Sec 6.6. Normal Distn. (Bell-shaped distn.)

density fn.

\[ f(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{(x - \mu)^2}{2\sigma^2}} \]

- \infty < x < \infty

Depends upon \( \mu \), \( \sigma \)

It is symmetrical about \( \mu \)

Normal Distn. with \( \mu = 0, \sigma = 1 \)

is called standard Normal Distn. \( Z \) distn.

There is no closed form cdf for a Normal Distn.

Since Normal Distn. is used extensively in our work, values of cdf \( F(z) \) of standard Normal Distn. \( Z \) have been calculated in a \( Z \) table.

(in the back cover) for \( z = -3.49 \) up to \( z = 3.49 \) in increments of 0.01

\[ F(z) = P(Z \leq z) = \int_{-\infty}^{z} f(z) \, dz = \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} e^{-\frac{z^2}{2\sigma^2}} \, dz \]

ie \( F(z) \) has been evaluated

for \( z = -3.49 \) to \( z = 3.49 \) in steps of 0.01

\( Z \) can be read with 2 decimal places

with 2nd decimal as leaf and the first part as a stem.
like 1.37 as 1.3 stem .37 leaf

All stems are written in a column of the table and leaf in the top row of the table for each stem

\[
\text{Prob. } F(1.37) = P(Z \leq 1.37) = 0.9147
\]

All other probabilities can be found using calf by the tables provided in class.

\[
\begin{align*}
P(Z > 1.37) &= 1 - P(Z \leq 1.37) \\
&= 1 - F(1.37) = 1 - 0.9147 \\
&= 0.0853
\end{align*}
\]

etc.
Another question that we have to answer is how to find $Z_0$ for given value of $F(Z_0) = F_0$ given prob.

1) We have to use this table in reverse.
2) Locate the given value of $F_0$ in the table, then determine the stem part and leaf of the $Z$ value.

Example:

- $F(Z_0) = .9750$
- $Z_0 = 1.96$

2. If given $F_0$ is not found exactly in the table, then we use the closest $F_0$ to get the solution for $Z_0$.

3. If there are two equally closest values, then $Z_0 = \frac{Z_1 + Z_2}{2}$
To study any X Normal Dist.

we use transformation $Z = \frac{X - \mu}{\sigma}$

and use Z table to get answers.

$P(a < X \leq b) = P\left( \frac{a - \mu}{\sigma} < Z \leq \frac{b - \mu}{\sigma} \right)$