The Age of a Coin Project

Math 171

November 30th, 2017

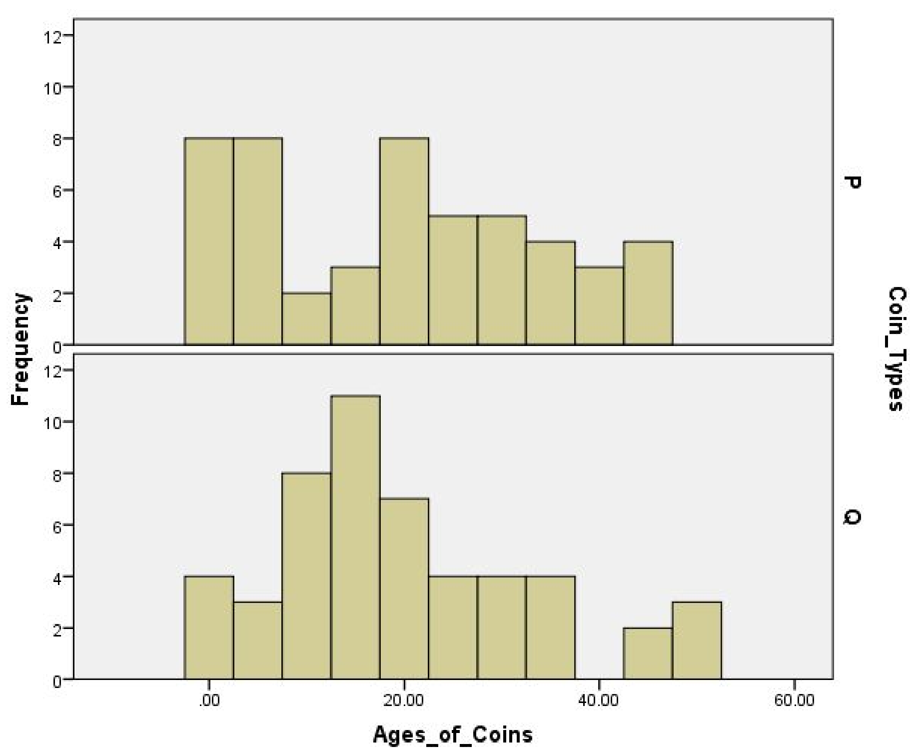
Bailey Dallas and Molly Mancini

I pledge that I have neither given nor received help, nor am I aware of any Honor Code fraction.

To begin this experiment, fifty quarters and fifty pennies were collected through Bailey's job as a waitress. The coins were given to her as tips, meaning that they were left by customers and the coins were given to her at random. The coins were collected and placed together in a large jar. The jar was then poured out onto the floor where 50 pennies and 50 quarters were selected from the pile of coins. The data collection method could have possibly introduced bias into the results. Through the selection of the coins, Bailey and I might have inadvertently selected the cleaner coins as compared to the ones covered in gum or mysterious substances. Since the coins were given to Bailey at random from her customers at her waitressing job, she did not hand pick the original coins for the potential sample though. Bias could have been present through the selection of the coins used in the group of 50 quarters and 50 pennies.

The population for this experiment included all of the pennies and quarters distributed from the United States. The individuals included the fifty pennies and fifty quarters selected for the project. The variables included the number of eagles present on the quarters and the ages of both the pennies and the quarters. There are both qualitative and quantitative and qualitative variables involved in this experiment. The quantitative contained the ages of both the pennies and the quarters while the qualitative variables involved the number of eagles present on the quarters.

Frequency of Coins Ages Comparing to Coin Types



	Mean	Standard Deviation	Minimum	Quartile 1	Median	Quartile 3	Maximum
Pennies	20.66	13.14	0	4	20	32	46
Quarters	19.68	14.65	0	12	17	29	52

The five number summary of the data for pennies has the mean of 20.66, standard deviation of 13.14, minimum of 0, maximum of 46, first quartile of 4, third quartile of 32 and a median of 20. For the data set of quarters, the five number summary included a mean of 19.68 for the mean, 14.65 standard deviation, minimum of 0, maximum of 52, first quartile of 12, third quartile 29, and a median of 17.

After examining the histogram for the penny distribution, there are no visible skews. There are three visible high peaks. There are no outliers and the center of the distribution and the median are equivalent at the coin age of 20. The data presented in the graph has no major skew because the coins were a random sample from tips left at a restaurant.

For the quarters, the distribution has a slight right skew and is single peaked. There are no outliers in the distribution. The center of the distribution and the median are equivalent at the coin age of 17. After looking at the histogram, one can see that we have a greater amount of newly minted pennies compared to the quarters, which were all minted ten or more years ago.

The distribution of all coins in circulation is somewhat similar to the data that was collected in the sample for this project. Our data resembles the distribution of all coins in circulation due to the varying of age within the coins collected, as there are newer and older coins present in our data.

Coin Type:	Pennies	Quarters
Confidence Interval (95%):	(17.018, 24.302)	(15.619, 23.741)
Margin of Error:	3.642	4.061

1. If you wanted to estimate the average age of pennies to within one year with 99% confidence, then how large of a sample size would you need to obtain? You may use the standard deviation from your sample as the population standard deviation.

For this problem, the correct formula would be n =(Z* σ/ *m.o.e.*)^2 to find the sample size (n).

Margin of Error= 1

Z*= 2.576 (invnorm 1.99/2, 0, 1)

Standard Deviation= 13.14

After plugging in the data, the sample size (n), would be 1146.

2. Suppose you want to estimate the proportion of pennies in circulation that are older than 20 years to within 2% with 98% confidence. Use the number of pennies in your sample that are older than twenty to determine the sample size necessary to achieve your goal.

For this specific problem, the formula needed is n= (z*/m.o.e.)^2 x p^(1-p^).

z*=2.326

x=25 (for the number of pennies greater than 20 years old)

Margin of Error= 0.02

P^=0.5 (25/50)

After plugging in the data, the sample size (n), would be 3382.

3. Is the mean age of all quarters in circulation the same as the mean age of all pennies in circulation? You will need to use an appropriate inferential technique to the answer this question. Make sure that you show (and explain) all work that supports your conclusion. You should also produce nice graphical representations of the distributions of the ages of your two coin types that makes it easy to compare the two distributions visually. Use a different type of graph from Part I. Also, discuss the assumptions necessary to run this inference test in your particular situation.

For this problem, the best test to use is 2-Sample T-Test. Our null hypothesis is that the mean of all circulating quarters is equal to the mean age of all circulating pennies. Our alternative hypothesis is that the mean age of all circulating quarters is not equal to the mean age of all circulating pennies.

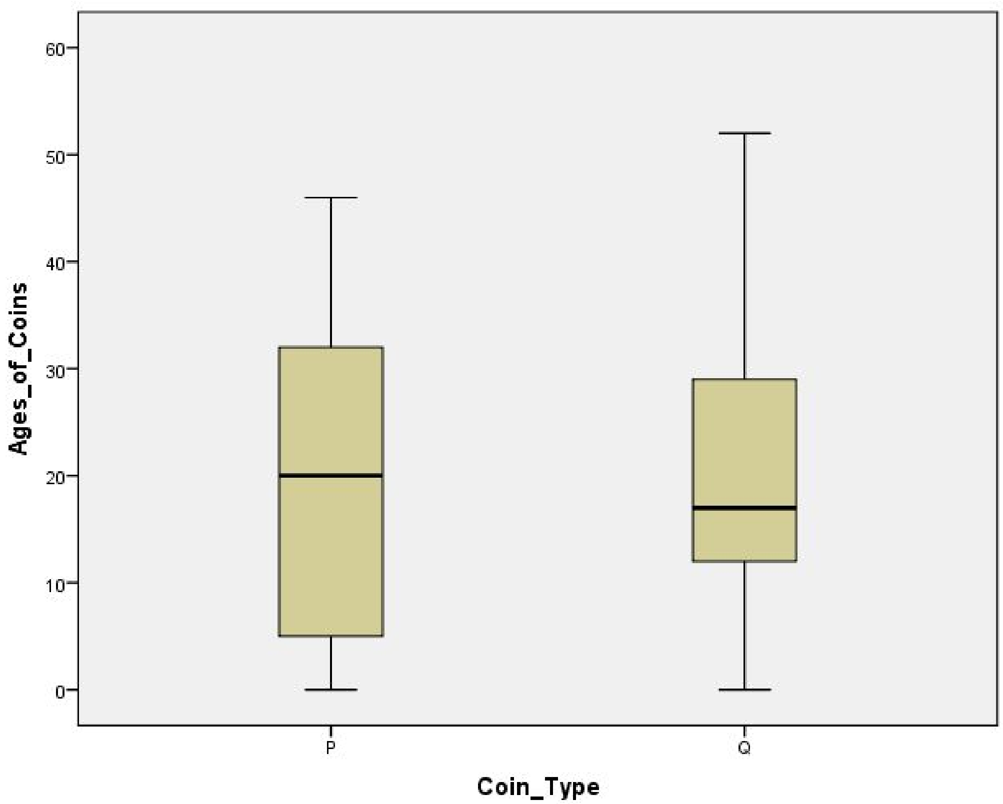
Here is the data from the 2-Sample T-Test in the calculator:

$\bar{X}1= 20.66$ $SX1=13.14$ $N=50$
$\bar{X}2= 19.68$ $SX2=14.65$ $N=50$

$t= .3521$
$p=.7255$

Due to a high p value, our null hypothesis will be accepted. The data has no significant evidence that the mean age of all circulating quarters is not equal to the mean age of all circulating pennies.

Age Distribution of Quarters and Pennies



Pennies Age (years) Stem & Leaf Plot
n= 50

0	0001111233334557
1	015678889
2	112245566899
3	225556
4	0123356

Quarters Age (years) Stem & Leaf Plot
n=50

0	0122344
1	00222222566666677777889
2	012234479
3	0123777
4	34
5	122

4. Working under the assumption that coins stay in circulation for thirty years and examining coin production figures from the last thirty years, I hypothesize that the proportion of quarters without an eagle on the "tails" side is 0.62. Use your data (all 50 quarters) to address the validity of my hypothesis using an appropriate inferential technique.

The test used was a 1-Proportion Z-Test in the calculator to work this problem. The P_0=0.62, X=28, and n=50. Our null hypothesis is that the proportion of quarters without an eagle on the back equals 0.62, and our alternative hypothesis was the proportion of quarters without eagles on the back won't equal 0.62. After entering the data in the calculator and running the test, z=-.8741 and p=.382. Due to the high p value, we accept the null hypothesis and reject the alternative. The data is not significant, due to the high p value.