Here is the distribution of IQ scores:

\[ Z = \frac{X - \mu}{\sigma} = \frac{X - 100}{15} \ldots \]

Suppose you have a sample size of 25. What does the distribution of means look like?

Central Limit Theorem:

1) \( \mu_X = \mu_\mu = 100 \)
2) \( \sigma_X = \frac{\sigma_\mu}{\sqrt{n}} = \frac{15}{\sqrt{25}} = \frac{15}{5} = 3 \)
3) The distribution of means will be normal

![Distribution of IQ scores](image)

![Distribution of Mean IQ](image)
1) What is the probability that a sample mean will be greater than 105? \( (n=25) \)

\[
\begin{align*}
\mu_x &= \mu = 100 \\
\sigma_x &= \frac{\sigma}{\sqrt{n}} = \frac{15}{\sqrt{25}} = 3 \\
\bar{x} &= 105 \\
Z &= \frac{\bar{x} - \mu}{\sigma_x} = \frac{105 - 100}{3} = 1.67 \\
Pr(Z \geq 1.67) &= 0.0475
\end{align*}
\]

2) Let \( n=100 \) \( Pr(\bar{x} \leq 99) \) ? \( \mu_x = 100 \) \( \sigma_x = \frac{\sigma}{\sqrt{n}} = \frac{15}{\sqrt{100}} = \frac{15}{10} = 1.5 \)

\[
Z = \frac{\bar{x} - \mu}{\sigma_x} = \frac{99 - 100}{1.5} = -0.67
\]

\[
Pr(\bar{x} \leq 99) = Pr(Z \leq -0.67) \\
Pr(\bar{x} > 0.67) = 0.2514
\]

\[
Pr(\bar{x} < 99 \text{ or } \bar{x} > 101) ?
\]

\[
= Pr(\bar{x} < 99) + Pr(\bar{x} > 101)
= 0.2514 + 0.2514 = 0.5028
\]

About \( \frac{1}{2} \) of the means will be between 99 and 101.
3) Suppose heights of men in a population has a mean of 70 inches and a standard deviation of 2.8 inches. If we sample 25 men, what is the mean height for the 95th percentile point ($P_{95}$)?

$$M_X = 70, \quad \sigma_X = 2.8, \quad n = 25$$

$$M_{\bar{x}} = 70, \quad \sigma_{\bar{x}} = \frac{\sigma_X}{\sqrt{n}} = \frac{2.8}{\sqrt{25}} = 0.56$$

$z$ score for $P_{95} = 1.64$

$$\bar{x} = 70 + (1.64)(0.56)$$

$$\bar{x} = 70.9 \text{ inches}$$