

You are allowed to operate a calculator and refer to one page (front and back of standard 8.5 by 11 inch sheet) of notes while taking this examination. Your solutions should be clear, complete, and sufficiently detailed in order to demonstrate your understanding and communicate your reasoning and method of solving the problem. Each problem will be evaluated on a 5-point standard rubric.

Student's Name _____

Problem 1

Twenty-five different automobiles were tested in dry conditions at a speed of 65 miles per hour for total stopping distance. The sample results, measured in feet, are given below.

345, 348, 342, 348, 342, 337, 342, 349, 346, 347, 358, 351, 343, 347, 349,
350, 345, 340, 352, 349, 353, 346, 338, 345, 339

Estimate the mean total stopping distance for automobiles traveling at 65 mph in dry conditions using this sample and a 95% confidence interval. Assume that the total stopping distance for automobiles traveling at 65 mph in dry conditions is normally distributed. Express the estimate both symbolically and verbally.

```
TInterval
Inpt: DATA Stats
List: L1
Freq: 1
C-Level: .95
Calculate
```

```
TInterval
(343.98, 348.1)
x̄=346.04
Sx=4.987317248
n=25
```

$$344.0 < \mu < 348.1$$

The mean total stopping distance for automobiles traveling at 65 mph in dry conditions is estimated to be between 344.0 feet and 348.1 feet with 95% confidence.

Problem 2

An article published in the American Journal of Hypertension reported the results of a longitudinal study on blood pressure. Ten years ago, 51 out of 188 people evaluated were classified as having high blood pressure. This year, 63 out of 194 people evaluated were classified as having high blood pressure.

Based on the results of this study, can one conclude that the proportion of people in the population with high blood pressure has increased in the last ten years? Use $\alpha = 0.05$.

$$H_0 : p_1 \leq p_2$$

$$H_1 : p_1 > p_2$$

Use $\alpha = 0.05$

```
2-PropZTest
x1:63
n1:194
x2:51
n2:188
P1:#P2 <P2  P2
Calculate Draw
```

```
2-PropZTest
P1>P2
z=1.141738591
P=.1267813985
P1=.324742268
P2=.2712765957
↓P=.2984293194
```

p-value ≈ 0.127

Since the p-value of 0.127 is not 0.05 or less, the decision is to not reject H_0 .

Therefore, based on the results of this study, one cannot conclude at the 0.05 level of significance that the proportion of people in the population with high blood pressure has increased in the last ten years.

Problem 3

Thirty-six Loggerhead Sea Turtle (*Caretta caretta*) nests were uncovered, and the number of eggs in each nest (the clutch size) was counted. A stem-and-leaf plot for this sample is given below.

9	2	3							
9	5	7	8	9	9				
10	0	1	1	3	3	4	4		
10	6	6	6	6	8	8	9	9	9
11	1	1	2	2	2	3			
11	5	5	7	8					
12	1	2							
12	6								

The South Carolina Department of Natural Resources website states that the average clutch size for the Loggerhead Sea Turtle population in South Carolina is 120 eggs per nest. Conduct a hypothesis testing procedure to determine if the mean clutch size for the population of Loggerhead Sea Turtles from which the above sample was selected is 120 eggs per nest.

$$H_0 : \mu = 120$$

$$H_1 : \mu \neq 120$$

Use $\alpha = 0.05$

```

T-Test
Inpt: DATA Stats
μ₀: 120
List: L₁
Freq: 1
μ: ≠μ₀ <μ₀ >μ₀
Calculate Draw
  
```

```

T-Test
μ≠120
t = -9.366455309
P = 4.567291E-11
X̄ = 107.25
Sx = 8.167444084
n = 36
  
```

$$p\text{-value} \approx 4.6E - 11 \approx 0.000$$

Since the p-value of 0.000 is 0.05 or less, the decision is to reject H_0 .

Therefore, at the 0.05 level of significance, the mean clutch size for the population of Loggerhead Sea Turtles from which the above sample was selected is not 120 eggs per nest.

Problem 4

The principal at Tahoe Elementary School randomly selected three of the school's twelve classes of students to participate in an opinion poll. All of the children in each of the three randomly selected classes were asked the question "What is your favorite fruit to eat?". The following results were obtained.

Apple, **Grapes**, Apple, Apple, Banana, Apple, Apple, **Grapes**, Orange, Apple, Apple, Banana, Strawberries, Apple, Apple, **Grapes**, Apple, Orange, Apple, Apple, Apple, Apple, Apple, **Grapes**, **Grapes**, Apple, Orange, Apple, Apple, Banana, Apple, Apple, Apple, Strawberries, Apple, Orange, **Grapes**, **Grapes**, Apple, **Grapes**, **Grapes**, **Grapes**, Banana, **Grapes**, Banana, Apple, Banana, **Grapes**, Apple, Banana, Strawberries, Banana, Apple, Orange, **Grapes**, Orange, **Grapes**, Apple, Orange.

Use the results of this opinion poll to estimate, with 95% confidence, the actual percentage of children attending Tahoe Elementary School whose favorite fruit to eat is Grapes. Express the estimate both symbolically and verbally.

This opinion poll questioned a total of $n = 58$ randomly selected Tahoe Elementary School students of which $x = 14$ identified Grapes as their favorite fruit to eat.

```
1-PropZInt
x:14
n:58
C-Level: .95
Calculate
```

```
1-PropZInt
(.13125, .35151)
P=.2413793103
n=58
```

$$13.1\% < p < 35.2\%$$

With 95% confidence, the actual percentage of children attending Tahoe Elementary School whose favorite fruit to eat is Grapes is estimated to be between 13.1% and 35.2%.

Problem 5

The National Association of Theatre Owners wanted to determine if there was a difference in the average ticket price at movie theatres in California and New York. So, they commissioned a study that randomly sampled 35 movie theatres in California and 35 movie theatres in New York. For the California sample, the mean ticket price was \$8.12 with a standard deviation of \$1.76. For the New York sample, the mean ticket price was \$12.28 with a standard deviation of \$2.04.

What determination should the National Association of Theatre Owners reach at the 0.01 level of significance?

$$H_0 : \mu_1 = \mu_2$$

$$H_1 : \mu_1 \neq \mu_2$$

Use $\alpha = 0.01$

```

2-SampTTest
Inpt:Data Stats
x̄1:8.12
Sx1:1.76
n1:35
x̄2:12.28
Sx2:2.04
↓n2:35
μ1:≠ <μ2 >μ2
Pooled:Yes Yes
Calculate Draw
  
```

```

2-SampTTest
μ1≠μ2
t=-9.134461966
P=2.327853E-13
df=66.56984446
x̄1=8.12
↓x̄2=12.28
Sx1=1.76
Sx2=2.04
n1=35
n2=35
  
```

p-value $\approx 2.3E - 13 \approx 0.000$

Since the p-value of 0.000 is 0.01 or less, the decision is to reject H_0 .

Therefore, the National Association of Theatre Owners should reach the determination that there is a difference in the average ticket price at movie theatres in California and New York at the 0.01 level of significance.

Problem 6

Sierra College is considering the option to include plus and minus in the school's letter grading system. An opinion poll was conducted on campus in order to gauge the reaction to this proposed change in the college's grading system. As a result, 58.7% of the 167 students polled and 43.4% of the 83 teachers polled were in favor of including plus and minus in the school's letter grading system.

Estimate the difference in the percentage of students and teachers on campus who are in favor of including plus and minus in the school's letter grading system. Express the estimate both symbolically and verbally.

$$x_1 = n_1 \cdot \hat{p}_1 = 167 \cdot 0.587 = 98.029 \approx 98$$

$$x_2 = n_2 \cdot \hat{p}_2 = 83 \cdot 0.434 = 36.022 \approx 36$$

The customary 95% confidence level will be used to make this estimate since there was no level of confidence specified.

```
2-PropZInt
x1:98
n1:167
x2:36
n2:83
C-Level:.95
Calculate
```

```
2-PropZInt
(.02292, .28326)
P1=.5868263473
P2=.4337349398
n1=167
n2=83
```

$$2.3\% < p_1 - p_2 < 28.3\%$$

The difference in the percentage of students and teachers on campus who are in favor of including plus and minus in the school's letter grading system is estimated to be between 2.3% and 28.3% with 95% confidence.

Therefore, there is anywhere from 2.3% to 28.3% higher percentage of students than teachers on campus who are in favor of including plus and minus in the school's letter grading system.