

### Question 1 (18 points)

Briefly and concisely discuss in your own words the following:

- A. Define the  $t$  statistic and the  $z$ -score. Why would you choose one over the other? (Give at least two reasons.) (3 pts)
- B. Compare Cohen's  $d$  and  $r^2$ . When and why are they used? (3 pts)
- C. Compare the independent-measures  $t$  test with the repeated measures  $t$  test. Give an example of each. (3 pts)
- D. Explain how to determine the  $F_{crit}$  value using Table B.4, "The  $F$  Distribution", in Appendix B of your textbook. (3 pts)
- E. Explain how you calculate the  $F$ -ratio, and explain why it is used in ANOVA. (3 pts)
- F. Compare the mean squares between treatments with the mean squares within the treatment. Be sure to include the role of the treatment in each mean square. (3 pts)

### Question 2 (12 points)

A random sample of  $n = 30$  has a mean of  $M = 56$ . Test the  $H_0$  that the population mean is  $\mu = 50$  in situations a and b below.

- A. The sample variance is  $s^2 = 6$ : Use two-tailed test at  $\alpha .05$ . Would the  $t$ -statistic be significant? Show the five steps of hypothesis testing. (7 pts)
- B. Suppose the sample variance is  $s^2 = 300$ : Use two-tailed test at  $\alpha .05$ . Would the  $t$ -statistic be significant? (Show only Steps 3 and 4 of hypothesis testing.) (3 pts)
- C. Explain the effect of the size of the variance on the decisions you made above. (2 pts)

### Question 3 (16 points)

Given a sample of female students,  $n = 10$ , with  $SS = 600$ , and a sample of male students,  $n = 12$ , with  $SS = 700$ :

- A. Compute the pooled variance when you combine the two samples. (3 pts)
- B. For the combined samples, what is the estimated standard error for the sample mean difference? (3 pts)
- C. If you computed the difference between the means of the two samples and obtained a difference of 6, is this enough to reject the  $H_0$  for an independent-measures hypothesis test using  $\alpha .01$ , one-tailed test? (3 pts)

- D. If the sample mean difference you obtained is 25 points, is this enough to reject the  $H_0$  for an independent-measures hypothesis test using  $\alpha .01$ , one-tailed test? (3 pts)
- E. Compute Cohen's  $d$  to measure the effect size for the 6-point difference and for the 25-point difference indicated in sub-questions c and d above. Briefly describe the effect size of each difference. (4 pts)

#### Question 4 (13 points)

A study found that lower social class people were more empathic and supportive of each other than higher social class people were among themselves. You wanted to prove this through your study on how participants from these two classes respond to a test measuring empathy and social support. Based on their scores shown in the table below, is there a significant difference on these traits between these two separate groups? Following the five steps of hypothesis testing, test at  $\alpha .05$ , two-tailed test. (NOTE: Solve SS using the computational formula.)

Lower Class	Higher Class
13	10
12	10
13	17

14	13
16	12
13	11
17	13
10	10
15	12
16	16

Question 5 (17 points)

After conducting your study in Question 4 above, you wanted to determine if the higher social class participants would significantly change their scores following volunteer work with a charitable organization for half a year. You re-tested them on the same test after volunteering. Was there a significant difference in their empathy and social support scores after volunteering? Using the five steps of hypothesis testing, test at  $\alpha .05$ , one-tailed test. If the difference is significant, test the effect size through  $r^2$  and describe the effect size.

<b>Participant</b>	<b>After Volunteering</b>	<b>Before Volunteering</b>
A	15	10
B	13	10
C	19	17
D	18	12

E	10	10
F	14	11
G	14	13
H	15	10
I	14	12
J	18	16

### Question 6 (24 points)

A psychologist found that transcendental meditation (TM) helped students perform better by increasing their GPA. He is aware that companies allowing their employees to have TM as part of their working hours became more successful. As the new industrial psychologist of a large manufacturing company, he wanted to test if it would work in the

assembly unit following approval by management. He recruited 30 employees from the day shift that he divided into 3 groups: Group A didn't do TM, Group B incorporated a 15-minute TM during their lunch hour on 3 alternating days of the week, and Group C also incorporated a 15-minute TM every day of the week. The study lasted for 3 months. At the end of the study, the productivity level of the employees exceeding their required quota was noted as shown below.

- A. Using ANOVA, test the significance of the apparent difference in productivity level at  $\alpha .05$ . (13 pts)
- B. Conduct two post hoc tests, Tukey's HSD Test (5 pts) and Scheffe Test, both at  $\alpha .05$  (6 pts). Be sure to indicate which mean differences are significant in each test. Then give a conclusion comparing the results of the two post hoc tests.

No TM	3-day TM	Daily TM
0	2	5
2	3	4
1	3	3

2	4	5
3	1	6
0	2	4
1	4	5
2	3	3
3	2	4
1	2	2