Let $X_1, X_2, \ldots, X_n$ be a random sample from the normal distribution with mean μ and variance $\sigma^2 = 2$.

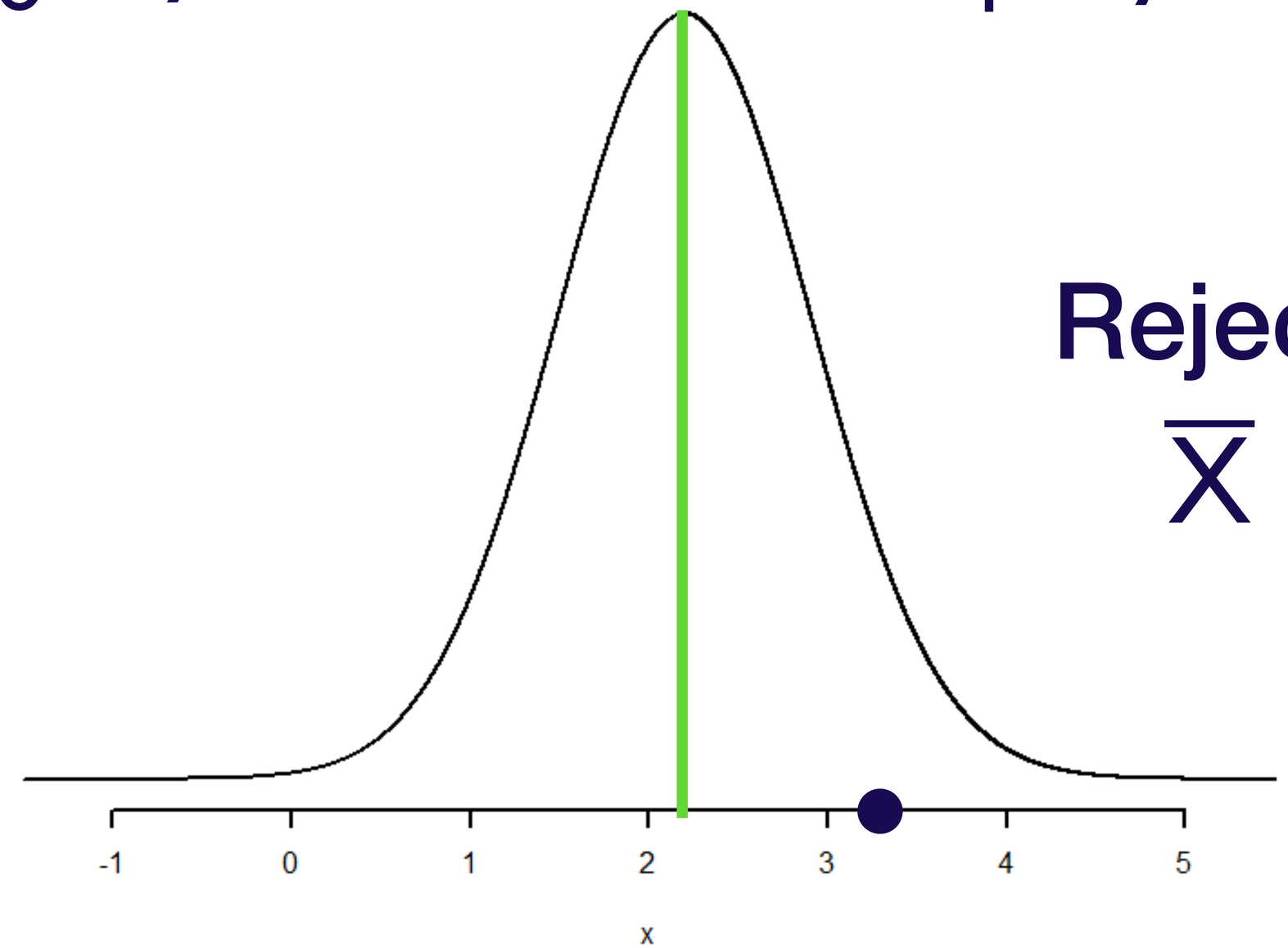
$$H_0 : \mu \leq 3 \qquad H_1 : \mu > 3$$

Idea: Look at $\overline{X}$ and reject H_0 in favor of H_1 if $\overline{X}$ is "large".

i.e. Look at $\overline{X}$ and reject H_0 in favor of H_1 if $\overline{X} > c$ for some value c.

Let $X_1, X_2, \ldots, X_n$ be a random sample from the normal distribution with mean μ and variance $\sigma^2 = 2$.

$$H_0 : \mu \leq 3 \qquad H_1 : \mu > 3$$



Reject H_0 if $\overline{X} > c$.

Errors in Hypothesis Testing

	Your Decision: "accept*" H_0	Your Decision: reject H_0
H_0 true	✓	✗
H_0 false	✗	✓

fail to reject

Errors in Hypothesis Testing

	Your Decision: "accept*" H_0	Your Decision: reject H_0
H_0 true	✓	Type I error
H_0 false	Type II error	✓

fail to reject

Errors in Hypothesis Testing

- Type I or Type II error
  which is worse?

- This totally depends on how you set up your hypotheses and what is at stake.

- The null hypothesis is assumed to be true and the alternate hypothesis is what you are out to show.

Example:

You are a potato chip manufacturer and you want to ensure that the mean amount in 15 ounce bags is at least 15 ounces.

$$H_0 : \mu \leq 15$$

$$H_1 : \mu > 15$$

Example:

You are an angry consumer group and you want to show that the chip company is cheating its customers.

$$H_0 : \mu \geq 15$$

$$H_1 : \mu < 15$$

Example:

You are a potato chip manufacturer and you want to ensure that the mean amount in 15 ounce bags is at least 15 ounces.

$$H_0 : \mu \leq 15 \quad H_1 : \mu > 15$$

Type I error:

The true mean is ≤ 15 but you concluded it was > 15. You are going to save some money because you won't be adding chips but you are risking a lawsuit!

Example:

You are a potato chip manufacturer and you want to ensure that the mean amount in 15 ounce bags is at least 15 ounces.

$$H_0 : \mu \leq 15 \quad H_1 : \mu > 15$$

Type II error:

The true mean is > 15 but you concluded it was ≤ 15. You are going to be spending money increasing the amount of chips when you didn't have to.

Errors in Hypothesis Testing

	Your Decision: fail to reject H_0	Your Decision: reject H_0
H_0 true	✓	Type I error
H_0 false	Type II error	✓

random sample

⇓

sample mean $\overline{X}$

⇓

decision
(potentially with error)

Question:

What is the probability that we will make a Type I or Type II error?

random sample

⇓

sample mean $\overline{X}$

⇓

decision
(potentially with error)

Related Question:

Can we control this error?