

1. The amount of general anesthetic a patient should receive prior to surgery has received considerable public attention. According to the American Society of Anesthesiologists, every year about 40,000 (some researchers have put the figure closer to 200,000) of the 28 million patients who undergo general anesthesia experience limited awareness during surgery because of resistance to the medication or from too little dosage. Patients commonly report overhearing doctors conversing with nurses and assistants during operations.

Suppose a study is conducted using 20 patients who are having eye surgery performed on both eyes, two weeks separating the treatments on each eye. Ten of the patients are given a lighter dose of general anesthetic prior to surgery on the first eye and the other ten patients are given a heavier dose. The following week, the procedure is reversed. Two days after each surgery is performed, the patients are asked to rate the amount of pain and discomfort they experienced on a scale from 0 (none) to 10 (unbearable). Results are shown below:

Subject	Light Dosage	Heavy Dosage	Subject	Light Dosage	Heavy Dosage
1	4	3	11	6	7
2	6	5	12	7	5
3	5	6	13	10	7
4	8	4	14	3	2
5	4	5	15	1	0
6	9	6	16	5	6
7	3	2	17	6	3
8	7	8	18	8	5
9	8	5	19	4	2
10	9	7	20	2	0

Can you conclude that the heavier dosage of anesthetic resulted in the patients experiencing lower pain and discomfort after the eye surgery? Use the 0.01 level of significance. Solve using the classical approach.

2. The following are the heart rates (in beats per minute) of 10 individuals both before and after using chewing smokeless tobacco. The subjects were randomly selected from the population of regular users of chewing tobacco.

Subject	Heart rate before use	Heart rate after use
1	75	78
2	72	75
3	72	74
4	65	68
5	77	75
6	80	84
7	73	71
8	75	81
9	79	81
10	59	63

- (a) Test the hypothesis, at the 5% level of significance, that chewing smokeless tobacco does not result in a change in the mean heart rate of the population of regular users of chewing tobacco.
- (b) Construct a 90% confidence interval for the mean difference (after – before) in heart rate before and after chewing smokeless tobacco.

3. Twenty laboratory mice were randomly divided into two groups of ten. Each group was fed according to a prescribed diet. At the end of three weeks, the weight gained by each animal was recorded. Do the data in the following table justify the conclusion that the mean weight gained on diet B was different from the mean weight gained on diet A, at the $\alpha = 0.05$ level of significance?

Diet A	5	14	7	9	11	7	13	14	12	8
Diet B	5	21	16	23	4	16	13	19	9	21

Solve using the classical approach.

4. A general contractor wants to compare the lifetimes of two major brands of electric water heaters, Eagle and National. Using independent samples, the contractor obtains the following data on lifetimes, in years.

Eagle				National				
6.9	7.3	7.8	7.4	7.6	7.6	9.4	9.0	6.4
7.2	6.6	6.2	8.2	8.8	6.2	8.2	4.7	9.2
7.6	5.7	5.5	6.9	6.3	7.8	6.9	10.4	9.1

At the 1% significance level, do the data provide sufficient evidence to conclude that, on the average, National water heaters last longer than Eagle water heaters?

5. Determine the critical region and critical value that would be used to test the following hypotheses using the classical model when F^* is used as the test statistic.

$$H_0 : \sigma_1 = \sigma_2 \quad \text{vs.} \quad H_a : \sigma_1 < \sigma_2 \quad \text{with } n_1 = 41, n_2 = 25, \text{ and } \alpha = 0.01.$$

6. Television viewing time appears to be quite different from one age group to the next. According to Nielson Media Research, adults in 1997 over age 54 watched TV for an average of 11.2 hours per week between 8:00 and 11:00 p.m. On the other hand, adults between the ages of 25 and 54 averaged 8.5 hours of viewing time per week. Media experts claim that such data is suspect to interpretation because younger adults are more unsettled and exhibit a greater variety of life styles than older adults, many of whom are retired and display more stability.

A recent study is conducted to check the results of the national survey, and the sampling data is shown in the table below:

Viewing Age Group	n	Weekly Mean Viewing Time (hrs)	Standard Deviation
25 to 54 (Y)	25	8.8	2.9
55 and over (O)	29	11.6	1.6

Test the hypothesis of equal variances against the alternative hypothesis that younger adults have a greater variance. Use the 0.05 level of significance. Solve using the classical approach.

7. A study investigated the cracking strength of reinforced concrete T-beams. Two types of T-beams were used in the experiment, each type having a different flange width. Cracking torsion moments for six beams with 60-cm slab widths and eight beams with 100-cm slab widths are recorded as follows:

60-cm slab width:	5.8	10.4	7.2	13.8	9.3	11.5		
100-cm slab width:	6.9	9.7	7.9	14.6	11.5	10.2	13.7	9.9

Assume the samples are randomly selected from the two populations.

Is there evidence of a difference in the variation in the cracking torsion moments of the two types of T-beams? Use $\alpha = 0.10$.