We can use TI-83+ to find probabilities related to Normal and Standard Normal distribution instead of using Z table. To do this, we use \texttt{normalcdf} function of TI-83.

**How to go to \texttt{normalcdf} with TI-83:**

\[ 2nd \Rightarrow DIST \Rightarrow normalcdf( \] 

**How to solve questions using \texttt{normalcdf}:**

Let X be \( Normal(\mu, \sigma) \) and Let \( Z = \frac{X - \mu}{\sigma} \) be \( StandardNormal(\mu = 0, \sigma = 1) \), Then

1. \( P(X < a) = normalcdf(-10^{10}, a, \mu, \sigma) \), after transformation \( P(Z < z_1) = normalcdf(-4, z_1) \)

2. \( P(b < X < a) = normalcdf(b, a, \mu, \sigma) \), after transformation \( P(z_1 < Z < z_2) = normalcdf(z_1, z_2) \)

3. \( P(X > a) = normalcdf(a, 10^{10}, \mu, \sigma) \), after transformation \( P(Z > z_1) = normalcdf(z_1, 4) \)

**How to go to \texttt{invNorm} in TI-83:**

\[ 2nd \Rightarrow DIST \Rightarrow invNorm( \] 

**How to solve questions using \texttt{invNorm}:**

Let X be a \( Normal(\mu, \sigma) \) distributed random variable. You are given a probability or percentage ”p” up to value \( X_p \). Find \( X_p \) which is pth percentile.

1. \( P(X < X_p) = p \), Find \( X_p =? \) for a given ”p”.

Solution: \( X_p = invNorm(p, \mu, \sigma) \)

2. \( P(X > X_p) = p \), Find \( X_p =? \) for a given ”p”.

Solution: \( X_p = invNorm(1 - p, \mu, \sigma) \)
Chapter-7: Sampling Distributions/Central Limit Theorem

Sampling Distribution of the mean: It is a distribution obtained by using the means computed from random samples of size(n) taken from a population.

Example: Suppose that a researcher selects 100 different random samples of a specific size (n) from a population, and computes the mean of the same random variable(X) for each 100 samples. These sample means $\bar{X}_1, \bar{X}_2, ..., \bar{X}_{100}$ constitute a sampling distribution of the sample mean.

Central Limit Theorem: The sample mean, $\bar{X}$, is (approximately) normally distributed with parameters $\mu_{\bar{X}} = \mu$ and standard deviation of $\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$, (we can write this as $\bar{X} \rightarrow \text{Normal}(\mu, \frac{\sigma}{\sqrt{n}})$)

1. if the random sample is from a population that is normally distributed with $\mu$ and $\sigma$ regardless of sample size.
OR

2. if the random sample is from an unknown population with parameters $\mu$ and $\sigma$ but sample size $n \geq 30$. The greater the sample size, better the approximation to normal distribution.

How to solve questions related to sample mean $\bar{X}$:

Let $\bar{X} \rightarrow \text{Normal}(\mu, \frac{\sigma}{\sqrt{n}})$. Then, we can use TI-83 to find the following probabilities without using Z table.

1. $P(\bar{X} < a) = \text{normalcdf}(-10^{10}, a, \mu, \frac{\sigma}{\sqrt{n}})$

2. $P(b < \bar{X} < a) = \text{normalcdf}(b, a, \mu, \frac{\sigma}{\sqrt{n}})$

3. $P(\bar{X} > a) = \text{normalcdf}(a, 10^{10}, \mu, \frac{\sigma}{\sqrt{n}})$

Suppose that you are given a probability or percentage $p$, you are asked to find a specific $X_p$ value such as

1. $P(\bar{X} < X_p) = p$, find $X_p = ?$ Solution: $X_p = \text{invNorm}(p, \mu, \frac{\sigma}{\sqrt{n}})$

2. $P(\bar{X} > X_p) = p$, find $X_p = ?$ Solution: $X_p = \text{invNorm}(1 - p, \mu, \frac{\sigma}{\sqrt{n}})$