Handout for Lecture 10

Normal Distribution and Z-Score

ECON 340: Economic Research Methods — Instructor: Div Bhagia

If $X \sim N(\mu, \sigma^2)$, then the standardized random variable,

$$Z = \frac{X - \mu}{\sigma} \sim N(0, 1)$$

Given $X \sim N(\mu, \sigma^2)$, to find $Pr(x_0 < X < x_1)$:

- Find $z_0 = (x_0 - \mu)/\sigma$ and $z_1 = (x_1 - \mu)/\sigma$
- Use standard normal table to find $Pr(z_0 < Z < z_1)$

Exercises: Refer to the standard normal table to answer the following.

1. Given $X \sim N(3, 16)$, find $Pr(2 < X < 5)$.

2. Given $X \sim N(15, 100)$, find $Pr(X > -3)$.

Given $X \sim N(\mu, \sigma^2)$ and $Pr(X < x) = p$, to find x :

- Use standard normal table to find z where $Pr(Z < z) = p$
- Find $x = \mu + z \cdot \sigma$

Follows analogously for when we are given $Pr(X > x) = p$.

Exercises: Refer to the standard normal table to answer the following.

1. Given $Pr(Z > z) = 0.95$. Find z.

2. Given $X \sim N(3, 16)$ and $Pr(X < x) = 0.95$. Find x.

3. Given $Pr(|Z| > z) = 0.10$. Find z.

   Note: Since the normal distribution is symmetric $Pr(Z > z) = Pr(Z < -z)$, so we have that: $Pr(|Z| > z) = 2Pr(Z > z) = 2Pr(Z < -z)$.