

Final Exam
Psych 3101, Fall 14

Name: _____

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Vocabulary

Define the following terms, using your own words as much as possible.

1. Random assignment: _____

2. Estimator: _____

3. Mode: _____

4. Histogram: _____

5. Reliability: _____

6. Outlier: _____

7. Type I error: _____

8. Replication: _____

9. Independent variable: _____

10. Grand mean: _____

Conceptual Questions

1. Subjects are randomly assigned to two groups, one of which undergoes a week of meditation practice, while the other group spends an equal amount of time in a control task. Afterward, everyone's blood cortisol level is measured.

Is this an experiment or a non-experimental study? _____

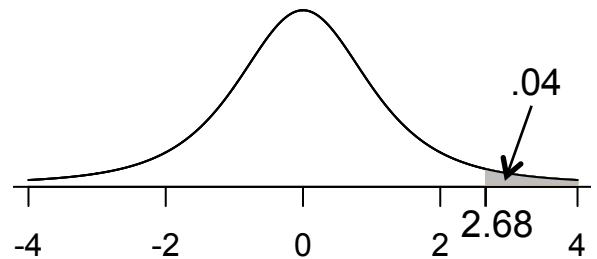
What is the independent variable? _____

What is the dependent variable? _____

2. Give an example of a ratio-scale variable.

3. Imagine we run a t-test to decide whether the mean of a sample is reliably different from zero. If the confidence interval for the mean is $[0.2, 4.8]$, what can you say about the relationship between p and α ?

4. A t-test gives a result of $t = 2.68$. Under a t distribution with the appropriate df, the probability of a value greater than 2.68 is .04. What is the p-value for a two-tailed test?



5. Normal male subjects average 85% on a memory test, and normal female subjects average 89%. Male subjects given midazolam average 65%. If there were no interaction between sex and midazolam administration, what would the average score be for females given midazolam?

6. 40% of house mice prefer cheddar cheese. If species and cheese preference are independent, what percentage of field mice prefer cheddar?

7. Sixty subjects are measured on a nominal variable with 4 possible values (e.g., apple, pumpkin, pecan, blueberry). According to the null hypothesis that all values are equally probable, what is the expected frequency (f^{exp}) for each?

8. What kind of hypothesis test should you use to test whether the average (median) of an ordinal-scale variable differs across five groups of subjects?

9. If you want to do a single-sample t-test, but the scores are non-normally distributed and your sample size is small, what test should you use instead?

Math questions

For all math questions: If you can't finish part of a question and you need the answer for the next part, you can make up an answer to use in that next part. Just state clearly that's what you're doing, e.g. "Assume the answer to part c is 5."

1. Consider the sample [38,32,35,39]. The critical value you will need below is $t_{\text{crit}} = 3.18$.

(a) Find the sample mean (M) and sample standard deviation (s).

(b) Calculate the z-score for the first subject.

(c) Calculate the standard error of the mean (σ_M).

(d) Calculate a 95% confidence interval for the population mean.

(e) Calculate a t statistic for testing the null hypothesis that the population mean (μ) is equal to 33.

(f) Do you retain or reject the null hypothesis that $\mu = 33$? Give two (brief) reasons for your answer, one based on your answer to part d and one based on your answer to part e.

2. An experiment using a repeated-measures design tests five subjects in three conditions. These are the data:

Subject	Condition		
	A	B	C
1	18	21	24
2	23	23	29
3	30	28	29
4	20	27	25
5	24	21	33

(a) Calculate the variability explainable by differences among conditions, $SS_{\text{treatment}}$.

(b) The variability explainable by individual differences is $SS_{\text{subject}} = 102$, and the total variability is $SS_{\text{total}} = 250$. The relevant degrees of freedom are $df_{\text{treatment}} = 2$ and $df_{\text{residual}} = 8$. Calculate an F statistic for the repeated-measures ANOVA to test for differences among the conditions.

3. A regression using 4 predictors measured on 30 subjects yields the following sums of squares:
 $SS_{\text{total}} = 1000$, $SS_{\text{regression}} = 600$, $SS_{\text{residual}} = 400$.

(a) Calculate R^2 for this regression.

(b) The degrees of freedom are $df_{\text{regression}} = 4$ and $df_{\text{residual}} = 25$. Calculate an F statistic for testing whether the regression explains meaningful variability in the outcome.

4. Two nominal variables, X and Y , are measured on 100 subjects. Here are the observed frequencies:

	y_1	y_2	y_3
x_1	3	2	5
x_2	12	10	4
x_3	20	8	6
x_4	15	11	4

Find the expected frequency (f^{exp}) for the upper-left cell, i.e. for the combination x_1 & y_1 .

R questions

1. Based on the following output, which hypothesis should you believe (null: $\mu=0$; alternative: $\mu \neq 0$), using an alpha level of 5%? There are two parts of the output that you could use to decide between the hypotheses. Describe them both.

```
> t.test(x, mu=0)

One Sample t-test

data:  x
t = 1.2523, df = 299, p-value = 0.2114
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 -0.04026887  0.18120764
sample estimates:
mean of x
0.07046938
```

Conclusion (circle): Null Alternative

Reason 1: _____

Reason 2: _____

2. Fill in the missing values in the following output from the `anova()` function. (It's easiest to do them in order.)

```
Response: memory

      Df Sum Sq Mean Sq F value    Pr(>F)
study    1    0.8      0.8      D 0.502537
test     B   48.4     24.2      C 0.000281
study:test  2   57.6     28.8 16.9412 0.000112
Residuals 16   27.2      A
```

A: _____ B: _____ C: _____ D: _____

3. Describe in words what this command produces, or when you would use it.

```
> qt(.05, 11, lower.tail=FALSE)
```

4. Use the regression output below to predict how long an alien species will take to achieve space flight if they have 8 fingers and their planet has a surface area of 10,000,000 square miles.

Call:

```
lm(formula = years.to.space.flight ~ fingers + area.square.miles)
```

Coefficients:

(Intercept)	fingers	area.square.miles
35,000	-750	-0.0001

5. What statistic is computed by the following commands?

```
> Yhat = b0 + b1*X1 + b2*X2 + b3*X3
```

```
> answer = sum((Y-Yhat)^2)
```

6. What statistic is computed by the following command? What kind of hypothesis test might you use it for?

```
> answer = sum((f.obs-f.exp)^2/f.exp)
```

7. What is the result of the following command?

```
> median(1:5)
```