# **Sampling Distribution and Confidence Interval - Segment 6**

## PROBLEM 1

A childcare agency was interested in examining the monthly amount that family pay for childcare outside the home per child. A random sample of 64 families was selected and the average and standard deviation were computed to be $675 and $40 respectively.

SE = Std /SQRroot SRS = ? 99% z score = 2.57

Average + (z score, SE) 90% z score = 1.34

Average – (z score, SE) 95% z score = 1.96

1. Find a 99% confidence interval for the monthly average amount spent per child.

99% = Z score = 2.57

SE = 40/SQR (64) = 5

(Z score + SE) = 12.85

Upper bound= Average (675) + (2.57 \* 5) = 687.85

Lower bound = Average (675) – (2.57 \* 5) = 662.15

1. A social worker claims that the average monthly amount spent for childcare outside the home is $700 per child. You suspect it is less. Based on the sample data, can you reject the social worker’s claim?

We can reject the social worker’s claim since the value of 700 dollars does not contain in the confidence interval computed above, this means that data provides strong evidence to reject the social worker’s claim.

Families spent less than 700 dollars per child per childcare.

## PROBLEM 2

The mean time between failures (in hours) for a Telektronic Company radio used in light aircraft is 420h. After 15 new radios were modified in an attempt to improve reliability, tests were conducted to measure the times between failures. For the 15 new radios, the average time between failures was 434.73h and the standard deviation was 18.01h. Compute a 95% confidence interval. Does it appear that the modification improved the reliability?

95% = Z score = 1.96

SE = 18.01/SQR (15) = 4.653

(Z score + SE) = 9.1213

Upper bound= Average (434.73) + (1.96 \* 4.653) = 443.84

Lower bound = Average (434.73) – (1.96 \* 4.653) = 425.61

Mean = 420

Although it’s not within the range, the confidence interval computed above. It indicates that the average time between failure is a value between 425.61h and 443.84h. this is significance higher than the previous value of 420h.

## PROBLEM 3

Fifty new computer chips were tested for speed in a certain application. The average speed, in Mhz, for the new chips was 495.6 and the standard deviation was 19.4.

1. Compute a 95% confidence interval for the average speed using the sample of 50 computer chips.

95% = Z score = 1.96

SE = 19.4/SQR(50) = 2.743

(Z score + SE) = 5.377

Upper bound= Average (495.6) + (1.96\* 2.743) = 500.97

Lower bound = Average (495.6) – (1.96 \* 2.743) = 490.226

1. An older version of the chips had a speed of 481.2 Mhz. Can you conclude that the mean speed for the new chips is greater than the average speed of 481.2 Mhz of the old chips?

We can conclude that the mean speed of the new chip, is significantly greater than the speed of the older chips since 481.2 is smaller than values of the confidence level.

1. A second sample of 100 new chips were selected and tested. The observed average computer speed was 500.3 mhz with standard deviation equal to 20.3. Can you conclude that the results from the first study are consistent with the second larger study?

SE = 20.3/SQR (100) = 2.03

(Z score + SE) = 3.98

Upper bound= Average (500.3) + (1.96\* 2.03) = 504.28

Lower bound = Average (500.3) – (1.96 \* 2.03) = 496.32

The second study confirms the results in A as the 95% confidence interval contains values larger than 481.2 mhz. The range is defined by the true 95% confidence intervals overlaps and provides similar results.

# Tests of Significance - Segment 8

## Problem 1

Step of computing the

Step 1)

Ho =

Ha =

Step 2)

Z score

Step 3)

P

Step 4)

Conclusion

A special cable has a breaking strength of 800 pounds. A researcher selects a sample of 80 cables and finds that the average breaking strength is 793 pounds, with standard deviation equal to 12 pounds.

Can one reject the claim that the breaking strength is 800 pounds?

1. Write down the test hypotheses, the test statistic and the p-value.

Step 1)

Ho = 800 pounds

Ha = 800 pounds

\*NOT EQUAL TO\*

Step 2)

Z score = average – Ho / std \* sqrt(srs)

793-800/(12 /sqrt (80)) = - 5.21

Step 3)

P = almost 0

1. Should the null hypothesis be rejected at the significance level of 0.01?

P is almost zero, we can reject the null hypothesis at 0.01% level. The data support the alternative hypothesis that the breaking strength is not 800 pounds.

## Problem 2

A bank wonders whether omitting the annual credit card fee for customers who charge at least $3,000 in a year would increase the amount charged on their credit card. The bank makes an offer to an SRS of 500 existing credit card customers. It then compares how much these customers charge this year with the amount they charges last year. The mean increase is $565, and the standard deviation is $267.

1. Is there significant evidence at the 1% level that the mean amount charged increases under the no-fee offer? State the null Ho and alternative hypothesis Ha and carry out a statistical test. (*HINT: the hypothesis test evaluates if the average increase in charges is significantly larger than zero*)

Step 1)

Ho = 0 ( no increase)

Ha = 0

\*Greater than HA\*

Step 2)

Z score = average – Ho / std \* sqrt(srs)

565-0/(267 /sqrt (500)) = 47.317

Step 3)

P = almost 0

Step 4)

After doing the p formula, the test is highly significant. Data shows strong evidence that there is a significant increase in charges under the no fee offer.

1. Give a 95% confidence interval for the mean amount of the increase

SE = 23.40

Upper bound = average (565) + (1.96 \* 11.94) = 588.40

Lower bound = average (565) – (1.96 \* 11.94) =541.6

1. A critic points out that the customers would probably have charged more this year than last even without the new offer because the economy is more prosperous and interest rates are lower. Briefly describe the design of an experiment to study the effect of the no-fee offer that would avoid this criticism.

To test the effectiveness of the no fee, offer, a randomized controlled experiment can be conducted where randomly selected customers are assigned to two groups. The controlled group that are not offered the no fee offer and the treatment group that is offered the no fee option. The credit card charges will be reordered from the two groups for a certain period of time.

## Problem 3

A random sample of 10 one-bedroom apartments from your local newspaper has these monthly rents (dollars): 500, 650, 600, 505, 450, 550, 515, 495, 650, 395.

Do these data give good reason to believe that the mean rent of all advertised apartments is greater than $500 per month?

1. State hypotheses.

Step 1)

Ho = 500 ( no increase)

Ha = 500 (increase)

\*Greater than HA\*

1. Find the mean and standard deviation using SPSS or Excel.

AVERAGE:

Once you add all the numbers and divide them by 10 (the number of rents there are) you get the Mean which is 531.

5,310/10 = 531

STANDARD DEVIATION:

Within the excel file you can use all the number of rent you get a s.td of 82.7915

= stdp

1. Compute the p-value and draw your conclusions.

Step 2)

Z score = average – Ho / std \* sqrt(srs)

531-500/(82.79 /sqrt (10)) = 1.184

Step 3)

We can use the = normdist(z score, mean, std, true/false) formula. We can implement it as 1 – normdist(1.18, 0, 1, 1)

P = 0 .119 called not significant because its greater than 0.05

Step 4)

The null hypothesis cannot be rejected because you will accept the null hypothesis and reject the alternative hypothesis.

Since the p value is larger than 0.05 data does not provide enough evidence, that the average rent is larger than 500 dollars.