

# Inferential Statistics

# What we Studied

- **Measures of Central Tendency**
- **Measures of Dispersion**
- **Basics of Probability**
- **Marginal Probability**
- **Bayes Theorem**
- **Probability Distributions**
  - **Binomial**
  - **Poisson**
  - **Normal**

# What we will Cover

- **Mutually exclusive Vs Independent Events.**
- **Conditional Probability.**
- **Bayes Theorem.**
- **Applying Probability Concepts.**
- **Applying Distribution Concepts.**
- **Applying Probability & Distribution in R.**
- **AOC's.**

# Mutually Exclusive Vs Independent Events

## Basic Event Types

- Mutually Exclusive Events
- Non Exclusive Events
- Independent Events
- Non Independent Events.

MUTUALLY EXCLUSIVE	INDEPENDENT
Both Events cannot happen at the same time.	Happening of one event cannot impact the happening of another event.
Occurrence of one event will lead to non-occurrence of another	1 <sup>st</sup> event has no influence on the 2 <sup>nd</sup> event.
Within the single event.	Outside the single event.
$P(A \cap B) = 0$	$P(A \cap B)$ is non zero
Additive in nature	Multiplicative in nature

# Discrete Probabilities

## Example

1. A survey of magazine subscribers showed that 45.8% rented a car during the past 12 months for business purposes, 54% rented a car for personal reasons, and 30% for both personal & business reasons.
  - a. What is the prob. That a subscriber rented a car for both business or personal reasons.
  - b. What is the prob. That a subscriber did not rent a car for either business or personal reasons.
  
2. NBA shooter converts 93% of its shots. During the game the same NBA shooter is fouled and is awarded two shots.
  - a. What is the prob. That he will make both shots.
  - b. What is the prob. That he will make at least one shot.
  - c. What is the prob. That he will miss both shots.

# Conditional Probability

## Example

3. Visa Card studied how frequently, young consumers, ages 18-24, use plastic cards. The results provided the following probabilities.

- Prob. That a consumer uses a plastic card when making a purchase .37
  - Given that consumer uses a plastic card, there is a .19 prob. That the consumer is 18-24 years old.
  - Given that consumer uses a plastic card, there is a .81 prob. That the consumer is 24+ years old.
  - 14% of the consumer population is b/w 18-24 years
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- a) Given the consumer is b/w 18-24, what is the prob. that the consumer uses plastic card
  - b) Given the consumer is 24+, what is the prob. that the consumer uses plastic card
  - c) What is the interpretations of the probabilities shown above.

# Bayes Theorem

## Example

4. A local bank reviewed its credit card policy with the intention of recalling some of its credit cards. In the past approx. 5% of cardholders defaulted, leaving the bank unable to collect outstanding balance. Hence, management established a prior probability of 0.05 that any particular cardholder will default. The bank also found that the probability of missing a monthly payment is .20 for customers who do not default. Of course, the probability of missing a monthly payment for those who default is 0.5.

Q: Given that a customer missed one or more monthly payments, compute the prob. That a customer will default

# Identifying Probability Technique

## Applying Probability Concepts: -

Key Steps: -

- a) Identify the problem
  - b) Categorize the problem into Exclusive or Independence.
  - c) Check if Conditional Probability is applied.
  - d) Check for Bayes Theorem application.
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- Flipping a coin
  - Flipping a coin twice, probability of getting a both heads
  - Flipping a coin twice, probability of getting both heads with a 1<sup>st</sup> coin already giving a head.
  - Flipping a coin twice, probability of getting both heads, with one coin already giving a head.



# Identifying Distribution Technique

## Applying Distribution Concepts: -

### Key Steps: -

- a) Extending the probability to a sample of data ; for ex. Coin tossing 1000 times.
- b) Above is a probability distribution.
- c) Determine the data i.e. Discrete or Continuous.
- d) If Discrete and has only two outcomes, the events are independent apply binom
- e) If time comes in picture, think Poisson
- f) If data is continuous with mean & S.D. provided, think Normal Dist.

# Binomial & Poisson

## Binomial Distribution: -

1. The census current population survey shows 28% of individuals , ages 25 and older have completed 4 years of college. For a sample of 15 individuals, ages 25 and older, answer the following.
  - A) What is the prob. 4 will have completed four years of college
  - B) What is the prob. 3 or more will have completed 4 years of college

## Poisson Distribution.

2. An average of 15 aircraft accidents occur each year. Compute the following
  - a) Mean number of aircraft accidents during a month.
  - b) Probability of no accidents during a month.
  - c) Probability of exactly one accident during a month.
  - d) Probability of more than one accident during a month.

# Normal Distribution

## Normal Distribution: -

3. During early 2012, economic hardship was stretching the limits of France welfare system. One indicator of the level of hardship was the increase in the number of people bringing items to the pawnbroker. Assume the number of people visiting the pawnshop is normally distributed with the mean of 658.
- a) Suppose you learn that on 3% of days, 610 or fewer people bought items to the pawnshop. What is the S.d. of the no. of people bringing items to the pawnshop.
  - b) On any given day, what is the prob. That b/w 600 and 700 people bring items to the pawnshop
  - c) How many people bring items to the pawnshop on the busiest 3% of days.