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Outline of Lesson Plan

Step 1: **Introduce the conditional probability concept through an example**

Learning Goals : Be able to understand, define, and identify "conditional probability" and other related concepts.

Review the concepts of "probability", "independent events", "dependent events" and "conditional probability"

Activity 1: Clarify and identify "conditional probability" :

Suppose we have a bag with four colored balls – 4 blue and 4 green.

Scenario 1: If a ball is picked from the bag randomly, what is the probability of picking a blue ball? What is the probability of picking a green ball?

Scenario 2: Suppose a blue ball is already picked and set aside. If a ball is now picked from the bag, what is the probability of picking a blue ball? What is the probability of picking a green ball?

1. Why do the probabilities in Scenario 2 change from the probabilities in Scenario 1?
2. Do you have any questions about this exercise?

Step 2: Introduce categorical data presented in a two-way table

- **Learning Goals** : Be able to (1) explain the terms "categorical data" and "two-way table"; (2) analyze categorical data that is presented in a "two-way" table; (3) Draw an inference.
- **Review the concepts** of "categorical data", "two-way table", "an inference."
- **Activity 2:** Suppose some of the balls in the bag have designs on them while others don't. The **two categories of colored balls** are presented below:

	Designs	No Design	TOTAL - for the row
Blue Balls	1	3	4
Green Balls	2	2	4
TOTAL – for the column	3	5	8

Based on the information presented on the Table:

1. How many balls are blue?
2. How many balls are green?
3. How many balls have designs?
4. How many balls don't have designs?
5. Based on your answers for #8-11, can you explain in writing why/when you would need to look at the columns versus the rows of the table to answer the questions?
6. Is it true that "most of the balls with designs are green"? Explain in writing how you decide.

7. Is it true that "most of the green balls have designs"? Explain in writing how you decide.
8. Are questions (5) and (6) different or the same? Write and explain why .
9. Do you have any questions about this exercise?

Step 3: Construct a "two-way table" from a word problem

Learning Goals : Be able to (1) construct a "two-way table" of categorical data; (2) draw an inference from the "two-way table"; (3) calculate conditional probability.

Review: the use of columns versus rows in a two-way table and formula for conditional probability.

Activity: Construction of a two-way table is often used to help understand the conditional probability and make an inference.

Suppose that accounting majors at Lehman can be grouped by their student status – full time or part-time – as well as by gender.   Full time students constitute 30% of the total accounting students while part-time students make up 70%. About 45% of the full-timers are males while 55% of the part-timers are females.   Use the questions given below to guide you in completing the following table:

	Male	Female	Total – by student status
Full-time students			
Part-time students			
Total – by gender			

Suppose there are 500 accounting majors at Lehman:

(a)   How many are full time students? How many are part-timers?   Enter these two numbers in the two rows under the column titled "Total – by status."

(b)   **Of the total full time students**, many are male students? How many are female students? Enter these two numbers in the row for 'Full-time students" under the columns titled "Male" and "Female."

(c)   **Of the total part-time students**, many are male students? How many are female students? Enter these two numbers in the row for "Part-time students" under the columns titled "Male" and "Female."

(d)   What is the total number of male students? What is the total number of female students? Enter the numbers on the last row under the columns for 'Male" and "Female."

Now that the table is completed, use it to answer the following questions:

(a)   Of the male accounting majors, **how many** are full-time students and **how many** are part time students.

(b)   Of the male accounting majors, **what proportion/percentage** are full-time students and **what proportion/percentage** are part time students.

(c)   Of the total full time students, **how many** are male students? **How many** are female students?

(d) Of the total full time students, **what proportion/percentage** are male
students? **What proportion/percentage** are female students?

(e) Did you have difficulties answering any of the above questions? Give reasons in writing.

(f)   Do you have any questions about this exercise?

Resources: Watch this video to help determine the proportion and percentage
values: http://www.youtube.com/watch?v=SR-0YEv3aQw

Watch this video to calculate the conditional probability values using the table:

http://www.youtube.com/watch?v=3b2DzwASNA4

Step 4: Application to real life topic

Learning goals: Be able to apply the conditional probability and make inferences of real world problems.

Activity: HIV testing . Suppose 1% of Americans carries the HIV virus. When tested, a person who
carries this virus produces a positive result 98% of the time while a non-carrier of the virus produces a
negative result 93% of the time. *What is the probability that an individual who tests positive for the virus actually
is a carrier of this virus?*

Assuming that the population of the U.S. is 100,000, complete the two way table given below and use it to
answer the questions below:

	Positive Test	**Negative Test**	**Total - Row**
HIV Carrier			
Non-HIV Carrier			
Total - Column			**100,000**

1. How many people are HIV carriers?
2. How many tested positive?
3. How many of those who tested positive are actual HIV carriers?

1. *What is the probability (percentage) that an individual who tests positive for the virus actually is a carrier of this
    virus?*
2. What is the probability of HIV carriers who tested positive for this virus?

Review this video for additional examples -- http://www.youtube.com/watch?v=4PwnvqGEHoU