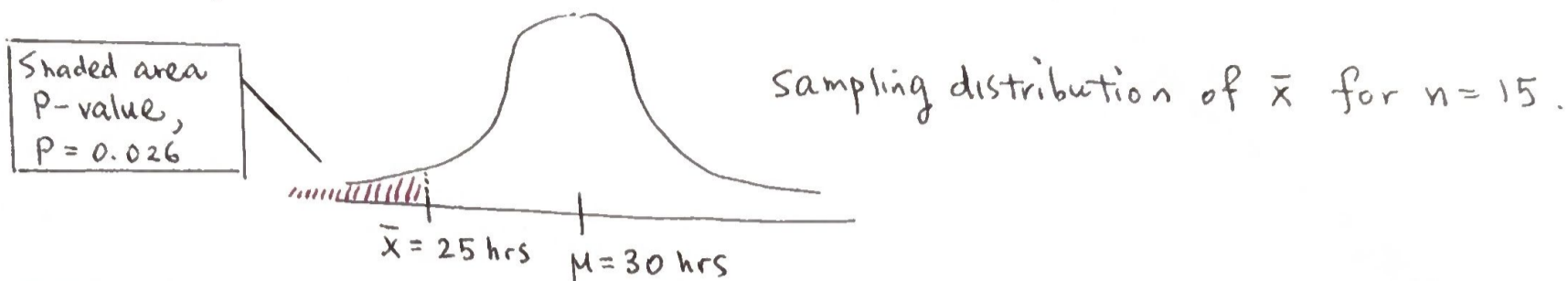


18 - Hypothesis Test for mean (σ known)

Ex 1 Company claims that on average, their batteries last ≥ 30 hrs with $\sigma = 10$ hrs. You select an SRS of 15 batteries, finding sample mean life of $\bar{x} = 25$ hrs. Is company's claim credible?



Principle	Null hypothesis H_0	Alternate hypothesis H_a
Reject a 'claim about μ ' if probability P below a small threshold α , assuming claim is true.		
"P-value"		"Significance level"

Ex 2 (a) Identify null & alternative hypotheses in Ex 1.

(b) What conclusion do you make for the significance level of $\alpha = 0.05$? 0.01 ?

A (a) $H_0: \mu \geq 30$ hrs.

$H_a: \mu < 30$ hrs.

(b) At $\alpha = 0.05$: Since $P = 0.026 < \alpha = 0.05$, we reject H_0 . We have convincing evidence that batteries last < 30 hrs on avg.

At $\alpha = 0.01$: Since $P = 0.026 > \alpha = 0.01$, we fail to reject H_0 . We do not have convincing evidence that batteries last < 30 hrs on avg.

Hypothesis test for mean μ (σ known)

State $H_0: \mu = \mu_0, \mu \geq \mu_0, \text{ or } \mu \leq \mu_0.$

$H_a: \mu \neq \mu_0, \mu < \mu_0, \text{ or } \mu > \mu_0.$

Check: 10% Condition: $N \geq 10n$

Approx normal: $n \geq 30$ OR pop. distribution is normal.

Compute: P-value using $\mu_{\bar{x}} = \mu_0$ and $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}.$

Conclude:

Ex 3 (One-sided test) Rowan claims its avg salary is \$88,200. A random sample of 32 employees gives $\bar{x} = \$85,000$. Assume pop. sd of \$9500. Test the claim that the ^{true avg} salaries are $\geq \$88,200$ at the $\alpha = 0.05$ significance level.

A State hypotheses: $H_0: \mu \geq 88200$

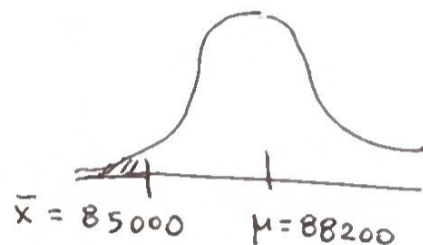
$H_a: \mu < 88200$

Check • $N \geq 10n = 30 \times 32 = 320$... Rowan has ≥ 320 employees \checkmark . (10% condition)

• Approx normal? $n = 32 \geq 30 \checkmark$.

Compute:

$$P = \text{pnorm}(85000, \text{mean} = 88200, \text{sd} = \frac{9500}{\sqrt{32}}) \\ = \text{pnorm}\left(\frac{85000 - 88200}{1679}\right) = 0.028 = 2.8\%$$



Conclude:

Since $P = 0.028 < \alpha = 0.05$, we reject H_0 . We have convincing evidence that avg salary at Rowan is $< \$88200$.

Ex 4 In Ex 3, test the claim that ^{avg} salary is $= \$88200$, at $\alpha = 0.05$ significance level.

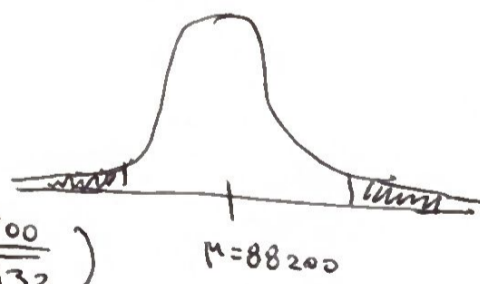
A State hypotheses: $H_0: \mu = 88200$

$H_a: \mu \neq 88200$

Check: same

Compute

$$P = 2 \cdot \text{pnorm}(85000, \text{mean} = 88200, \text{sd} = \frac{9500}{\sqrt{32}}) \\ = 0.057.$$



Conclude: Bc $P > \alpha = 0.05$, we fail to reject H_0 . We don't have convincing evidence that the avg salary at Rowan is different from \$88200.