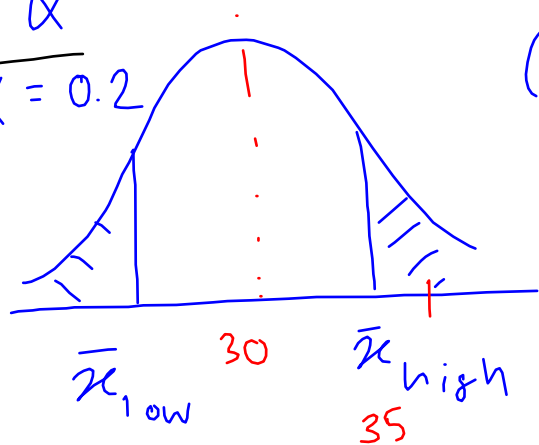


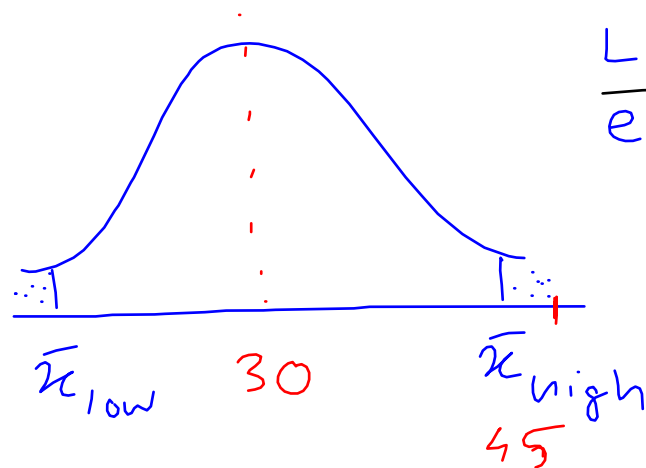
Decision rule — what determines whether we reject H_0

— based on α
(assuming H_a to be 2-sided)

High α
e.g. $\alpha = 0.2$



Low α
e.g. $\alpha = 0.01$



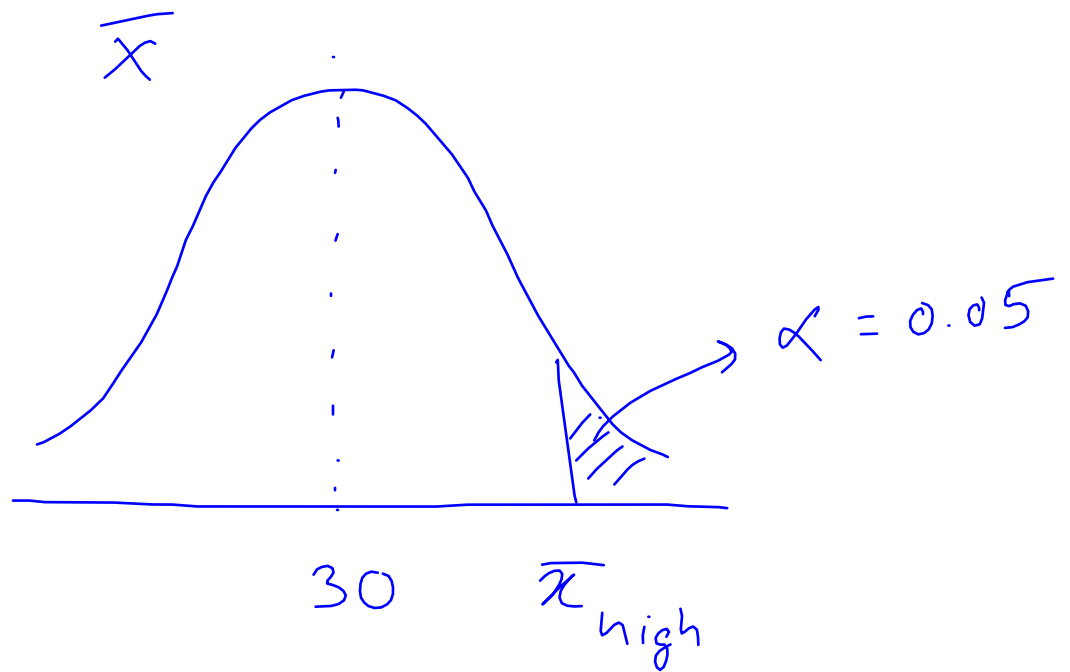
Where is it more difficult / more unlikely to reject H_0 ? when low α

More strict rule for rejecting H_0 .

$$H_0: \mu = 30$$

$$H_a: \mu > 30$$

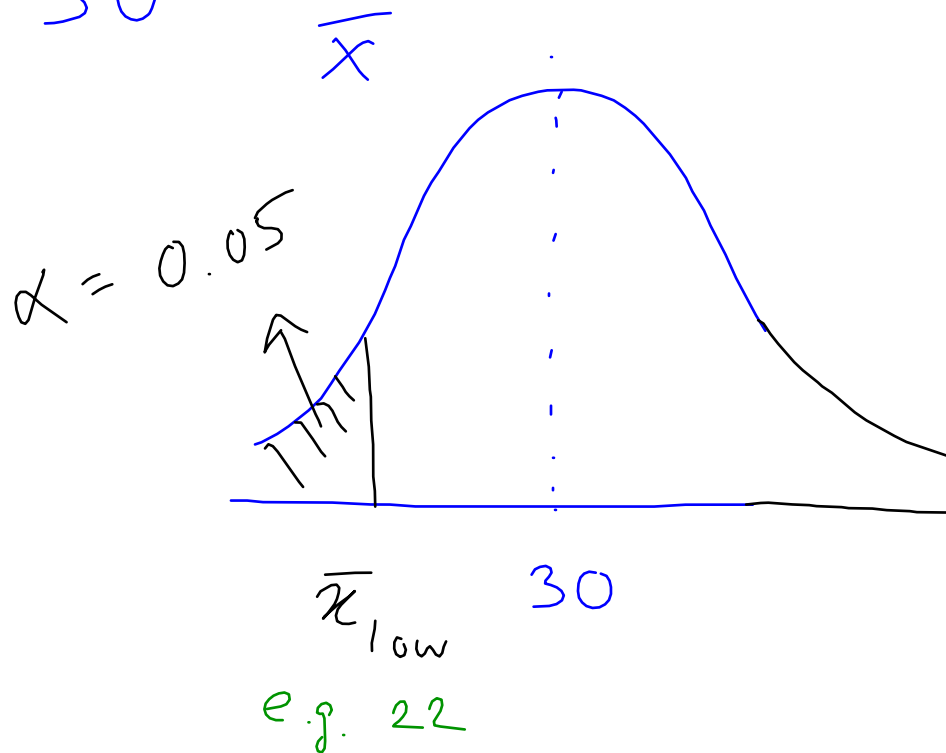
$$\alpha = 0.05$$



$$H_0: \mu = 30$$

$$H_a: \mu < 30$$

$$\alpha = 0.05$$



Can all of this be done using
Z values instead of $\bar{x}$
values?

Yes! $\bar{x}$ follows normal

Under H_0

$$\bar{x} \sim N(\mu_0, \sigma/\sqrt{n})$$

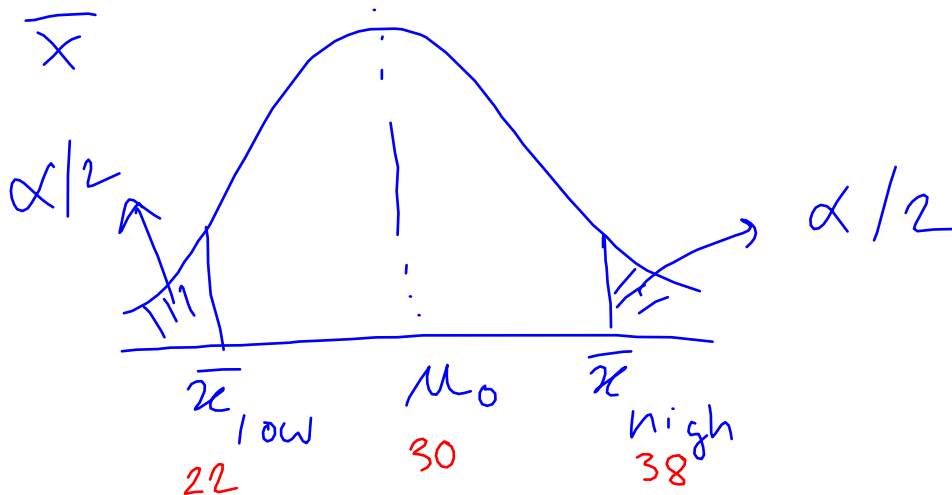
$$H_0: \mu = \mu_0$$

$$H_a: \mu \neq \mu_0$$

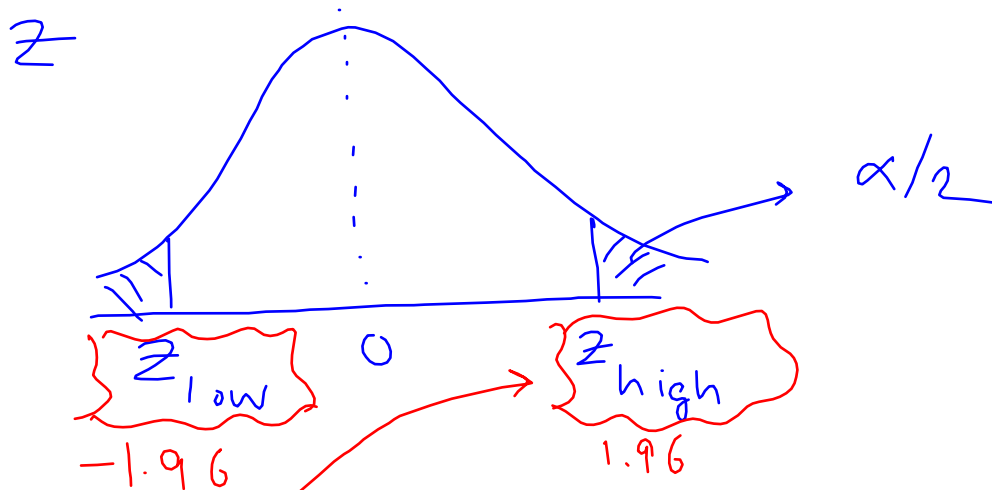
α

$$\frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} \sim N(0, 1)$$

↓
test statistic
 z_{test}



critical
values



$$H_0: \mu = 30$$

$$H_a: \mu \neq 30$$

$$\sigma = 5$$

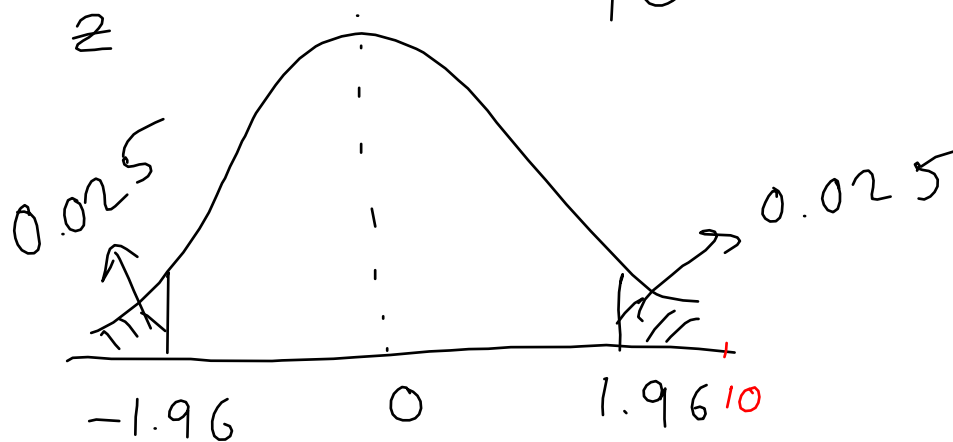
$$n = 25$$

$$\bar{x} = 40$$

$$\alpha = 0.05$$

$$z_{\text{test}} = \frac{40 - 30}{5/\sqrt{25}}$$

$$= 10$$



Reject H_0 !

$z_{\text{test}} > \text{critical value}$
1.96

$$H_0: \mu = 30$$

$$H_a: \mu \neq 30$$

$$\sigma = 5$$

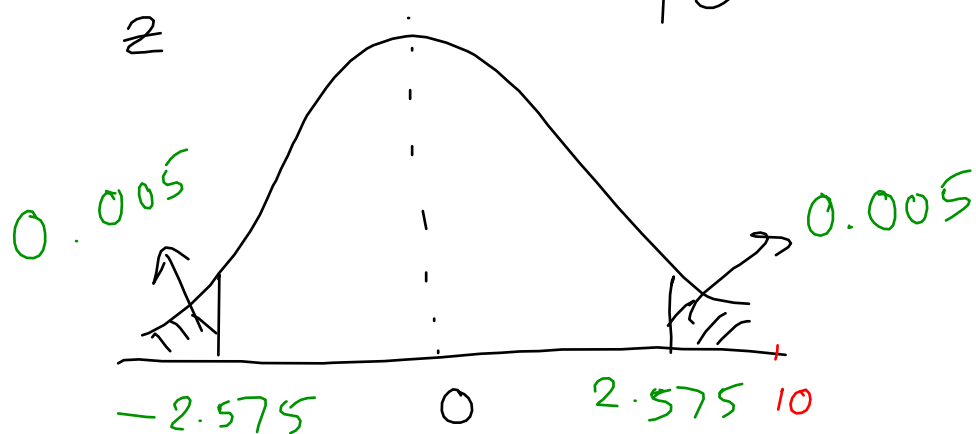
$$n = 25$$

$$\bar{x} = 40$$

$$\alpha = 0.01$$

$$z_{\text{test}} = \frac{40 - 30}{5/\sqrt{25}}$$

$$= 10$$



Is it possible to have z_{test}

such that

H_0 rejected at $\alpha = 0.05$

but not " at $\alpha = 0.01$? Yes e.g.

$$z_{\text{test}} = 2$$

Is it possible to have z_{test} such that

H_0 not rej. at $\alpha = 0.05$ but

H_0 rej. at $\alpha = 0.01$? No!

Reject H_0 !
 $z_{\text{test}} > \text{critical value}$
 2.575

$$H_0: \mu = 30$$

$$H_a: \mu > 30$$

$$\sigma = 5$$

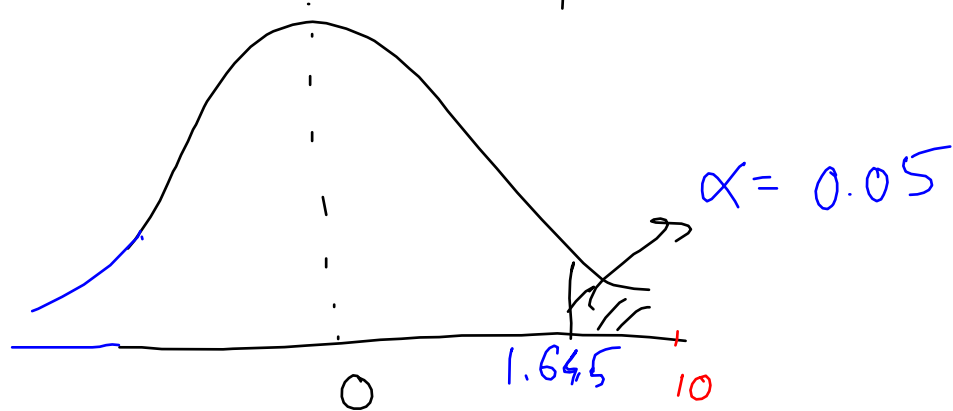
$$n = 25$$

$$\bar{x} = 40$$

$$\alpha = 0.05$$

$$z_{\text{test}} = \frac{40 - 30}{5/\sqrt{25}}$$

$$= 10$$



Reject H_0 !

$$z_{\text{test}} > \text{critical value}$$

$$1.645$$

for same α , is it
more difficult to
reject when

H_a is 2-sided v/s

H_a is 1-sided? Yes e.g. $z_{\text{test}} = 1.87$

Rej. ($\alpha = 0.05$) $H_a: \mu > 30$
crit. val. = 1.645

Not rej. ($\alpha = 0.05$) $H_a: \mu \neq 30$
crit. val = 1.96