

1.(1 pt) Complete the ANOVA table for a completely randomized design below.

Source	df	SS	MS	F
Treatments	19	17	—	—
Error	—	—	—	—
Total	49	49.1		

2.(1 pt) The table below lists the body temperatures of six randomly selected subjects from each of three different age groups. Use the  $\alpha = 0.05$  significance level to test the claim that the three age-group populations have different mean body temperatures.

	16-20	21-29	30 and older
subject 1	97.4	98.5	97
subject 2	97.8	97.7	98.4
subject 3	98.7	97.8	98
subject 4	97.4	97.9	98.4
subject 5	97.5	98.6	97.8
subject 6	97.6	97.9	98.2
mean	97.733	98.067	97.967
standard deviation	0.497	0.383	0.528

The variance between samples is  $ns_x^2 =$  \_\_\_\_\_

The variance within samples is  $s_p^2 =$  \_\_\_\_\_

The test statistic is  $F =$  \_\_\_\_\_

The critical value is  $F =$  \_\_\_\_\_

Is there sufficient evidence to warrant the rejection of the claim that the three age-group populations have the same mean body temperature?

- A. No
- B. Yes

3.(1 pt) An experiment is conducted to determine whether there is a difference among the mean increases in growth produced by five inoculins (A, B, C, D and E) of growth hormones for plants. The experimental material consists of 20 cuttings of a shrub (all of equal weight), with four cuttings randomly assigned to each of the five different inoculins. The increase in weight and the standard deviation of the experiment are given in the table below.

	A	B	C	D	E
Plant 1	9	19	22	10	9
Plant 2	11	24	21	14	8
Plant 3	16	27	21	14	6
Plant 4	19	20	23	13	8
Mean	13.75	22.5	21.75	12.75	7.75
Standard Dev.	3.9607	3.2016	0.8292	1.6394	1.0897

Compute the following:

(a) SST = \_\_\_\_\_

(b) SSE = \_\_\_\_\_

(c) MST = \_\_\_\_\_

(d) MSE = \_\_\_\_\_

(e) F = \_\_\_\_\_

4.(1 pt)

Which of the following changes the analysis of variance results?

- A. each of the sample values is converted to a different scale
- B. the order of the samples is changed
- C. the same constant is added to every one of the sample values
- D. each value in one of the samples is multiplied by the same constant
- E. the same constant is added to each value in one of the samples
- F. each of the sample values is multiplied by the same constant

5.(1 pt) 43 387 Suppose the Total Sum of Squares for a completely randomized design with  $p = 6$  treatments and  $n = 18$  total measurements (SS(Total)) is equal to 430. In each of the following cases, conduct an  $F$ -test of the null hypothesis that the mean responses for the 6 treatments are the same. Use  $\alpha = 0.1$ .

(a) Sum of Squares for Treatment (SST) is 10% of SS(Total)

$F =$  \_\_\_\_\_

Rejection region  $F >$  \_\_\_\_\_

The final conclusion is

- A. There is not sufficient evidence to reject the null hypothesis that the mean responses for the treatments are the same.
- B. We can reject the null hypothesis that the mean responses for the treatments are the same and accept the alternative hypothesis that at least two treatment means differ.

(b) Sum of Squares for Treatment (SST) is 20% of SS(Total)

$F =$  \_\_\_\_\_

Rejection region  $F >$  \_\_\_\_\_

The final conclusion is

- A. There is not sufficient evidence to reject the null hypothesis that the mean responses for the treatments are the same.
- B. We can reject the null hypothesis that the mean responses for the treatments are the same and accept the alternative hypothesis that at least two treatment means differ.

(c) Sum of Squares for Treatment (SST) is 60% of SS(Total)

$F =$  \_\_\_\_\_

Rejection region  $F >$  \_\_\_\_\_

The final conclusion is

- A. We can reject the null hypothesis that the mean responses for the treatments are the same and accept the alternative hypothesis that at least two treatment means differ.
- B. There is not sufficient evidence to reject the null hypothesis that the mean responses for the treatments are the same.

6.(1 pt) Use the Minitab display to test the claims. Use the  $\alpha = 0.05$  significance level. The sample data are SAT scores on the verbal and math portions of SAT-I.

Analysis of Variance for SAT

Source	DF	SS	MS	F	P
Gender	1	52810	52810	5.08	0.03
Ver/Math	1	6026	6026	0.58	0.451
Interaction	1	31695	31695	3.05	0.089
Error	37	376565	10391		
Total	40	467096			

Test the claim that SAT scores are not affected by an interaction between gender and test (verbal/math).

The  $F$ -test statistic is \_\_\_\_\_

The P-value is \_\_\_\_\_

Does there appear to be a significant effect from the interaction between gender and test?

- A. No
- B. Yes

Test the claim that gender has an effect on SAT scores.

The  $F$ -test statistic is \_\_\_\_\_

The P-value is \_\_\_\_\_

Is there sufficient evidence to support the claim that gender has an effect on SAT scores?

- A. Yes
- B. No

Test the claim that the type of test (math/verbal) has an effect on SAT scores.

The  $F$ -test statistic is \_\_\_\_\_

The P-value is \_\_\_\_\_

Is there sufficient evidence to support the claim that the type of test has an effect on SAT scores?

- A. No
- B. Yes

7.(1 pt) A study was conducted to see how people reacted to certain facial expressions. A sample group of  $n = 36$  was randomly divided into six groups. Each group was assigned to view one picture of a person making a facial expression. Each group saw a different picture, and the different expressions were (1) Surprised (2) Nervous (3) Scared (4) Sad (5) Excited (6) Angry. After viewing the pictures, the subjects were asked to rank

the degree of dominance they inferred from the facial expression they saw. (The scale ranged from -10 to 10) The data collected is summarized in the table below.

Surprised	Nervous	Scared	Sad	Excited	Angry
1	-0.8	-0.9	1.9	0.2	0.3
-2	0.7	-1.9	1.9	-0.8	2
-1.6	1.9	0.9	1.3	1.7	0.3
-1.1	-1.4	1.1	0.8	-2	-0.9
-1.6	0.5	0.3	-0.7	1.5	-0.9
-0.4	1.5	-1.7	-0.9	-1.3	1.2

Complete the following ANOVA table

Source	df	SS	MS	F
Expressions	—	—	—	—
Error	—	—	—	—
Total	—	—	—	—

8.(1 pt) Use the Minitab display to test the claims using the significance level of  $\alpha = 0.05$ . The sample data are the numbers of support beams manufactured by 5 different operators using 3 different machines. Assume that there is no interaction effect from operator and machine.

Analysis of Variance for Beams

Source	DF	SS	MS	F	P
Operator	4	59.78	20.16	2.64	0.113
Machine	2	93.63	46.62	6.09	0.015
Error	8	48.59	7.65		
Total	14	202			

Test the claim that the four operators have the same mean production output.

The  $F$ -test statistic is \_\_\_\_\_

The P-value is \_\_\_\_\_

Is there sufficient evidence to warrant the rejection of the claim that the four machine operators have the same mean production output?

- A. Yes
- B. No

Test the claim that the choice of machine has no effect on the production output.

The  $F$ -test statistic is \_\_\_\_\_

The P-value is \_\_\_\_\_

Is there sufficient evidence to warrant the rejection of the claim that the choice of machine has no effect on the production output?

- A. No
- B. Yes