Conditions

The length of human pregnancies is bell-shaped with a mean of 265 days and a standard deviation of 10 days. Use the Empirical Rule to determine the percent of women whose pregnancies are between 255 and 275 days.

Solution

In statistics, the 68-95-99.7 rule — or three-sigma rule, or empirical rule — states that for a normal distribution, nearly all values lie within 3 standard deviations of the mean.

About 68.27% of the values lie within 1 standard deviation of the mean. Similarly, about 95.45% of the values lie within 2 standard deviations of the mean. Nearly all (99.73%) of the values lie within 3 standard deviations of the mean.

In mathematical notation, these facts can be expressed as follows, where x is an observation from a normally distributed random variable, μ is the mean of the distribution, and σ is its standard deviation:

$$P(\mu - \sigma \leq x \leq \mu + \sigma) \approx 0.6827$$

$$P(\mu - 2\sigma \leq x \leq \mu + 2\sigma) \approx 0.9545$$

$$P(\mu - 3\sigma \leq x \leq \mu + 3\sigma) \approx 0.9973$$

For our example

$$\mu = 265$$

$$\sigma = 10$$

$$P(255 \leq x \leq 275) = P(265 - 10 \leq x \leq 265 + 10) = P(\mu - \sigma \leq x \leq \mu + \sigma) = \mathbf{0.6827}$$

And the answer is: The percent of women whose pregnancies are between 255 and 275 days is probably 68.27%