FREC 408

Group Exercise 5

Alpha is the Greek term α.

- In Inferential Statistics alpha represents the probability of making an error when we make an inference from a sample to the population. In most cases α is the probability of finding a sample with our z-score value or beyond - i.e., the area in the tail of the distribution, either positive or negative. In a confidence Interval, we divide α by 2 to spread this error in both tails.
- We need to calculate the values of α for different Confidence Intervals. Fill in the following table. It will require you to find the z value that is associated with an α/2 level of probability.

Hint

- **The standard normal table shows the probability up to a value, and α/2 is the probability after the value.**
- **It is easiest to find in the table the probability of .5 - α/2 and then read the z-value that corresponds to it.**
- **For example, for α/2 = .125, find the probability for .5 - .125 = .375 (or something very close to it) and**
- **read the z-value of 1.15 that corresponds to this probability.**

Determining Levels of alpha and z-values

100(1-α)	α	α/2	$Z_{\alpha/2}$
75%	.25	.125	1.15
80%			
90%			
95%			
99%			

Determining Levels of alpha and z-values

100(1-α)	α	α/2	$Z_{\alpha/2}$
75%	.25	.125	1.15
80%	.20	.100	1.28
90%			
95%			
99%			

Determining Levels of alpha and z-values

100(1-α)	α	α/2	$Z_{\alpha/2}$
75%	.25	.125	1.15
80%	.20	.100	1.28
90%	.10	.050	1.645
95%			
99%			

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75%	.25	.125	1.15
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95%	.05	.025	1.96
99%			

Determining Levels of alpha and z-values

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75%	.25	.125	1.15
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95%	.05	.025	1.96
99%	.01	.005	2.575

An experiment was conducted at MIT on the effect of melatonin on inducing sleep.

- Young male volunteers were either given melatonin or a placebo. They were then placed in a dark room at midday and told to close their eyes for 30 minutes. The length of time it took them to fall asleep was recorded.
- With the placebo the researchers found it took on average 15 minutes to fall asleep with a standard deviation of 5. We will assume this is the population parameters for young males.
  - **That is, $\mu = 15$ and $\sigma = 5$**

Minutes to Sleep for the Sample	
1	5 6 7 8
2	
3	1 2 3 4 9
4	0 4 4 5 5 7 8 8 9
5	0 0 1 1 9
6	0 0 1 1 1 2 2 3 3 4 4
7	5 6
8	2 3
9	
10	
11	
12	
13	
14	
15	6
16	2
Stem=whole number	Leaf = decimal place

Sum X = 222.1	n = 40
Sum X^2 = 1570.43	

The data here are a random sample of 40 young men who were given melatonin.

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Melatonin Study for Minutes	
Stem uni	1
1	5 6 7 8
2	
3	1 2 3 4 9
4	0 4 4 5 5 7 8 8 9
5	0 0 1 1 9
6	0 0 1 1 1 2 2 3 3 4 4
7	5 6
8	2 3
9	
10	
11	
12	
13	
14	
15	6
16	2

Sum of X	222.1
Sum of x squared	1570.4
n	40

Descriptives

Minutes	
Mean	5.55
Standard Error	0.46
Median	5.05
Mode	6.10
Standard Deviation	2.94
Sample Variance	8.65
Kurtosis	6.46
Skewness	2.10
Range	14.70
Minimum	1.50
Maximum	16.20
Sum	222.10
Count	40
Confidence Level(95.0%)	0.94

Melatonin Sleep Study

- Calculate the **Standard Error** of the data:
  - **2.941/6.3246 = .465**
- Construct a **95% Confidence Interval** for this data. Use the Z-value you calculated from problem 1.
  - **5.553 ± 1.96*(.465) =**
  - **5.553 ± .9114**
  - **6.4644 to 4.6416**

Melatonin Sleep Study

- Calculate the Z-score for this sample mean as part of a sampling distribution with **$\mu = 15$ and $\sigma_{\bar{x}} = 5/\sqrt{40}$**
  - **z = (5.553 - 15)/.7906 =**
  - **z = -11.9496**
  - **This is a very large z-value!**

Melatonin Sleep Study

- What is the probability of finding a sample mean equal to or less than the value you calculated if the population parameter for the mean is really 15. Did the melatonin seem to work?
  - **p < .001**
  - **YES!!!!! It was a rare event to get a random sample of 40 young men with a mean of 5.55 if it really came from a population with a mean of 15**
  - **We have evidence to support that our is different from the placebo group.**
  - **As a result there appears evidence that melatonin does lead to a reduction in time to get to sleep.**

Tropical swarm-founding wasps rely on female workers to raise their offspring.

- One possible explanation for this strange behavior is inbreeding, which increase relatedness among the wasps, presumably making it easier for workers to pick out their closest relatives as propagators of their own genetic material.
- To test this theory, **197** swarm-founding wasps were captured in Venezuela, frozen at -70° C and then subjected to a series of genetic tests.
- The data are used to generate an inbreeding coefficient, x, for each wasp specimen. The results are:
  - $\bar{x}$ = .044 and s= .884

Wasp In-Breeding

- Construct a 99% C.I. for the mean inbreeding coefficient for this species of wasps.
  - **$.044 \pm 2.575(.884/(197)^{.5})$**
  - **= .044 ± .162**
  - **= -.1182 to .2062**

Wasp In-Breeding

- A coefficient of 0 implies that the wasp has no tendency to inbreed. Use the Confidence Interval in part a to make an inference about the tendency for this species of wasp to inbreed.
- **Since zero is within the 99% confidence interval, it is probable/possible to get a sample which has a mean value equal to zero, which implies no tendency to inbreed.**
- **Within our 99% framework, zero is a probable value.**
- **We have evidence to suggest that there was no tendency to inbreed.**