Subject:.................... / /

random variables

1) uniform Distribution

2) Exponential Distribution

3) Gaussian Distribution

4) Poission Distribution

uniform Distribution

the pdf of the uniform distribution is given by

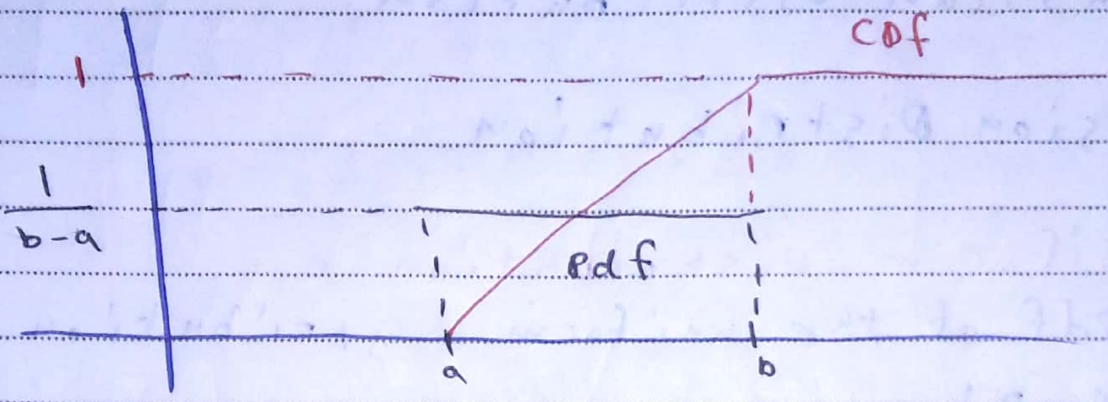
$$f_X(x) = \begin{cases} \dfrac{1}{b-a} & a < x < b \\ 0 & \text{o.w} \end{cases}$$

we define the uniform distribution betwen a two points a and b such that any point between a and b has the same probability

$$F_X(x) = \begin{cases} 0 & x < a \\ \int_a^x \dfrac{1}{b-a} * du & a < x < b \\ \int_a^b \dfrac{1}{b-a}\, du & x \geq b \end{cases}$$

Subject: .... / /

$$= \begin{cases} 0 & x < a \\ \dfrac{x-a}{b-a} & a \le x \le b \\ 1 & x \ge b \end{cases}$$



problem

The time to wait @ a bus stop follows a uniform distribution in which the waiting time varies between 0 and 20 minutes.

$$f_X(x) = \begin{cases} \frac{1}{20} & 0 \le x \le 20 \\ 0 & \text{o.w} \end{cases}$$

1) write the pdf ?

2) Find a formula for the CDF ?

3) Find the probability that a person will wait less than 5 minutes ?

$P[X < 5]$

4) find the probability that a person will wait 10 minutes or more ? $P[X \ge 10]$

Subject:........ / /

Random variables [r.v]

① uniform distribution (a, b) بداية الفترة ونهايتها

② Gaussian Distribution
[Normal]

The pdf of Gaussian distribution is given by.

$$f_X(x) = \frac{1}{\sigma_x \sqrt{2\pi}} e^{\frac{-(x - a)^2}{2\sigma_x^2}}$$

or $\bar{X}$

σ_x : standard deviation الانحراف المعياري

σ_x^2 : variance [signal power] > 0

$std = \sqrt{\sigma_x^2}$ → variance

$\bar{X}$: mean

$X \sim N(\bar{X}, \sigma_x^2)$

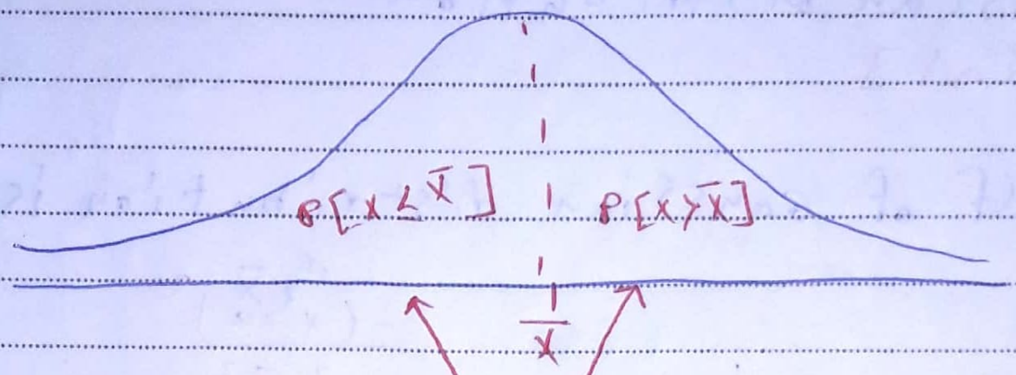
The random variable X follows a Gaussian distribution with mean $\bar{X}$ and variance σ_x^2.

I need 2 quantity $(\bar{X}, \sigma_X^2)$ are required to wite the Gaussian pdf.

$X \sim N(2, 25)$

$\bar{X}$

$\sigma_X^2 = 25 \rightarrow \sigma X = +5$



$P[X \leq \bar{X}] = 0.5$ → this two sidey are similiar

$P[X > \bar{X}] = 1 - P[X \leq \bar{X}] = 0.5$ متساويات أو متطابقات

$$F_X(x) = \int_{-\infty}^{x} f_u(u)\, du$$

$$= \int_{-\infty}^{x} \frac{1}{\sigma_X \sqrt{2\pi}}\, e^{\frac{-(u-\bar{X})^2}{2\sigma_X^2}}\, du$$

$=$ let $z = \dfrac{u - \bar{X}}{\sigma X}$ $\qquad \sigma X z = u - \bar{X}$

$\sigma_X\, dz = du$ $\qquad \frac{1}{2}\left(\left(\dfrac{u-\bar{X}}{\sigma X}\right)^2\right) \rightarrow z$ فرضتها

$$\int_{-\infty}^{\frac{x-\bar{X}}{\sigma_X}} \frac{1}{\sigma_X \sqrt{2\pi}}\, e^{-z^2/2}\, \sigma X\, dz$$

Subject: .... / /

$$= \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\frac{x-\bar{x}}{6x}} e^{-z^2/2} \, dz$$

$$= Q\left(\frac{x-\bar{x}}{6x}\right)$$

from table

$$P[X \le x] = f_X(x) = \int_{-\infty}^{x} f_X(x)\, dx$$

$$= Q\left[\frac{x-\bar{x}}{6_x}\right]$$

$$X \sim N(\bar{x}, 6_x^2)$$

Ex/ let $X \sim N(3, 4)$ $\quad \bar{x} \quad 6_x^2 \quad 6_x = 2$

1) Find $P[X \le 5.5]$?

$$P[X \le 5.5] = f_X(5.5) = Q\left[\frac{5.5-3}{2}\right]$$

$$= Q[1.25]$$