its student body participates in Greek societies, 26% participate in academic societiies, with 14% particpating in both. Let G = a student participates in a Greek society and A = a student participates in an academic society.

a). Construct a Venn diagram for this scenario.



Using proper notation, find the following probabilities:

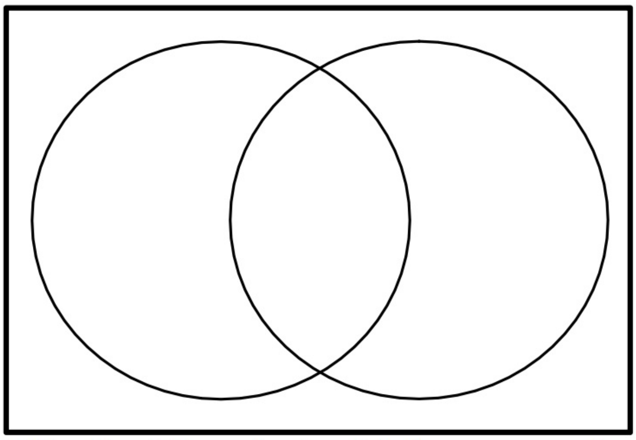
b) the probability that a student is in a Greek society or in an academic society

c) the probability that a student is in both

d) the probability that the student is only in a Greek Society

e) the probability that the students is only in an Academic Society

f) the probability that the student is in neither



a. The probability that the student is in an academic society given that he is in a Greek society.

b. The probability that the student is in an academic society given that he is not in a Greek society.

c. The probability that the student is not in an academic society given that he is in a Greek society.

d. The probability that the students is in a Greek Society given that he is in an academic society.

Mary has applied to both Clemson and the University of Florida. She thinks the probability that Clemson will admit her is 0.3, the probability that Florida will admit her is 0.8, and the probability that both will admit her is 0.2.

a. Make a Venn diagram with the probabilities given marked.

b. What is the probability that only Florida will admit her?

c. What is the probability that she will get into either school?

d. What is the probability that she will get into neither school?

e. What is the probability that she gets into Clemson but not Florida?

f. What is the probability she gets into Florida given that she get into Clemson?

g. What is the probability she get into Florida given that she does not get into Clemson?

Complete the 15 Multiple Choice in the packet I asked you to print & bring to class. Use a Chromebook if you did not print it. [supplemental material provided in Activities section in Canvas]

HW: pg. 329 #63-71, 95, 96

Reminder!

Multiplication Rule:

P(A and B) = P(A)*P(B|A)

"AND THEN"	MULTIPLY
"OR"	ADD

With his team leading the Indianapolis Colts by 6 points with just over 2 minutes left in the game, Bill Belichick had to make a crucial decision. His offense had the ball, but it was 4th down and they needed 2 yards to get a 1st down. Getting the first down basically guaranteed them a win because they could then run out the clock. But a failed attempt on fourth down would give the Colts great field position and a good chance of scoring a touchdown to take the lead. Historically, when teams go for it on fourth down with 2 yards to go, they successfully gain the 2 yards 60% of the time. If the Patriots get the necessary two yards, they have a win probability of 100%. However, if the Patriots did not gain the necessary yardage, the Colts would get the ball with good field position, leaving the Patriots with only a 47% chance of winning the game.

Draw a tree diagram with the given probabilities.

P(1st down) = 0.6

P(win | 1st) = 1

P(win | turnover) = 0.47

Belichick's other option was to punt the ball on fourth down. This would give the ball to the Colts, but much further down the field. Based on the expected distance of the punt and the expected distance of the return, the Patriots would have a win probability of about 70%. Based on the two probabilities, which is the better option for Coach Belichick?

Tree diagrams

-used when given probabilities are sequential in nature

67% of the students that speed get tickets. Of those that do not speed, 16% get tickets. Assume that 54% of all students speed.

a). Draw a tree diagram to model the probabilities presented in the problem.

Find the probability that:

b). a student speeds

c). a student gets a ticket

d). a student speeds given that he/she got a ticket

e). a student doesn't speed and gets a ticket

A medical test for malaria will come back positive 98% of the time given that the person has malaria. The test will come back positive 12% of the time when a person does not have malaria. Assume 14% of the population has malaria. Draw a tree diagram

1. What percent of the population has malaria and tests positive?

2. What percent of the population has malaria and tests negative?

3. What percent of the population does not have malaria and test positive?

4. What percent of the population test positive?

5. What is the probability of not having malaria given that the test came back positive?

6. What is the chance the test come back negative given that a person has malaria?

Complete #13 and #14 on the FRQ section of the Chapter 5 Review.