Math 148 Exam 3 Study Guide

Exam 3 will take place Monday, November 22nd in class. It will cover Chapters 19-25. The following is a study guide for the different tests and confidence intervals covered in those chapters. Please note that not all the material on the exam is covered here. To use this study guide, fill in the formulas for the hypothesis tests and confidence intervals. The first section is filled in for you. Then read the worked examples in the textbook and try the given odd numbered problems. If you find any errors in this study guide, please let your TA know.

1 One proportion test (Ch. 19)

I. Hypothesis testing.

0. Sample data:

variable	what it represents
$\hat{p}$	sample proportion
n	sample size

1. Null hypothesis: $H_0 : p = p_0$ (the population proportion is "unchanged")

   Alternative hypothesis: $H_A : p \neq p_0$, $p > p_0$, or $p < p_0$

2. Test statistic: $z = \frac{\hat{p}-p_0}{SD(\hat{p})}$ where $SD(\hat{p}) = \sqrt{\frac{p_0 q_0}{n}}$.

   (Note: why standard deviation instead of standard error here? See page 495 in Ch. 19)

3. This is a z-statistic, so we calculate p-value from z-score table.

II. Confidence intervals.
$\hat{p} \pm z^* SE(\hat{p})$ where $SE(\hat{p}) = \sqrt{\frac{\hat{p}\hat{q}}{n}}$ and z^* is a critical value which depends on confidence level. We calculate it using a two-sided value from the z-score table. For example, a 95% confidence interval has a critical value of $z^* = 1.96$ (or approximately $z^* \approx 2$ from the 68-95-99.7 rule).

III. Examples and problems.

Worked example for hypothesis testing	Ch. 19 pg. 502
Problem for hypothesis testing	Ch. 19 #21, pg. 514
Worked example for confidence interval	Ch. 18 pg. 480
Problem for confidence interval	Ch. 18 #5, pg. 489

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2 One mean test (Ch. 20)

I. Hypothesis testing.

0. Sample data:

variable	what it represents
$\overline{y}$	
s	
n	
df	

1. Null hypothesis: H_0 :

   Alternative hypothesis: H_A :

2. Test statistic:

   $t =$

   where

   $SE(\overline{y}) =$

3. This is a ____-statistic, so we calculate p-value from the ____ table.

II. Confidence intervals.

III. Examples and problems.

Worked example for hypothesis testing	Ch. 20 pg. 530
Problem for hypothesis testing	Ch. 20 #11, pg. 541
Worked example for confidence interval	Ch. 20 pg. 526
Problem for confidence interval	Ch. 20 #7, pg. 541

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3 Difference between proportions (Ch. 22)

For this test, note the difference between $SE(\hat{p}_1 - \hat{p}_2)$ and $SE_{pooled}(\hat{p}_1 - \hat{p}_2)$.

I. Hypothesis testing.

0. Sample data:

variable	what it represents
$\hat{p}_1$	
n_1	
$\hat{p}_2$	
n_2	

1. Null hypothesis: H_0 :

   Alternative hypothesis: H_A :

2. Test statistic:

   $z =$

   where

   $SE_{pooled}(\hat{p}_1 - \hat{p}_2) =$

3. This is a ____-statistic, so we calculate p-value from the ____ table.

II. Confidence intervals. (Use $SE(\hat{p}_1 - \hat{p}_2)$ here.)

III. Examples and problems.

Worked example for hypothesis testing	Ch. 22 pg. 594
Problem for hypothesis testing	Ch. 22 #9, pg. 617
Worked example for confidence interval	Ch. 22 pg. 590
Problem for confidence interval	Ch. 22 #27, pg. 618

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4 Difference between means (Ch. 22)

Note on degrees of freedom: you do not need to know how to calculate the degrees of freedom when testing the difference between means. (There is a complicated formula given in the book.) On the exam, you will either be given the degrees of freedom or the test statistic itself.

I. Hypothesis testing.

0. Sample data:

variable	what it represents
$\overline{y}_1$	
s_1	
n_1	
$\overline{y}_2$	
s_2	
n_2	

1. Null hypothesis: H_0 :

   Alternative hypothesis: H_A :

2. Test statistic:

   $t =$

   where

   $SE(\overline{y}_1 - \overline{y}_2) =$

3. This is a ____-statistic, so we calculate p-value from the ____ table.

II. Confidence intervals.

III. Examples and problems.

Worked example for hypothesis testing	Ch. 22 pg. 604
Problem for hypothesis testing	Ch. 22 # 77, pg. 627
Worked example for confidence interval	Ch. 22 pg. 599
Problem for confidence interval	Ch. 22 #61, pg. 623

5 Paired data (Ch. 23)

Note: compare this to the one mean test from Ch. 20.
I. Hypothesis testing.

0. Sample data:

variable	what it represents
$\overline{d}$	
s_d	
$SE(\overline{d})$	
df	

1. Null hypothesis: H_0 :

   Alternative hypothesis: H_A :

2. Test statistic:

   $t =$

   where

   $SE(\overline{d}) =$

3. This is a ____-statistic, so we calculate p-value from the ____ table.

II. Confidence intervals.

III. Examples and problems.

Worked example for hypothesis testing	Ch. 23 pg. 634
Problem for hypothesis testing	Ch. 23 #29, pg. 651
Worked example for confidence interval	Ch. 23 pg. 638
Problem for confidence interval	Ch. 23 #31, pg. 651

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6 Comparing Counts - Goodness of Fit (Ch. 24)

A test for goodness-of-fit addresses the question: how well do the observed counts fit a model?

I. Hypothesis testing.

0. Sample data:

variable	what it represents
Obs	
Exp	
df	

1. Null hypothesis: H_0 :

   Alternative hypothesis: H_A :

2. Test statistic:

   $\chi^2 =$

3. This is a ____-statistic, so we calculate p-value from the ____ table.

III. Examples and problems.

Worked example for hypothesis testing	Ch. 24 pg. 659
Problem for hypothesis testing	Ch. 24 #13, pg. 682

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7 Comparing Counts - Homogeneity and Independence (Ch. 24)

A test for homogeneity addresses the question: does one categorical variable have the same distribution across multiple groups?

A test for independence addresses the question: are two categorical variables of one group independent of each other?

I. Hypothesis testing.

0. Sample data:

variable	what it represents
Obs	
Exp	
df	

1. Null hypothesis: H_0 :

   Alternative hypothesis: H_A :

2. Test statistic:

   $\chi^2 =$

3. This is a ____-statistic, so we calculate p-value from the ____ table.

III. Examples and problems.

For homogeneity.

Worked example for hypothesis testing	Ch. 24 pg. 665
Problem for hypothesis testing	Ch. 24 #45, pg. 687

For independence.

Worked example for hypothesis testing	Ch. 24 pg. 671
Problem for hypothesis testing	Ch. 24 #39, pg. 686

8 Inferences for Regression - slopes (Ch. 25)

I. Hypothesis testing for slopes.

0. Sample data:

variable	what it represents
b_1	
s_e	
s_x	
df	

1. Null hypothesis: H_0 :

   Alternative hypothesis: H_A :

2. Test statistic:

   $t =$

   where

   $SE(b_1) =$

3. This is a ____-statistic, so we calculate p-value from the ____ table.

II. Confidence intervals for slopes.

III. Examples and problems.

Worked example for hypothesis testing	Ch. 25 pg. 700
Problem for hypothesis testing	Ch. 25 #25 pg. 721
Worked example for confidence interval	Ch. 25 pg. 700
Problem for confidence interval	Ch. 25 #29 pg. 722

9 Inferences for Regression - predicted values (Ch. 25)

I. Confidence intervals for predicted values.
A regression analysis gives a line of best fit

$$\hat{y} = b_0 + b_1 x.$$

This allows us to *predict* values $\hat{y}$ for a given value of x. Important: there is a slight difference between **confidence intervals for the mean** and **confidence intervals for a value (prediction)**. Read sections 25.5 and 25.6.

Sample data:

variable	what it represents
b_1	
$SE(b_1)$	
s_e	
$\overline{x}$	
df	

II. Examples and problems.

Worked example for confidence interval	Ch. 25 pg. 707
Problem for confidence interval	Ch. 25 #49 part b, pg. 726