

A laboratory employs a technique for determining the phosphorus content of hay. The question arises: "Do phosphorus determinations differ among the technicians performing the analysis?" To answer this question, each of four randomly selected technicians was given five samples from the same batch of hay. The results of the 20 phosphorus determinations (in mg phosphorus/g of hay) are shown.

Technician			
1	2	3	4
34	37	34	36
36	36	37	34
34	35	35	37
35	37	37	34
34	37	36	35

1. Write down appropriate null and alternative hypothesis to test the laboratory's question.

$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu$

$H_a: \text{At least one mean is different.}$

2. Is this considered a fixed-effect or random-effect ANOVA model? Explain why; include the objective of the lab in performing this analysis.

Random effects. Trying to extrapolate about all technicians, not just the levels in the study. Also, they are randomly chosen from a larger group.

3. Do the test. Report your F observed value (the test statistic) and p-value. What is your conclusion in terms of the problem?

Source	df	MS	F	p
Technicians	3	3.75	$3/1.25 = 2.4$	0.1 - 0.25
Error	16	1.25		Do not reject H_0
Total	19			State in terms of Q.

4. If the F-test rejects H_0 , compute confidence intervals for individual treatment means. If the F-test does not reject H_0 , compute a confidence interval for the common mean.

$\bar{x} = 35.5$ $CI: \bar{x} \pm t_{\alpha/2, n} \sqrt{\frac{s^2}{n}}$
 $35.5 \pm 2.12 \sqrt{\frac{1.25}{20}}$

95% CI [34.97, 36.03]