Panel 1

\[ N(\bar{x}, s) \]

Distribution contains 69% of data

\[ N(0,1) \]

Def: \( N(\mu, \sigma) = \text{normal distribution with mean } \mu \text{ and std dev. } \sigma \)

\( N(0,1) \) is called standard normal distr.

Panel 2

\[ N(0,1) \]

\[ P(\bar{x} \leq 0) = 0.5 \]

\[ P(\bar{x} > 0) = 0.5 \]

\[ P(\bar{x} \leq 0.5) = 0.8 \]

\[ P(\bar{x} > 0.5) = 0.2 \]

\[ N(10,2) \]

\[ P(x \leq 10) = 0.5 \]

\[ P(8 \leq x \leq 12) = 0.69 \]

\[ P(x = 12) = 0.0413 \]

\[ P(x < 8) = 0.159 \]
Panel 3

\[ N(10,4) : \]
\[
\begin{align*}
\text{1. } P(8 \leq x \leq 12) &= 0.69 \\
\text{2. } P(x = 12) &= 0.0413 \\
\text{3. } P(x < 9) &= 0.158 \\
\end{align*}
\]

\[ P(\theta \leq x \leq 12) = P(x = 12) - P(x < \theta) \]
\[
= 0.0413 - 0.158 = 0.069
\]

Panel 4

Ex: Use Shat Cruise to find the normal cdf that best fits the AGE variable in GSS survey.

Then compute \( P(x > 50) \) using \( N(47.3, 12.5) \):

\[ N(47.3, 12.5) \]

\[ P(x > 50) = 0.45 \]

Frequency table results for AGE:

<table>
<thead>
<tr>
<th>AGE</th>
<th>Frequency</th>
<th>Relative Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 to 20</td>
<td>37</td>
<td>0.018380527</td>
</tr>
<tr>
<td>20 to 30</td>
<td>322</td>
<td>0.159900208</td>
</tr>
<tr>
<td>30 to 40</td>
<td>373</td>
<td>0.18529558</td>
</tr>
<tr>
<td>40 to 50</td>
<td>381</td>
<td>0.18926973</td>
</tr>
<tr>
<td>50 to 60</td>
<td>371</td>
<td>0.18430264</td>
</tr>
<tr>
<td>60 to 70</td>
<td>272</td>
<td>0.13912171</td>
</tr>
<tr>
<td>70 to 80</td>
<td>165</td>
<td>0.08497213</td>
</tr>
<tr>
<td>80 to 90</td>
<td>92</td>
<td>0.045702931</td>
</tr>
</tbody>
</table>

Overlay:
- Normal Distribution: Mean = 47.765333, Std. Dev. = 17.350639
Panel 5

\[ P(1 < z < 2) \]

Panel 6

**Theorem:** If \( x \sim N(\mu, \sigma) \) then
\[ z = \frac{x - \mu}{\sigma} \sim N(0,1) \]

**Example:** Say \( x \sim N(30, 5) \). Find \( P(x \geq 32) \). 0.5

Then convert \( x = 32 \) into the equivalent \( z \)-score.

\[ z = \frac{32 - \mu}{\sigma} = \frac{32 - 30}{5} = 0.4 \]

\[ P(x \geq 32) = P(z \geq 0.4) = 0.344 \]