

Inference Concerning Variances

Q.1. A researcher samples 9 computer monitors from each of two manufacturers. The lifetime of each monitor is observed and recorded (in 1000s of hours). The following table gives the summary results:

Brand	Mean	SD
A	4.20	1
B	4.60	0.8

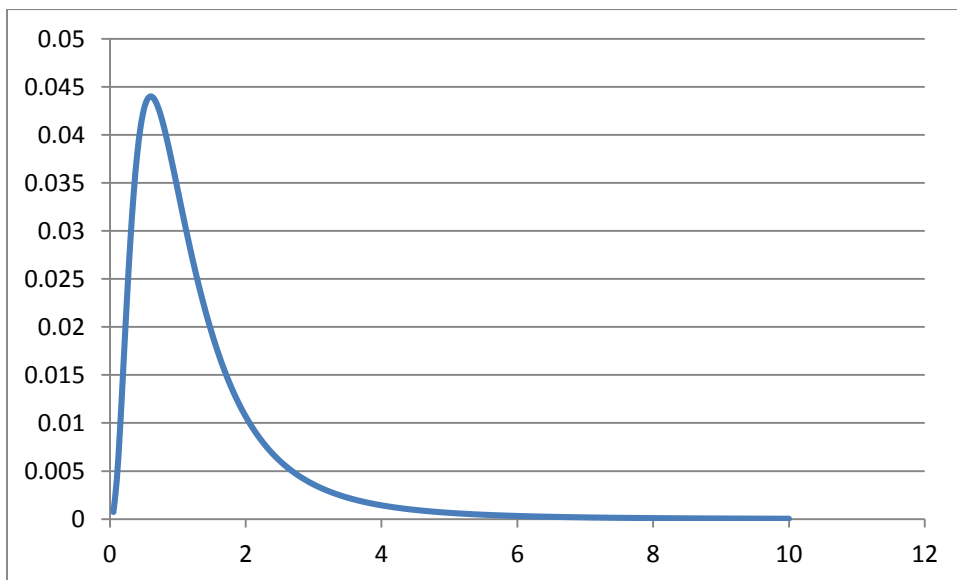
- Test $H_0: \sigma_A^2 = \sigma_B^2$ versus $H_A: \sigma_A^2 \neq \sigma_B^2$ at the $\alpha = 0.05$ significance level.
 - Test Statistic: _____
 - Rejection Region: _____
 - Conclusion (circle best answer):
 - Conclude $\sigma_A^2 > \sigma_B^2$
 - Conclude $\sigma_A^2 < \sigma_B^2$
 - Do not reject $H_0: \sigma_A^2 = \sigma_B^2$

Q.2. A confidence interval for a population variance can include both positive and negative values. T/F

Q.3. A chemist is interested in comparing the variation of chemical purity for the 2 suppliers her lab purchases the chemical from. She takes random samples of 9 vials from each supplier, and observes sample standard deviations of 10.0 for supplier 1 and 7.0 for supplier 2.

p.3.a. Give the test statistic for testing $H_0: \sigma_1^2 = \sigma_2^2$ versus $H_A: \sigma_1^2 \neq \sigma_2^2$ ($\alpha = 0.05$ significance level)

p.3.b. Clearly Give the Rejection Region for her Test Statistic.



Q.4. A researcher samples 7 adult males from each of two species of squirrels and measures their body mass index . The following table gives the summary results:

Species	Mean	SD
A	7.20	2.4
B	5.70	3.2

- Test $H_0: \sigma_A^2 = \sigma_B^2$ versus $H_A: \sigma_A^2 \neq \sigma_B^2$ at the $\alpha = 0.05$ significance level.
 - Test Statistic: _____
 - Rejection Region: _____
 - Conclusion (circle best answer):
 - Conclude $\sigma_A^2 > \sigma_B^2$
 - Conclude $\sigma_A^2 < \sigma_B^2$
 - Do not reject $H_0: \sigma_A^2 = \sigma_B^2$

Q.5. A chemist is interested in the mean and variance of batches of a compound received from a supplier. A random sample of $n=18$ batches are obtained and the amount of the compound is measured from each batch. The sample mean and standard deviation are 23.8 ounces and 0.8 ounces, respectively. Give a 95% confidence interval for the standard deviation among all batches from this supplier.

Q.6. Ultrasound measurements were made on mice of 2 Age Groups (Adult Mice, $n_1=10$ and Old Mice, $n_2=9$). The standard deviations of the pulse rates were $S_1 = 70$ and $S_2 = 49$, respectively. Test:

$$H_0: \sigma_1^2 = \sigma_2^2 \quad \text{vs} \quad H_A: \sigma_1^2 \neq \sigma_2^2$$

Test Statistic = _____ Rejection Region: _____ P-value $>$ $<$ 0.05

Q.7. A sample of $n = 93$ lobsters at Devil's Hole was obtained with sample mean and standard deviation carapace lengths measured as 37.6 mm and 7.1 mm, respectively. Obtain a 95% Confidence Interval for the population standard deviation of lengths at this site. Hint: Obtain a 95% CI for the variance, then obtain square roots of the upper and lower bounds.

95% Confidence Interval for σ : _____

Q.8. A machine that fills cans with coffee is working properly if the standard deviation of net weights is small (less than 0.5 ounces). The production manager will take random samples of filled cans and measure their net weights. If his test shows significant evidence that the variation is too large, he will stop the filling process for corrections.

$$i) H_0 : \sigma \geq 0.5 \quad H_A : \sigma < 0.5 \quad ii) H_0 : \sigma \leq 0.5 \quad H_A : \sigma > 0.5 \quad iii) H_0 : \sigma = 0.5 \quad H_A : \sigma \neq 0.5$$

Q.9. Two types of measuring instruments may be used to determine a measurement that is critical in a laboratory analysis. Each instrument is used to make measurements of a known substance. Do the sample results indicate there is a difference in the precision (variability) of the measurements for the two instruments?

	Intrument1	Intrument2
n	8	8
Mean	8.2	8.1
SD	1.24	0.64

Q.10. An textile engineer is interested whether the variation in breaking strength of Yarn Type A is larger than the variation in Type B. Random samples of $n_A=n_B=7$ measurements were obtained, and the sample variances were $s_A^2=5.0$ and $s_B^2=1.25$. Do the data provide sufficient evidence to conclude $\sigma_A^2 > \sigma_B^2$? Test by using $\alpha = 0.05$.

- Test Statistic:
- Rejection Region:
- The P-value is **Larger** or **Smaller** than 0.05.

Q.11. An experiment is conducted to compare breaking strengths of 2 types of fibers. The means, standard deviations, and sample sizes of random samples from each fiber type are: $\bar{y}_{1\bullet} = 50$ $s_1 = 12$ $n_1 = 10$ $\bar{y}_{2\bullet} = 45$ $s_2 = 8$ $n_2 = 10$

p.11.a. Test $H_0: \sigma_1^2 = \sigma_2^2$ versus $H_A: \sigma_1^2 \neq \sigma_2^2$ at $\alpha = 0.10$ significance level

Test Statistic: _____ Reject H_0 if Test Statistic < _____ or > _____