# Assignment 1

## Measures of Spread

A teacher wants to assess the performance of a class in a mathematics quiz. The class consists of 10 students, and their quiz scores are as follows:

Class: [40,30, 20, 60, 70, 60, 80, 50, 60, 60]

1. Calculate the variance of the quiz scores for the class. Show your calculations step by step.

2. Calculate the standard deviation of the quiz scores.

Table 1: Finding (x-μ)^2

|  |  |  |
| --- | --- | --- |
| x | x-μ | (x-μ)^2 |
| 40 | -13 | 169 |
| 30 | -23 | 529 |
| 20 | -33 | 1089 |
| 60 | 7 | 49 |
| 70 | 17 | 289 |
| 60 | 7 | 49 |
| 80 | 27 | 729 |
| 50 | -3 | 9 |
| 60 | 7 | 49 |
| 60 | 7 | 49 |

## Normal distribution

Consider a continuous random variable X that follows a normal distribution with a mean (µ) of 4 and a standard deviation (σ) of 2.

1. Write a Python program to calculate the Probability Density Function (PDF) of X at x = 3. Your program should use the provided mean and standard deviation values

Note: Your code should look good with proper commenting where necessary.

from scipy.stats import norm

x = 3 # x=3 variable

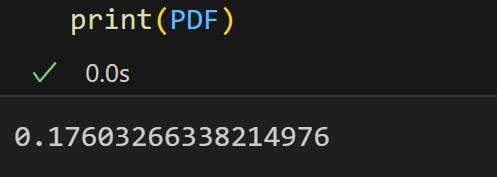
mean = 4 # mean (mu) is 4

deviation = 2 #Standard deviation is 2

PDF = norm.pdf(x,mean,deviation) # Calculating PDF of X at x=3.

print(PDF)

Result is 0.17603266338214976



## Binomial Distribution

1. Sixty-five percent of people pass the state driver’s exam on the first try. A group of 50 individuals who have taken the driver’s exam is randomly selected. Give two reasons why this is a binomial problem.

Two Possible Outcomes: In this scenario, there are only two possible outcomes for each individual taking the driver's exam: they either pass on the first try or they do not. This binary nature of the outcomes (success or failure) is a fundamental characteristic of a binomial distribution. (p=0.65, q=0.35)

Fixed Number of Trials: The number of trials, which in this case is the number of individuals (50), is fixed and known in advance. In a binomial distribution, the number of trials is predetermined.

1. Suppose you play a game that you can only either win or lose. The probability that you win any game is 55%, and the probability that you lose is 45%. Each game you play is independent.

* If you play the game 20 times, write the function that describes the probability that you win 15 of the 20 times.
* Find the mean number of wins.
* Find the standard deviation of wins.

## Poisson Distribution

You notice that a news reporter says ”uh,” on average, two times per broadcast. What is the probability that the news reporter says ”uh” more than two times per broadcast? This is a Poisson problem because you are interested in knowing the number of times the news reporter says ”uh” during a broadcast.

1. What is the interval of interest?
2. What is the average number of times the news reporter says ”uh” during one broadcast?
3. What does X represent? Write the correct notation for Poisson distribution?
4. Write a mathematical statement for the probability question?
5. Find the probability that the news reporter says ”uh” more than two times per broadcast.

## Exponential Distribution

Suppose that an average of 30 customers per hour arrive at a store, and the time between arrivals is exponentially distributed.

1. On average, how many minutes elapse between two successive arrivals?
2. When the store first opens, how long on average does it take for three customers to arrive?
3. After a customer arrives, find the probability that it takes less than one minute for the next customer to arrive.
4. After a customer arrives, find the probability that it takes more than five minutes for the next customer to arrive.
5. Seventy percent of the customers arrive within how many minutes of the previous customer?
6. Is an exponential distribution reasonable for this situation?

* Yes, it is. Because that question is continuous distribution.