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MGMT 670 – Business Analytics

Purdue University

Professor Alexander

# Homework Exercise #3

Homework exercises must be prepared individually and submitted online through Brightspace prior to the posted deadline. Up to three submissions are allowed but only the last submission will be graded. See the Syllabus for more information on Homework Exercise requirements and expectations. Any necessary modifications to this assignment will be posted to Brightspace as an announcement.

For this exercise, submit only one Microsoft Word document with all appropriate output results and graphs from Minitab and Excel into the single Word document.

## Question 1

Suppose a survey of individuals between the ages of 24 and 74 indicated that 66% of Baby Boomers, 61% of Generation X, and 58% of Millennials expect IRAs to be their primary source of income in retirement. The margin of error was given as ± 5 percentage points.

1. **Calculate 95% confidence interval for the proportion of Baby Boomers who expect IRAs to be their primary source of income in retirement.**

***CI*=*p*±*Z*∗*np*(1−*p*)​​**

* + - Proportion = 66% or 0.66
    - Margin of error = ± 5 or ± 0.05%
    - CI (0.66 – 0.05) = 0.61 & (0.66 + 0.05) = 0.71
    - 95% of Confidence Interval for the proportion of Baby Booms who expect their IRAs to be their primary source of income is 61% to 71%

1. **Although the *margin of error* for the entire survey was listed, the sample size for each of the three generations was not given. Assuming the confidence level was 95%, determine the sample size for each of the three generations**.

**Z = Z score corresponding to the confidence level (1.96)**

**P = proportion (BB = 0.66, GX = 0.61, M = 0.58)**

**E = Marketing of Error (0.05)**

* BB = 0.66(1-0.66)(1.96/.05)^2 = 344.82 or 345
* GX = 0.61(1-0.61)(1.96//05)^2 = 365.56 or 366
* M = 0.58(1-0.58)(1.96/.05)^2 = 374/32 or 374

## Question 2

A local West Lafayette commercial bank issues Mastercard credit cards. As a part of its annual review of the profitability of each type of credit card, the bank randomly samples 36 customers to measure the average annual charges per card. A random sample of 36 Mastercard accounts shows the following annual spending per account (in USD):

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 2869 | 3770 | 2854 | 2750 | 2574 | 2972 |
| 2549 | 3267 | 3013 | 2707 | 2794 | 1189 |
| 2230 | 2178 | 3032 | 3485 | 2679 | 2010 |
| 1994 | 2768 | 3853 | 2064 | 3244 | 2738 |
| 2807 | 2395 | 3405 | 3006 | 3368 | 2691 |
| 1996 | 3008 | 2518 | 2674 | 2730 | 3719 |

1. **Based on these randomly sampled accounts, what is the best point estimate of the true mean annual spending for Mastercard account holders?**

* Sample mean is used at the best point estimate of true mean.
* Sample Mean = Sum(X) / n
* 99900 / 36 = 2775

1. **Develop a 95% confidence interval estimate of the mean annual spending. Interpret this range.**



* This states that 95% of the annual charges per card are between 2593.06 and 2956.94

1. **To encourage more use of the card, the company offers a promotion that costs the bank $5 for each card that carries a balance of $3,000 or more. If the bank has 50,000 total customers, what can be stated about the cost of this program to the bank?**

* Includes:
  + n = 36,
  + Account holders carrying > $3000 = 12, 50000 Customers
  + $5 for each card
* x/n = 12/36 = 0.333
* To estimate the number of customers carrying > $3000 = (50,000 x 0.333) = 16,667
* The promotion costs the bank $5 for each card
* Cost for Bank = (16,667 x $5) = $83,355.00

## Question 3 – I didn’t realize Minitab can do this….

Big Hitter is a manufacturer of golf products in the United States and Canada. One of the golf accessories it produces at its plant in Winnipeg, Manitoba, Canada, is plastic golf tees. The injector molder produces golf tees that are designed to have an average height of 66mm. To determine if this specification is met, random samples are taken from the production floor. One sample is contained in the file labeled *THeight*.

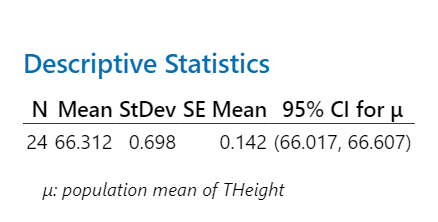
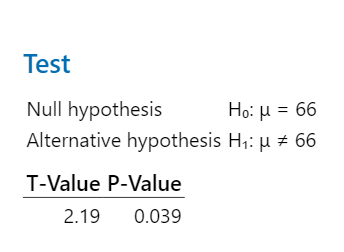
1. **Determine if the process is not producing the tees to specification. Use a significance level of 0.01.**

*Null Hypothesis:* The mean of the golf tee is 66mm

*Alternative Hypothesis:* The mean height of the golf tees is not 66mm

*Significance level:* 0.01 or 1%

*Critical Value = 2.*81



* Given the significance level of 0.01 the p value is greater than the significance level which indicates not to reject the null hypothesis at the 0.01 level.
* There is not enough evidence to say that the process is not producing the tees to requirement of 66m at 0.01 significance level.

1. **Develop a 95% confidence interval estimate of the mean annual spending. Interpret this range.**
   * **Shown Above**

* Sample Mean = 66
* Standard Deviation = 0.70
* T Stat = 2.190
* Lower = 66.017
* Upper = 66.607
* Interpretation:
  + I am 95% confident that the true mean height of the golf tees produced within the Big Hitter falls within the interval; showing that 95% of these intervals will contain a true mean of golf tees.

1. **If the hypothesis test determines the specification is not being met, the production process will be shut down while causes and remedies are determined. At times this occurs even though the process is functioning to specification. What type of statistical error would this be?**
   * + - Type 1 Error
       - Type 1 Error is also known as a false positive. This is due to the rejection in favor of the Alternative Analysis.

## Question 4

Many complaints have been received in the past six months regarding airlines losing fliers’ baggage. The airlines claim that problem is nowhere near as great as the newspaper articles have indicated. In fact, one airline spokesman claimed that less than 1% of all bags fail to arrive at the destination with the passenger. To test this claim, 800 bags were randomly selected at various airports in the United States when they were checked with this airline. Of these, 6 failed to reach the destination when the passenger (owner) arrived.

1. **Is this sufficient evidence to support the airline spokesman’s claim? Test using a significance level of 0.05. Discuss.**
   * Null Hypothesis: Bags that fail to arrive at the destination with the passenger (less than or equal to 1%)
   * Alternative Hypothesis: Bags that fail to arrive at the destination with the passenger (greater than or equal to 1%)
   * Information Presented:

- Sample Size = 800 bags

- Claimed Proportion = 0.01

- Significance level = 0.05

- Number of Failures = 6

- Sample Proportion = 6/800 = 0.0075

* + Test Statistic: ​​
  + P-Value:



* + The Test Stat indicates a negative which is less than the hypothesized proportion of (0.01) which shows an offer in the airline.
  + The P value of (0.7614) is greater than the significance level of 0.05 which shows there is no appropriate evidence that can reject the null hypothesis.

1. **Estimate the proportion of bags that fail to arrive at the proper destination using a technique for which 95% confidence applies.**
   * Information Presented:

- Sample Proportion = 6/800 = 0.0075

- Standard Error = 0.00305



- Z Score = 1.96 due to Z distribution for 95% confidence level

- Margin of Error = 0.005978



- Upper Bound = 0.0075 + 0.0060 = 0.0135

- Lower Bound = 0.0075 – 0.0060 = 0.0015