This exam consists of two parts. In the first part you will be writing your answer on the exam itself. In the second part you will be writing your answers on a scantron sheet. Please take the time right now to write your name and id number both on the exam and on the scantron sheet and fill in the bubbles for your name and id number on the scantron sheet to insure that you get credit for both parts.

### Part One: Write answers on the exam. 66 points total

For all the questions in Part One use a significance level of .05.

You do not need to show your work (computations) leading up to your answers for the various elements of this first question. It is a good idea to do so, however, as partial credit might be given if you have the right idea but make a simple error that affects that and later answers. More space to show your computations for part one is available at the end of part one.

1. A researcher wanted to know whether type of emotional communication (abuse or praise) with plants affects their growth rate. Eight corn seeds were randomly divided into two groups, four seeds were planted in one planting tray and the other four seeds in a second planting tray. The researcher then spent 5 minutes a day berating the ‘abused’ seeds, telling them what slackers they were; and 5 minutes a day heaping praise on the ‘praised’ seeds, telling them what great little growers they were (the berating and praising were done out of ear shot of the other group of corn). The height (in inches) of each plant after three weeks of growth was recorded. The researcher is not predicting ahead of time which group should grow more.

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<th>Abuse</th>
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a) Name the dependent variable: growth of the beans  4 pts

b) Name the independent variable. type of emotional communication  4 pts

c) Does the theory support a directional or non-directional hypothesis? nondirectional 3pts

d) Does this make it a one-tail test or a two-tail test? two-tailed  3 pts
e) State H0 and Ha in terms of population means (use the correct symbols)

**H0:** \( \mu_a = \mu_p \) \hspace{1cm} 4 pts

**H0:** \( \mu_a \neq \mu_p \)

f) Draw the sampling distribution, label it correctly ('Sampling distribution of...'), label the mean of the curve. 2 pts

![Sampling Distribution of \( M_1 - M_2 \) Assuming H0 is True]

- Reject H0
- Do not reject H0
- Reject H0

\[ \text{est. } \sigma_{M_1-M_2} = 1.07 \]

\[ t_{\text{obt}} = -2.10 \]  
\[ t_{c} = \pm 2.447 \] (df = 4 + 4 – 2 = 6)

g) On the curve above mark the correct regions 'reject H0' and 'do not reject Ho', put in the appropriate p value(s). 4 pts

h) Find the 't critical' value(s) and put them on the curve above in the appropriate places (a t table is available on the last page of this exam as well as in the workbook) 3 pts

\[ t_{c} = \pm 2.447 \] (df = 4 + 4 – 2 = 6)

i) Compute the standard error (standard deviation) of the curve, put its value next to the curve above (the area below is for you to show your computations if you would like, you don’t need to redraw the curve). 7 pts

\[
SS_1 = 281 - \frac{33^2}{4} = 281 - 272.25 = 8.75 \quad M_1 = \frac{33}{4} = 8.25 \quad N_1 = 4
\]

\[
SS_2 = 446 - \frac{42^2}{4} = 446 - 441 = 5 \quad M_2 = \frac{42}{4} = 10.5 \quad N_2 = 4
\]

\[
est \sigma_{M_1-M_2} = \sqrt{\frac{8.75 + 5}{4 + 4 - 2}} \left( \frac{4 + 4}{(4)(4)} \right) = \sqrt{(2.29)(0.5)} = \sqrt{1.15} = 1.07
\]

j) Compute the obtained value of t for your data, mark its location on the curve above. 4 pts

\[
t_{\text{obt}} = \frac{(8.25 - 10.5) - 0}{1.07} = -2.10
\]
Note: ‘k’ through ‘n’ must all be correct to receive credit for any of them. 8 pts, your answer graded on whether it fit your earlier answers.

k) State the value of p (circle one).
   a. p<.05
   b. p=.05
   c. p>.05

l) State your decision in terms of H0 (circle one)
   a. reject H0
   b. do not reject H0

m) Is the difference between the group means statistically significant (circle one)
   a. no
   b. yes

n) If there are no serious confounding variables, what is your conclusion about the independent variable? (circle one)
   a. Can conclude that the type of communication affected plant growth.
   b. Can conclude that the type of communication did not affect plant growth.
   c. Can not determine whether or not the type of communication affected plant growth.

2. Let's use the same story problem as in question #1. This time, however, the researcher is testing a theory which specifically predicts that the praised seeds show grow more than the abused seeds.

   a) State H0 and Ha in terms of population means (use the correct symbols) 3 pts, ok if you switched the two mu’s as long as you also switched the direction of the sign.
      \[
      \text{H0: } \mu_a \geq \mu_p \\
      \text{Ha: } \mu_a < \mu_p
      \]

   b) Draw a curve and mark the correct regions ‘reject H0’ and ‘do not reject H0’ (you don’t need to provide any additional information on the curve, just the regions) 3 pts graded on whether it fit what you wrote in ‘a’ above.

3. In a completely different experiment with two groups the t test for 2 independent groups led to a p=0.15.

   Note: the following three questions must all be correct to receive credit for any of them. 8 pts
What is your decision in terms of H0? (circle one)
   a. reject H0
   b. do not reject H0

Is the difference between the group means statistically significant? (circle one)
   a. no
   b. yes

If there are no serious confounding variables, what is your conclusion about the independent variable? (circle one)
   a. we can conclude the independent variable had an effect
   b. we can not determine whether or not the independent variable had an effect.

4. In another experiment with two groups the t test for 2 independent groups led to a p=0.001

Note: the following three questions must all be correct to receive credit for any of them. 8 pts

What is your decision in terms of H0? (circle one)
   a. reject H0
   b. do not reject H0

Is the difference between the group means statistically significant? (circle one)
   a. no
   b. yes

If there are no serious confounding variables, what is your conclusion about the independent variable? (circle one)
   a. we can conclude the independent variable had an effect
   b. we can not determine whether or not the independent variable had an effect.
---- Additional computational work space for Part One ----
Part Two: Write answers on the scantron sheet. 34 points total (2 per question)

Please write all of your answers to the following questions on the scantron sheet, no credit will be awarded for answers written on the exam itself. Important: unless the question indicates otherwise select the single best answer.

1. What type of design was the experiment in part one?
   A. static group  
   B. true experimental  
   C. quasi-experimental

2. Which of the following is a correct definition of power?
   A. The probability you will be able to reject H0 when H0 is indeed false.
   B. The probability you will be able to reject H0 when H0 is actually true.

3. Which of the following is a correct definition of power (in experiments with no confounding variables)?
   A. The probability you will conclude that the independent variable had an effect when it actually did have an effect.
   B. The probability you will conclude that the independent variable had an effect when it actually did not have an effect.

4. Which of the following would increase the power of the experiment (circle all that apply)?
   A. increasing the amount and strength of the emotional communication
   B. decreasing the amount and strength of the emotional communication
   C. using a one-tail test (if the effect of the independent variable was in the direction predicted by the theory)
   D. using a two-tail test

5. Which of the following would increase the power of the experiment (circle all that apply)?
   A. decreasing the variance of the scores
   B. increasing the variance of the scores
   C. decreasing number of seeds in the experiment
   D. increasing the number of seeds in the experiment

6. Not rejecting H0 when in reality H0 is false is a:
   A. correct decision
   B. type 1 error
   C. type 2 error

7. Rejecting H0 when in reality H0 is true is a:
   A. correct decision
   B. type 1 error
   C. type 2 error
8. The probability of making a type 1 error is called:
   A. power
   B. beta
   C. alpha
   D. gamma

9. The probability of making a type 2 error is called:
   A. power
   B. alpha
   C. beta
   D. gamma

10. The ‘p value’ of an experiment is the probability that:
    A. you would have obtained your data (a difference that large or larger between the group means) if H0 were true.
    B. H0 is true given the data you obtained

11. How unlikely your results have to be to reject H0 is known as your:
    A. beta weight
    B. confidence interval
    C. significance level

12. What effect does a confounding variable have on your interpretation of the results of an experiment.
    A. It keeps you from rejecting H0.
    B. If you reject H0 you don’t know if it was the confounding variable or the independent variable that made the groups different.
    C. It is irrelevant to the interpretation.

13. Once you set your significance level you have also set the value of:
    A. power
    B. beta
    C. alpha

14. What significance level is used most often in psychology?
    A. .05
    B. .025
    C. .01

15. If you do not reject H0, and your experiment has no serious confounding variables, then which of the following can you conclude:
    A. The independent variable had an effect on the dependent variable.
    B. The independent variable did not have an effect on the dependent variable
    C. You cannot determine whether or not the independent variable had an effect on the dependent variable.
16. When is it safe to not worry about whether or not the populations have the same variance?
A. When the N of each group is large.
B. When you have about the same number of scores in each group.
C. This is never a serious concern.

17. When is it safe to not worry about whether or not the populations are normally distributed (when doing the t test for independent groups)?
A. When the N of each group is large.
B. When you have about the same number of scores in each group.
C. This is never a serious concern.

(Abbreviated table):  \( t_{\text{critical}} \) Values

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