Chapter 8 Estimation

Solutions

1. Therefore 127.83 is the point estimate of the population mean.



1. Therefore ‒2.33 is the point estimate of the population mean.



* 1. Therefore 0.40 is the point estimate of the population proportion of successes.



* 1. Therefore 0.60 is the point estimate of the population proportion of failures.



* 1. Therefore 0.75 is the point estimate of the population proportion of successes.



* 1. Therefore 0.25 is the point estimate of the population proportion of failures.



1. Therefore $3.04 is the point estimate of the population mean price for the pain reliever.



1. Therefore, the point estimate of the population mean unemployment rate in major economies around the world is 7.89%..



1. 1. Therefore 0.23 is the point estimate of the population proportion of those who believe that low crime is most important.



* 1. Therefore 0.52 is the point estimate of the population proportion of those who believe that good jobs or affordable homes are most important.



1. 1. Therefore 0.30 is the point estimate of the population proportion of those who would put a tax refund in the bank.



* 1. Therefore 0.10 is the point estimate of the population proportion of those who never get a refund.



1. 1. For 90%,



* 1. For 98%,



* 1. For 88%,



1. 1. For 89%,



* 1. For 92%,



* 1. For 96%,







* 1. is normally distributed because the sample is derived from a normally distributed population.



* 1. We use to find . The margin of error for the 80% confidence interval is .



* 1. We use to find = . The margin of error for the 90% confidence interval is



* 1. The higher confidence level will lead to a higher margin of error, which will lead to a wider interval.



* 1. is approximately normally distributed because the sample size *n* is sufficiently large ().



* 1. We use to find . The margin of error, with *n* = 64, for the 95% confidence interval is .



* 1. The margin of error with *n* = 225, for the 95% confidence interval is .



* 1. The smaller sample size of *n* =64 will lead to a wider interval because the margin of error is higher.

1. There are three factors that influence the margin of error of the confidence interval:

1) a higher population standard deviation σ will lead to a higher margin of error (and hence a wider confidence interval),

2) a smaller sample size *n* will lead to a higher margin of error, and

3) a greater confidence level will lead to a higher margin of error.

Therefore, in order to reduce the margin of error, one can gather a bigger sample size and/or reduce the confidence level.



* 1. The sample mean, , is the point estimate of the population mean.



* 1. ; the margin of error is: .



* 1. The 90% confidence interval is



For the 90% confidence interval,; the confidence interval is



For the 99% confidence interval,; the confidence interval is



* 1. For the 95% confidence interval, ; the confidence interval is



* 1. Yes, we can conclude with 95% confidence that the mean sleep in this Midwestern town is not 7 hours because the value 7 does not fall within the confidence interval.



* 1. We need to assume that the population has a normal distribution since = 26 is not sufficiently large (not ≥ 30).



* 1. For the 90% confidence interval, ; the confidence interval is



* 1. For the 99% confidence interval, the margin of error is



* 1. The 99% confidence interval is







1. 1. We use to find .



* 1. We use to find .



* 1. We use to find .



* 1. We use to find .



* 1. We use to find The 90% confidence interval is .



* 1. We use to find . The 99% confidence interval is .



* 1. As the confidence level increases, the interval becomes wider.



* 1. We use and to find The 95% confidence interval is .



* 1. With The 95% confidence interval is .



* 1. The bigger sample size will lead to a smaller interval width and therefore a more precise interval.



* 1. We use . The 80% confidence interval is .



* 1. we use The 90% confidence interval is .



* 1. As the confidence level increases, the interval becomes wider.

1. . Since weight loss is believed to be normally distributed, we can consider to be approximately normally distributed. We use the distribution.



* 1. We use to find For the 95% confidence interval, the margin of error is



We use . The 90% confidence interval is .



1. . Since the sample size is sufficiently large (, we consider to be approximately normally distributed. We use the distribution.



* 1. We use , to find For the 99% confidence interval, the margin of error is



. The 95% confidence interval is ]







We use . The 99% confidence interval is .



* 1. In order for the above confidence interval to be valid, must be normally distributed. Therefore, we must assume that the population has a normal distribution since *n* is smaller than 30.







We use . The 90% confidence interval is



* 1. In order for the above confidence interval to be valid, must be normally distributed. Therefore, Sara must assume that CEO compensations have a normal distribution since *n* is smaller than 30.



* 1. In order to reduce the margin of error of a 90% confidence interval, Sarah has to increase her sample size, *n*.



We use . The 90% confidence interval is .







* 1. We use . The 90% confidence interval is: .



* 1. The margin of error increases as the confidence level increases, and therefore the confidence interval becomes wider.



We use .



* 1. Electronic:



The 99% confidence interval is .



Utilities:



The 99% confidence interval is: .



* 1. We must assume that the annual return of each fund has a normal distribution, since the sample size is less than 30.

1. We use the debt payments data to calculate the sample mean and sample standard deviations as .



1. Given , we use to compute a 90% confidence interval as 983.46. Similarly, we use to compute a 95% confidence interval as 983. The 95% confidence interval is wider.



* 1. is the point estimate of the population proportion



* 1. We use . Therefore the interval estimate is .



* 1. We use . Therefore the interval estimate is .



* 1. We use . Therefore the 95% confidence interval for the proportion of successes is .



* 1. Since the proportion of successes = 0.625, the proportion of failures = 1 – 0.625 = 0.375. Therefore the interval for the proportion of failures is

.



* 1. We use . With *n* = 50, the 95% confidence interval for the population proportion is



* 1. With *n* = 200, the 95% confidence interval for the population proportion is

.



Here, since *n* is larger, the interval is narrower and therefore more precise.



* 1. is the point estimate of the population proportion



* 1. For the 90% confidence interval:



The interval is:



For the 99% confidence interval:



The interval is:



* 1. Yes, with 90% confidence, we can conclude that the population proportion differs from 0.5 because the value 0.5 does not fall within the interval.
  2. No, since the value 0.5 falls within the interval, we cannot conclude with 99% that the population proportion differs from 0.5.



* 1. We use . The 88% confidence interval is



* 1. We use . The 98% confidence interval is



.



* 1. The interval becomes wider and therefore less precise as the confidence level increases.



* 1. We use . The margin of error is



.



1. The population parameter of interest is the proportion of Americans who support Arizona’s new immigration enforcement law. We use , and use . The 95% confidence interval is



* 1. The population parameter of interest is the proportion of middle-income Americans who actively participate in the stock market. We use . The 90% confidence interval is



.



* 1. With 90% confidence, we can conclude that the population proportion is not 50% because the value 0.50 does not fall within the interval.



* 1. The margin of error in part b is higher because it uses a higher confidence level.



. The 90% confidence interval for the population proportion is



* 1. We use . The 90% confidence interval for the population proportion is



.



* 1. 0.026 is the margin of error
  2. Using , the margin of error increases to



.



* 1. We use . The 90% confidence interval for the population proportion is



.



* 1. No, we cannot conclude that the adult obesity rate in the US is not 30% because the value 0.30 falls in the interval.



The proportion of B’s and A’s is 0.05 + 0.23 = 0.28. Therefore, the point estimate is . We use . Therefore, the 95% confidence interval is:



* 1. we use . The 95% confidence interval for the population proportion is



.



* 1. No, the mayor’s claim cannot be justified with 95% confidence since the national average value 0.20 (=1/5) falls within the interval.

1. For a 90% confidence interval, Given D = 1.2,



which is rounded up to 24.



If the margin of error decreases to *D* = 0.7, then,

which is rounded up to 68.



1. With 80% confidence, Since is not given, calculate it as Given *D* = 2.6,



which is rounded up to 55.



With 95% confidence, Thus,



which is rounded up to 128.



1. Given



which is rounded up to 62.



1. Given



which is rounded up to 166.



1. Given



which is rounded up to 139.



If which is rounded up to 62.



1. Given Thus,



which is rounded up to 74.



Thus,



which is rounded up to 31.



1. Since no prior population proportion estimate is available, we use a conservative estimate :



which is rounded up to 267.



1. Given



which is rounded up to 189.



* 1. D = 0.04, thus which is rounded up to 102.



* 1. D = 0.04, thus which is rounded up to 40.



* 1. Since the population standard deviation for Fund A is higher than for Fund B, it leads to a higher margin of error. Therefore, in order to achieve the same margin of error for both funds, Fund A requires a larger sample size.

1. Given



which is rounded up to 50.



1. . Thus,



which is rounded up to 182.



1. Given



* 1. The population parameter of interest is the proportion of all people between the ages of 50-64 who have tried alternative therapies. The point estimate is .



For 90% confidence, so the margin of error is:



* 1. With *D* = 0.02, assuming is a reasonable estimate of *p*,



which is rounded up to 1421.



1. Given



which is rounded up to 136.



1. Since no prior population proportion estimate is available, use :



which is rounded up to 664.



1. , thus:



1. We use the price data realtor in Mission Viejo, California to calculate the sample mean as . We are also given . We use to compute a 90% confidence interval as 516.03. Similarly, we use to compute a 99% confidence interval as 516.03. The 99% confidence interval is wider.



* 1. ;



* 1. ;



* 1. As the confidence level increases, the interval becomes wider and less precise.







* 1. We assume that single family homes in San Luis Obispo follow a normal distribution.



* 1. (approximately)



* 1. Yes, we can conclude with 95% confidence that the average worker does not take 14 days of vacation because the interval does not include the value 14.



* 1. The parameter of interest is the average filing weight of all cereal packages.

The point estimate is .



For a 95% margin of error, thus the margin of error is:



.



* 1. The confidence interval is which means that with 95% confidence we can conclude that machine is operating properly because the interval contains the target filling weight of 1.20 pounds.



* 1. , thus



which is rounded up to 139.



Thus the sample size should be at least 139 in order to get a margin of error below 0.01.

1. With 90% confidence, Since is not given, calculate it as Given *D* = 15, which is rounded up to 271.



* 1. The 99% margin of error is 0.14, as calculated above.



* 1. ;



* 1. You must assume that the annual returns at Vanguard Energy Fund follow a normal distribution.
  2. Monthly rent: 
  3. Square footage: 
  4. With 90% confidence, the margin of error for monthly rent is 113.17, resulting in the 90% confidence interval as: .



Similarly, for square footage, the margin of error is 172.05 resulting in the 90% confidence interval as:



* 1. ;



* 1. The confidence interval in part b is wider because of a higher confidence level.

1. Given



which is rounded up to 174. This is assuming that , based on prior studies, is a reasonable estimate of *p* in the planning stage.



* 1. , thus



which is rounded up to 196.



* 1. , thus



which is rounded up to 381.



**Case Study 8.1**

Using Excel, we obtain the following relevant results:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | *Bachelor's Degree* |  | *High School Diploma* |  | *No High School Diploma* |  |
|  | |  |  |  |  |  |  |
|  | | Mean | 22.9596 | Mean | 12.261 | Mean | 10.4607 |
|  | Standard Deviation | 3.56262 | Standard Deviation | 3.55175 | Standard Deviation | 2.36902 |
|  | Confidence Level(95.0%) | 1.330302 | Confidence Level(95.0%) | 1.326247 | Confidence Level(95.0%) | 0.88461 |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

1. The average hourly wage for a Texas worker with a bachelor’s degree or higher is $22.96. The average hourly wage for a Texas worker with and without a high school diploma is $12.26 and $10.46, respectively. Texas workers with a bachelor’s degree or higher earn

approximately twice as much per hour than those workers with at most a high school education. The variability in the hourly wage for Texas workers with a bachelor’s degree or higher and those with a high school diploma seems comparable (in absolute terms) with standard deviations of $3.56 and $3.55, respectively. The variability in the hourly wage is less for those workers without a high school diploma with a standard deviation of $2.37.

1. The 95% confidence interval for the mean hourly wage of Texas workers with a bachelor’s degree or more is .



The 95% confidence interval for the mean hourly wage of Texas workers with a high school diploma is .



The 95% confidence interval for the mean hourly wage of Texas workers without a high school diploma is .



**Case Study 8.2**

1. Fidelity Select Automotive Fund has an average annual return of 15.52% with a high of 122.28% in 2009, and a low of -61.20% in 2008. The standard deviation (used as a measure of risk) is 49.02%.

Fidelity Select Gold Fund has an average annual return of 24.46% with a high of 64.28% in 2002 and a low of ‒20.49% in 2008. The standard deviation is 25.70%, which suggests that the Gold fund is less risky than the Automotive Fund.

1. The 95% confidence intervals can be found using .



The Automotive Fund has a 95% confidence interval of:



The Gold fund has a 95% confidence interval of:



The two confidence intervals show that the Automotive Fund has an average annual return between -22.16% and 53.20% with 95% confidence, whereas the Gold Fund has an average annual return between 4.71% and 44.21% with 95% confidence. The margin of error is much higher for the Automotive Fund (37.68% compared to 19.75%), which is in part

because the volatility (standard deviation) is much higher for that fund. This leads to a less precise interval than the Gold fund.

The above confidence intervals were constructed under the assumption that the annual returns for both funds follow a normal distribution.

**Case Study 8.3**

Using *n* = 1000, we can find 95% confidence intervals of the population proportions using



1. With , the 95% confidence interval of the proportion of people who approved of the way that President Bush handled Hurricane Katrina is



With , the 95% confidence interval of the proportion of people who approved of the way that President Obama handled the Gulf Coast Spill is:



Since the confidence interval for the approval of President Obama is entirely above the confidence interval for President Bush, we can infer that people believed that President Obama handled the Gulf Coast spill better than President Bush handled Hurricane Katrina.

1. With , the 95% confidence interval of the proportion of people who believed domestic issues were more important in 2006 is:



With , the 95% confidence interval of the proportion of people who believed domestic issues were more important in 2010 is:



Since the confidence interval for 2010 is entirely above the confidence interval for 2006, we can infer that domestic issues were of more importance to Americans in 2010 than they were in 2006.