Uniform Distribution

Uniform Distribution

Eg: Rolling a dice $\{1,2,3,4,5,6\}$

$$Pr(1) = \frac{1}{6} \quad Pr(2) = \frac{1}{6} \quad Pr(3) = \frac{1}{6}$$

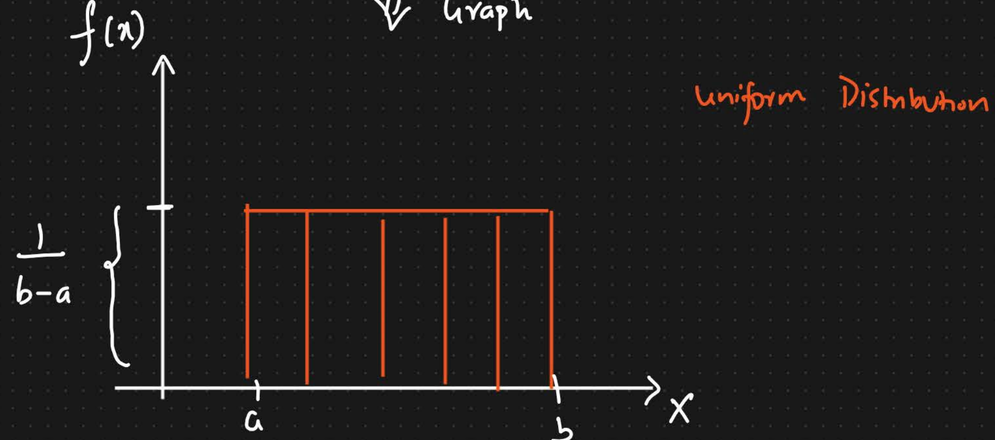
In Uniform Distribution the probability of getting the outcome is equal

This forms the basis.

A variable X is said to be uniformly distributed

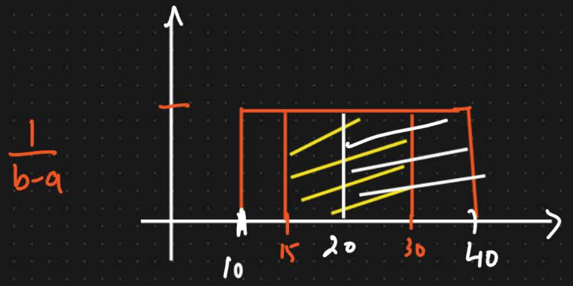
$$f(x) = \frac{1}{b-a} \quad \text{for} \quad -\infty < a \leq x \leq b < \infty$$

$\Downarrow$ Graph



* The number of candies sold daily at a show is uniformly distributed with a maximum of 40 and minimum of 10.

i) Probability of daily sales to fall between 15 and 30?



$x_1 = 15$

$x_2 = 30$

$$Pr(15 \le x \le 30) = (x_2 - x_1) * \frac{1}{(b-a)}$$

$$= (30-15) * \frac{1}{30}$$

$$= 15 * \frac{1}{30} = 0.5$$

$x_1 = 20$

$x_2 = 40$

$$Pr(x \geq 20) = (40-20) * \frac{1}{30}$$

$$= 20 \times \frac{1}{30} = 0.666 \Rightarrow 66\%$$

Mean and Variance of Uniform Distribution

Mean $\rightarrow E(X) = (a+b)/2. = (40+10)/2$

$= 25$

Variance $\rightarrow V(X) = (b-a)^2/12$

Standard Normal Distribution Formula

① Standard Normal Distribution   Z-score

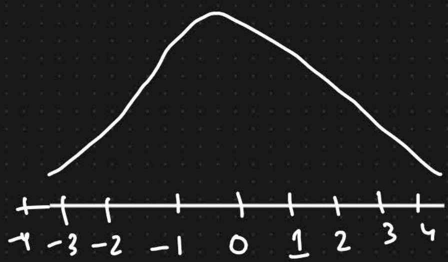
$X = \{1, 2, 3, 4, 5\}$ $\mu = 3$

$\sigma = 1.414 \approx 1$

$\Longrightarrow$

$\mu = 0$

$\sigma = 1$



$X = \{1, 2, 3, 4, 5\}$ Z-score = $\frac{x_i - \mu}{\sigma}$ $Y : \{-2, -1, 0, 1, 2\}$

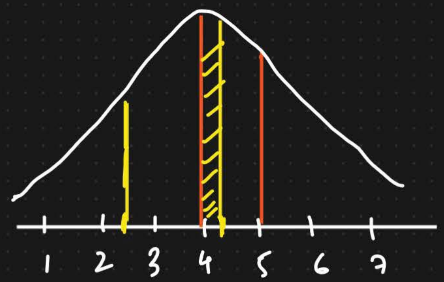
① $\frac{1-3}{1} = -2$ ③ $\frac{3-3}{1} = 0$

② $\frac{2-3}{1} = -1$ ④ $\frac{4-3}{1} = 1$

$X \approx SND(\mu = 0, \sigma = 1)$

$\mu = 4$

$\sigma = 1$



Q) How many standard deviation 4.25 is away from the mean?

$x_i = 4.25$

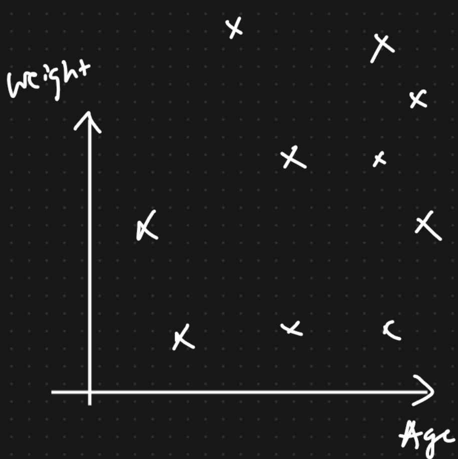
$$z\text{-score} = \frac{4.25 - 4}{1} = \underline{\underline{0.25}}$$

$x_i : 2.5$

$$z\text{-score} = \frac{2.5 - 4}{1} = \underline{\underline{-1.5}}$$

Eg: Dataset

yrs	kg	cms	INR
Age	Weight	Height	Salary
24	70	175	40K
25	60	160	50K
25	55	180	60K
27	40	130	30K
30	30	175	20K
31	25	180	70K
$\Downarrow$	$\Downarrow$	$\Downarrow$	$\Downarrow$



1. Clustering Algorithms
2. Linear Regression
3. Logistic Regression

Standardization $\Rightarrow$ ML Models

$$z\text{-score} = \frac{x_i - \mu_{age}}{\sigma} \qquad \frac{x_i - \mu_{weight}}{\sigma}$$

Standard Normal Distribution Formula

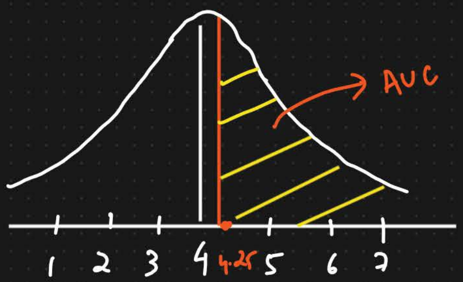
Problem Statement on Z Score

[Z table]

$$Z\text{-score} = \frac{x_i - \mu}{\sigma}$$

$X = \{1, 2, 3, 4, 5, 6, 7\}$

$\mu = 4 \quad \sigma = 1$



1 ⇒ Symmetric Distribution

Z_table

Question: What percentage of scores fall above 4.25?

$x_i = 4.25$

$\mu = 4$

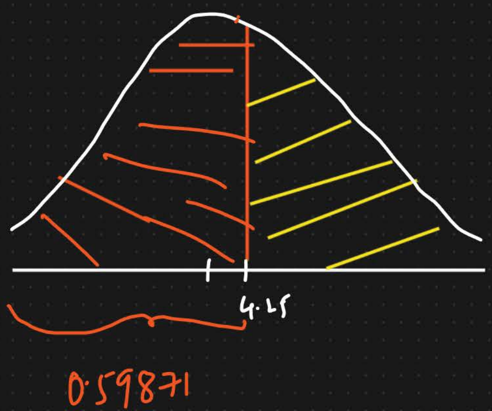
$\sigma = 1$

$$Z\text{-score} = \frac{x_i - \mu}{\sigma}$$

$$= \frac{4.25 - 4}{1} = 0.25 \Rightarrow \text{Std}$$

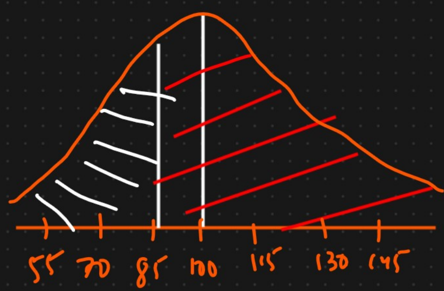
Q) What percentage of scores falls above 4.25?

$1 - 0.59871 = 0.4013 \Rightarrow 40.13\%$



② In India the average IQ is 100, with a standard deviation of 15. What is the percentage of the population would you expect to have an IQ lower than 85?

Ans) $\mu = 100$ $\sigma = 15$



0.15866 = 15.86 %

① $Z\text{-score} = \frac{x_i - \mu}{\sigma} = \frac{85 - 100}{15} = \boxed{-1}$

② $IQ \geq 85$

$= 1 - 0.15866 = 84.13\%$

$\boxed{75 \geq IQ \leq 100}$ ⇒ Internal Assignment