STAT 3011 Discussion 007

Week 5

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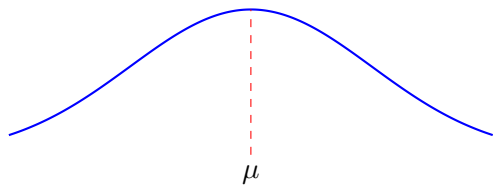
Recap: Normal Distribution

- The **normal distribution** is a continuous probability distribution characterized by:
  - Mean (μ)
  - Standard deviation (σ)
  - Notation: $X \sim N(\mu, \sigma)$

- The **standard normal distribution** is a special case where:
  - $\mu = 0$, $\sigma = 1$
  - Denoted as: $Z \sim N(0, 1)$



Using pnorm() in R

To find the probability under the standard normal curve:

- $P(Z < z)$: **pnorm(z)**
- $P(Z > z)$: **1 - pnorm(z)**
- $P(z_a < Z < z_b)$: **pnorm(z_b) - pnorm(z_a)**

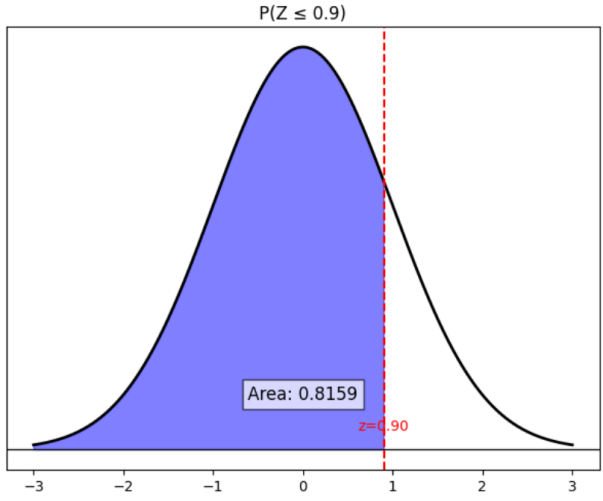
Note: `pnorm()` can also be used for any normal distribution $X \sim N(\mu, \sigma)$ by specifying the mean and standard deviation:

- $P(X < x)$: `pnorm(x, mean =` μ`, sd =` σ`)`
- $P(X > x)$: `1 - pnorm(x, mean =` μ`, sd =` σ`)`

Examples

Example 1: Find $P(Z < 0.9)$

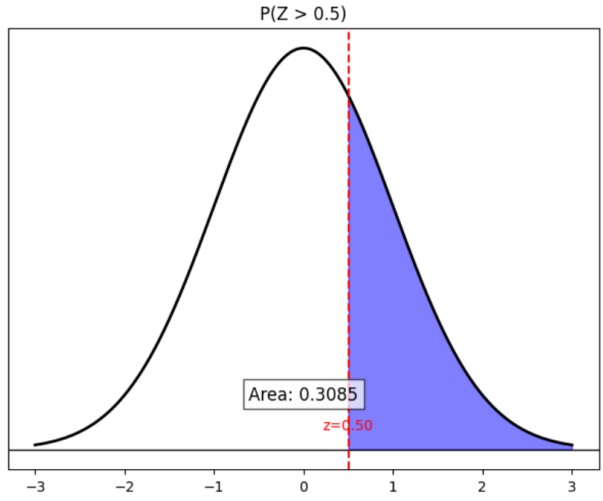
```
pnorm(0.9)
# Output: 0.8159
```



More Examples

Find $P(Z > 0.5)$.

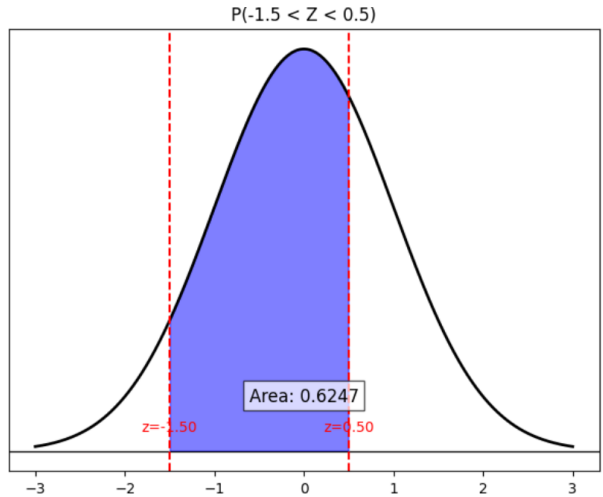
```
1 - pnorm(0.5)
# Output: 0.3085
```



More Examples

Find $P(-1.5 < Z < 0.5)$.

```
pnorm(0.5) - pnorm(-1.5)
# Output: 0.6247
```



Using qnorm() in R

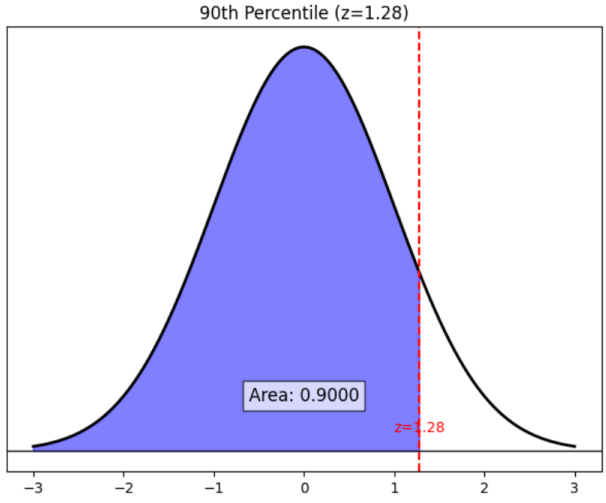
To find the z-value corresponding to a given percentile:

- z such that $P(Z < z) = p$: ‘qnorm(p)‘
- z such that $P(Z > z) = p$: ‘qnorm(1 - p)‘

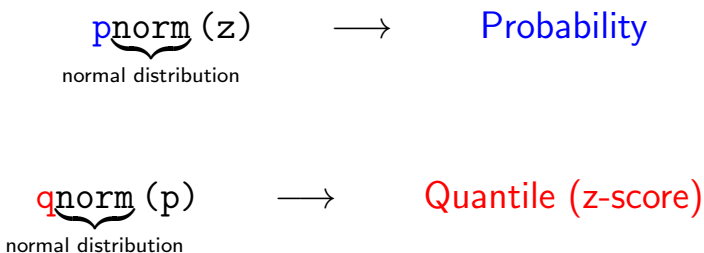
Example

Example 4: Find the z-value that marks the 90th percentile of the standard normal distribution.

```
qnorm(0.9)
# Output: 1.2816
```



`pnorm()` **vs.** `qnorm()`



Q-Q Plots

Q-Q (Quantile-Quantile) plots help us assess if data follows a normal distribution and reveal skewness patterns.

Patterns:

- **Points follow straight line**: Data is normally distributed
- **Curve upward (right skew)**: More extreme large values
- **Curve downward (left skew)**: More extreme small values

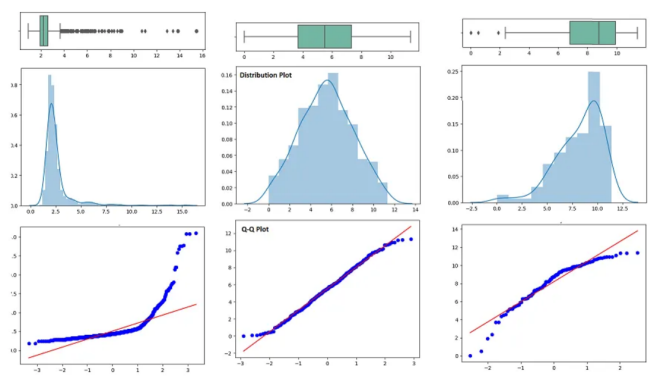


Image credits: link

Questions?