TOPIC: MULTIPLICATION RULE: DEPENDENT EVENTS

Multiplication Rule for Dependent Events

◆ Recall: For *independent* events, find the probability of events A and B occuring by multiplying their probabilities.

► For *dependent* events, multiply $P(A)$ by the **Conditional Probability**: prob. of event B _____ A occurred.

EXAMPLE A bag contains 2 red and 4 blue marbles. Find each probability.

Recall — Independent Events	New — Dependent Events
$(\boldsymbol{A})$ Drawing a blue marble from the bag, replacing it, then drawing a red marble.	$(\boldsymbol{B})$ Drawing and *keeping* a blue marble from the bag, then drawing a red marble.
$\frac{4}{6} \cdot \frac{2}{6} = \frac{6}{36} = \frac{1}{6}$	
$P(A \cap B) = P(A) \cdot P(B)$	$P(A \cap B) = P(A) \cdot P($ $)$

PRACTICE

What is the probability that a card player draws two aces from a standard deck of 52 cards if they keep the first card after drawing it?

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PRACTICE

A library has chosen to select the two monthly book club reads by randomly choosing two books from a list of top 100 adult reads posted in the local newspaper. On the list, 62 books are fiction and 38 books are nonfiction. What is the probability of choosing two nonfiction books for this month's book club meeting?

EXAMPLE

Each customer service representative at a national company receives a bonus if a customer leaves a positive review and mentions that representative by name in the review. If 25% of customers who speak to a specific employee leave a positive review and 10% of positive reviews for this employee mention her by name, what is the probability that a randomly selected customer she talks to will leave a positive review that mentions her by name so she can get the bonus?

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Conditional Probability

◆ Rearrange the multiplication rule to get conditional probability:

Recall

$$P(A \cap B) = P(A) \cdot P(B|A)$$

→

New

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

EXAMPLE

You conduct a survey of your statistics class with 40 students. 20 students have a math major, 15 have a science major, 10 have a business major, and 8 students have a double major in math & science. What is the probability that a randomly selected student has a math major, given that the student has a science major?

given event $(A) =$

other event $(B) =$

$P(A) =$

$P(A \cap B) =$

$P(B|A) =$

PRACTICE

About 15% of people in a town have both a cat and a dog. As 64% of residents have a dog, what is the probability that someone in the town owns a cat, given they have a dog?

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EXAMPLE

A company is hiring software developers and data analysts. Out of all the applicants, 6 applied for the software developer position and 4 applied for the data analyst position. 4 of the software developer applicants have a degree in computer science and 2 of the analyst applicants have a degree in computer science. What is the probability that a randomly selected candidate with a degree in computer science applied for the software developer position?

given event $(A) =$

other event $(B) =$

$P(A) =$

$P(A \cap B) =$

$P(B|A) =$

EXAMPLE

An insurance company is interested in determining if they should increase the price of their home insurance policies for homeowners with pets. According to policy data, the company finds that 5% of their clients are pet owners who have filed claims and 60% of clients own pets. The company decides that they will raise insurance prices for pet owners if the probability that a client will file a claim given they are a pet owner is at least 8%, which is much higher than the probability that a client will file a claim if they don't have a pet. Will they raise the price?