

Emperical Rule of Standard Deviation

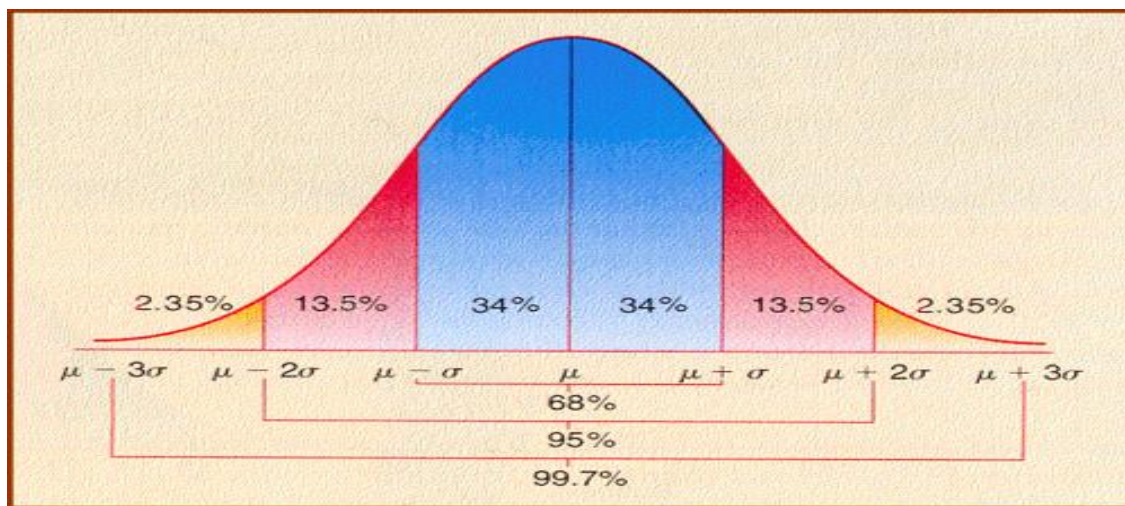
For symmetrical, bell shaped frequency distribution (also called normal Curve), the range with in which a given percentage of values of the distribution are likely to fall within a specified number of standard deviation of the mean is determined as follows:

$\mu \pm \sigma$ covers approximately 68.27% of values in the data set

$\mu \pm 2\sigma$ covers approximately 95.45% of values in the data set

$\mu \pm 3\sigma$ covers approximately 99.73% of values in the data set

These ranges are illustrtated in the following figure



Problem:

The following data give the number of passengers travelling by airplane from one city to another in one week.

115 122 129 113 119 124 132 120 110 116

Calculate the mean and standard deviation and determine the percentage of class that lie between (i) $\mu \pm \sigma$, (ii) $\mu \pm 2\sigma$ and (iii) $\mu \pm 3\sigma$. What percentage of cases lie outside these limits?

Solution:

The calculation for mean and standard deviation are given in the following table

x	$x - \mu$	$(x - \mu)^2$
115		
122		
129		
...		
...		
110		
116		

$$\mu = \frac{\sum x}{N} = \frac{???}{??} = 120 \text{ and } \sigma^2 = \frac{\sum (x - \mu)^2}{N} = ??? = 48.4$$

$$\text{Therefore, } \sigma = \sqrt{\sigma^2} = \sqrt{48.4} = 6.96$$

The percentage of cases that lie between a given limit are as follows:

Interval	Values within Interval	Percentage of population	Percentage falling Outside
$\mu \pm \sigma = 120 \pm 6.60$ = 113.4 and 126.6	113, 115, 116, 119, 120, 122, 124	60%	40%
$\mu \pm 2\sigma = 120 \pm 2(6.60)$ = 106.80 and 133.20	110, 113, 115, 116, 119, 120, 122, 124, 129, 132	100%	Nil