Monday, April 1, 2019

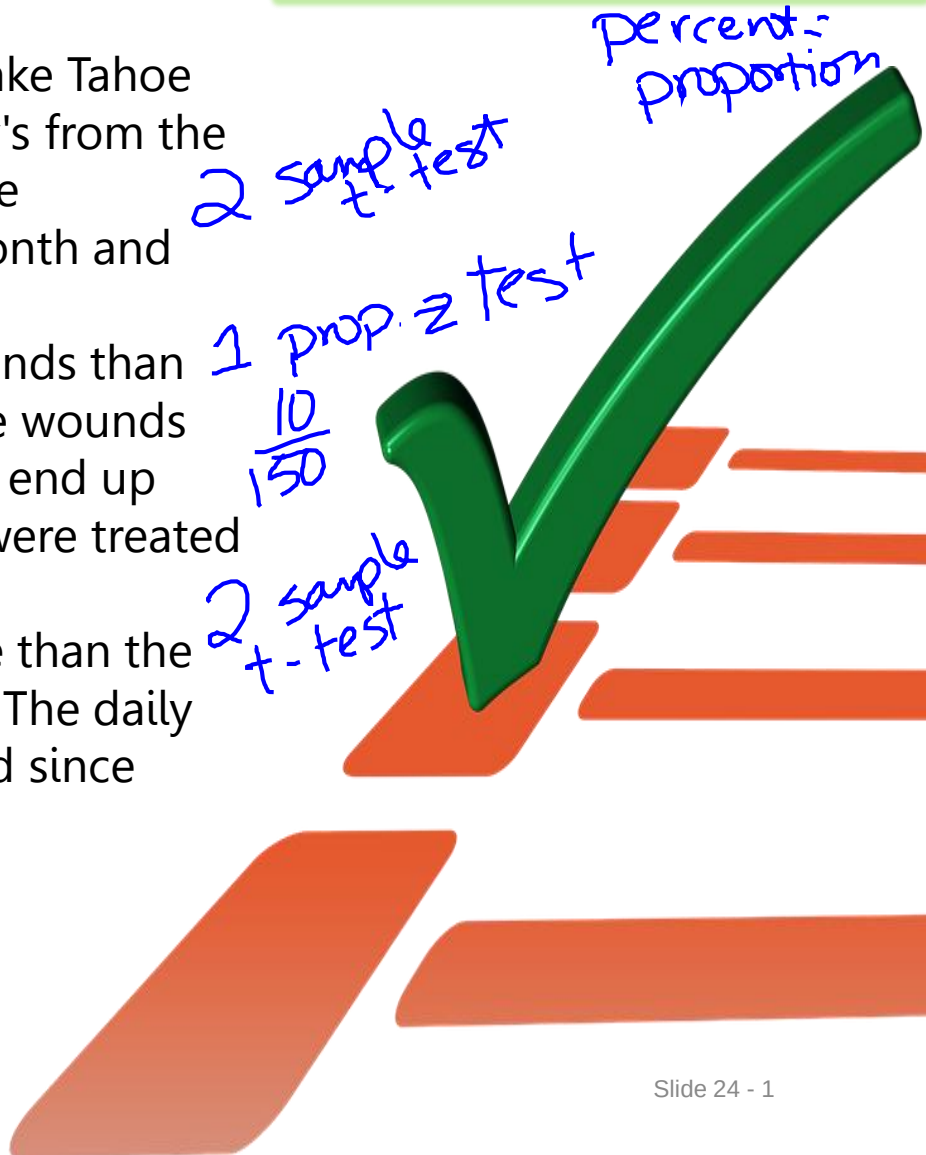
1. One-proportion z-test
2. Two-proportion z-test
3. One-sample t-test
4. Two-sample t-test

- Warm-up
  - Match the following situations to the type of test:

A. Are automobile prices higher in South Lake Tahoe than in Sacramento. Fifty Subaru Legacy's from the South Tahoe dealership and fifty from the Sacramento dealership were sold last month and recorded

B. Is honey a better medicine for small wounds than conventional salves? Currently 9% of the wounds that are treated with conventional salves end up infected. 150 wounds in a study group were treated with honey.

C. How much better has the NASDAQ done than the Dow Jones Industrial Average this year? The daily point gains and losses have been charted since January 2.



- Check Homework
- Another t-test

Objectives

- **Content Objective**: I will use the t-distribution to compare means of different samples.
- **Social Objective**: I will listen and not cause distractions for myself or others.
- **Language Objective**: I will take clear notes that I can understand when I refer to them later.

Sometimes a 2 sample isn't actually 2 samples...

- Gather data
- Check Conditions

resting
representative
< 10% of entire pop
approx 30 - assume nearly normal

non-resting
representative
< 10% of entire pop
approx 30 - assume nearly normal

Groups are NOT independent

paired t-test

one sample t-test

- ~~Perform test/interval~~

$H_0: \mu_{diff} = 0$
$H_a: \mu_{diff} > 0$

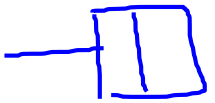
$t = 14\ldots$
$df = 27$
p-value ≈ 0

- Conclude

In a study of memory recall, eight students from a large psychology class were selected at random and given 10 minutes to memorize a list of 20 nonsense words. Each was asked to list as many of the words as he or she could remember both 1 hour and 24 hours later. The data are as shown in the accompanying table. Is there evidence to suggest that the mean number of words recalled after 1 hour exceeds the mean recall after 24 hours by more than 3? Use a level 0.01 test.

$H_0: \mu_{diff} = 3$

$H_A: \mu_{diff} > 3$



Due to outlier and small sample size - data is not nearly normal. do not proceed w/ paired t-test

Subject	1	2	3	4	5	6	7	8
1 hour later	14	12	18	7	11	9	16	15
24 hours later	10	4	14	6	9	6	12	12
	4	8	4	1	2	3	4	3

FR Practice

Intent of Question

The primary goal of this question was to assess students' ability to set up, perform and interpret the results of a significance test. More specific goals were to assess students' ability to (1) state appropriate hypotheses; (2) identify the name of an appropriate statistical test and check appropriate assumptions/conditions; (3) compute the appropriate test statistic and *p*-value; (4) draw an appropriate conclusion, with justification, in the context of the study.

A large pet store buys the identical species of adult tropical fish from two different suppliers—Buy-Rite Pets and Fish Friends. Several of the managers at the pet store suspect that the lengths of the fish from Fish Friends are consistently greater than the lengths of the fish from Buy-Rite Pets. Random samples of 8 adult fish of the species from Buy-Rite Pets and 10 adult fish of the same species from Fish Friends were selected and the lengths of the fish, in inches, were recorded, as shown in the table below.

	Length of Fish	Mean	Standard Deviation
Buy-Rite Pets ($n_B = 8$)	3.4 2.7 3.3 4.1 3.5 3.4 3.0 3.8	3.40	0.434
Fish Friends ($n_F = 10$)	3.3 2.9 4.2 3.1 4.2 4.0 3.4 3.2 3.7 2.6	3.46	0.550

Do the data provide convincing evidence that the mean length of the adult fish of the species from Fish Friends is greater than the mean length of the adult fish of the same species from Buy-Rite Pets?

Step 1: States a correct pair of hypotheses

Let μ_B represent the population mean length of all adult fish of this species from Buy-Rite Pets, and
let μ_F represent the population mean length of all adult fish of this species from Fish Friends.

The hypotheses to be tested are H_0: $\mu_B = \mu_F$ versus H_a: $\mu_B < \mu_F$.

Step 1 is scored as follows:

Essentially correct (E) if the student uses correct parameters *AND* states correct hypotheses.

Partially correct (P) if the student uses correct parameters *OR* states correct hypotheses but not both.

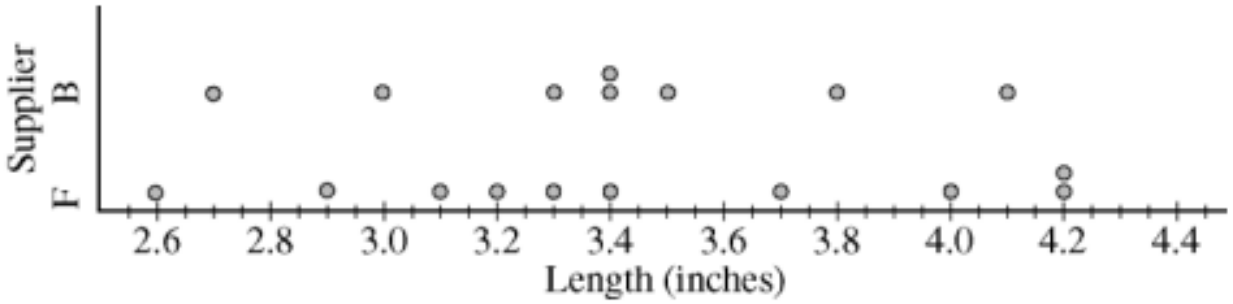
Incorrect (I) otherwise.

Notes

- If the null hypothesis is wrong, reduce the score in this step by one level (i.e., E to P, or P to I).
- If the alternative hypothesis is two-sided or in the wrong direction, the student does not get credit for the hypotheses.
- If standard symbols are used for the parameters with appropriate group labels (e.g., μ_B, μ_F), the parameter component is considered correct.
  - If *generic* standard symbols are used for the parameters (e.g., μ_1, μ_2), students must clearly identify the parameters with the suppliers.
  - If standard symbols (either with context or generic) are used for the parameters *and* the student attempts to define them, the definitions must be correct and in context, including the concept of mean.
  - If *nonstandard* symbols are used for the parameters, they must be explicitly defined in context and include the concepts of mean and population.
  - If a student does not use symbols in the hypotheses, the response can still receive an E as long as the alternative hypothesis is in the correct direction and it clearly refers to population means in context.

Step 2: Identifies a correct test procedure (by name or by formula) and checks appropriate conditions

The appropriate test is a two-sample *t*-test. The first condition is that the samples are independent random samples from the two populations. This was stated in the question. The second condition is that the population distributions of fish lengths are normal. The following dotplots reveal no obvious departures from normality, so it appears reasonable to proceed with the two-sample *t*-test.



Step 2 is scored as follows:

Essentially correct (E) if the student correctly completes all three of the following components:

- Identifies the correct test procedure (by name or by formula)
- Checks for independent random samples
- Checks for normality

Partially correct (P) if the student correctly completes two of the three components listed above.

Incorrect (I) otherwise.

Step 3: Demonstrates correct mechanics, including the value of the test statistic, df and p-value (or rejection region)

The test statistic is: $t = \dfrac{\bar{x}_B - \bar{x}_F}{\sqrt{\dfrac{s_B^2}{n_B} + \dfrac{s_F^2}{n_F}}} = \dfrac{3.40 - 3.46}{\sqrt{\dfrac{0.434^2}{8} + \dfrac{0.550^2}{10}}} \approx -0.259$

With df = 15.99999, p-value = 0.3996.

Step 3 is scored as follows:

Essentially correct (E) if the student correctly calculates both the test statistic and p-value.

Partially correct (P) if the student correctly calculates the test statistic but not the p-value *OR* omits the test statistic but correctly calculates the p-value.

Incorrect (I) otherwise.

Step 4: States a correct conclusion in the context of the problem, using the result of the statistical test

Because this *p*-value is larger than any conventional significance level (such as $\alpha = 0.10$ or $\alpha = 0.05$), we fail to reject H_0. The sample data do not provide convincing evidence to conclude that the mean length of the adult fish of the species from Fish Friends is greater than the mean length of the adult fish of the same species from Buy-Rite Pets.

Step 4 is scored as follows:

Essentially correct (E) if the student provides a correct conclusion in context, also providing justification based on linkage between the *p*-value and conclusion.

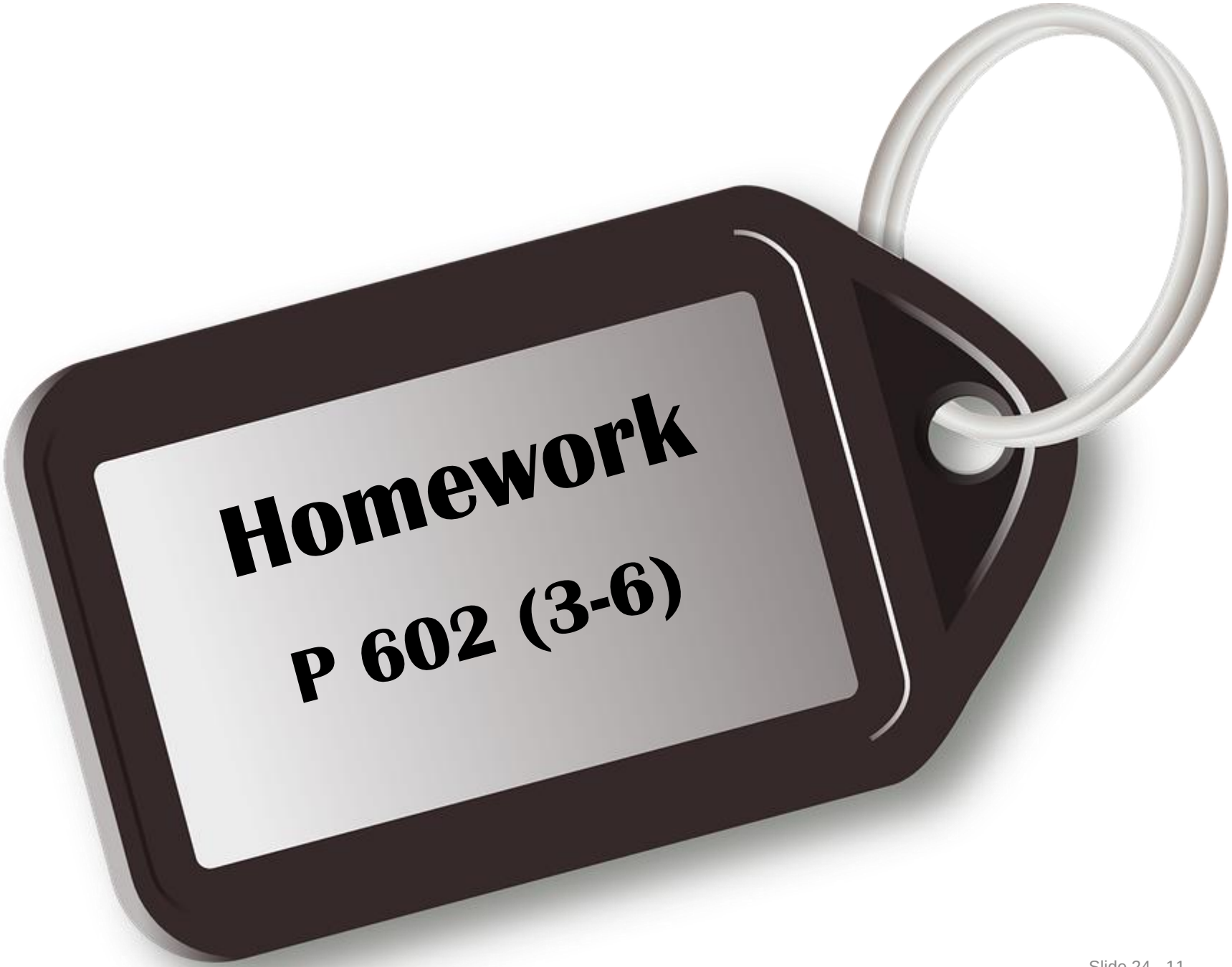
Partially correct (P) if the student provides a correct conclusion, with linkage to the *p*-value, but not in context *OR* provides a correct conclusion in context, but without justification based on linkage to the *p*-value.

Incorrect (I) otherwise.

Each essentially correct (E) step counts as 1 point. Each partially correct (P) step counts as ½ point.

4	**Complete Response**
3	**Substantial Response**
2	**Developing Response**
1	**Minimal Response**

If a response is between two scores (for example, 2½ points), use a holistic approach to determine whether to score up or down, depending on the overall strength of the response and communication.


Homework
P 602 (3-6)