***Geraldo Braho  
Chapter #7***

***Section 1***

***In Exercises 7.3–7.10, we have given population data for a variable. For each exercise, do the following tasks.***

*a. Find the mean, μ, of the variable.*

*b. For each of the possible sample sizes, construct a table similar to Table 7.2 on page 299 and draw a dotplot for the sampling distribution of the sample mean similar to Fig. 7.1 on page 299.*

*c. Construct a graph similar to Fig. 7.3 and interpret your results.*

*d. For each of the possible sample sizes, find the probability that the sample mean will equal the population mean.*

*e. For each of the possible sample sizes, find the probability that the sampling error made in estimating the population mean by the sample mean will be 0.5 or less (in magnitude), that is, that the absolute value of the difference between the sample mean and the population mean is at most 0.5.*

***8. Population data: 2,3,5,7,8.***

*a)*

*b)* ***Sample (n=1) Sample (n=2) Sample (n=3) Sample (n=4) Sample (n=5)***

***Date x Data x Data x Data x Data x*** *2 2 2,3 2.5 2,3,5 3.3 2,3,5,7 4.3 2,3,5,7,8 5.0  
 3 3 2,5 3.5 2,3,7 4.0 2,3,5,8 4.5  
 5 5 2,7 4.5 2,3,8 4.3 2,5,7,8 5.5   
 7 7 2,8 5.0 2,5,7 4.3 3,5,7,8 5.8  
 8 8 3,5 4.0 2,5,8 5.0 2,3,7,8 5.0  
 3,7 5.0 3,5,7 5.0  
 3,8 5.5 3,5,8 5.3  
 5,7 6.0 3,7,8 6.0  
 5,8 6.5 5,7,8 6.7  
 7,8 7.5 2,7,8 5.7*

*b) & c)   
parts of answer b) build up the answer c) – so that is why I am showing all dotplots in answer c)*

***Sample size (n=1)*** ***. . . . .***

*|\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_| 🡪 x  
2.0 3.0 4.0 5.0 6.0 7.0 8.0*

***Sample size (n=2)***

***.  
 . . . . . . . . .***

*|\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_| 🡪 x  
2.0 3.0 4.0 5.0 6.0 7.0 8.0*

***Sample size (n=3)***

***. .  
 . . . . . . . .***

*|\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_| 🡪 x  
2.0 3.0 4.0 5.0 6.0 7.0 8.0*

***Sample size (n=4)   
 . . . . .***

*|\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_| 🡪 x  
2.0 3.0 4.0 5.0 6.0 7.0 8.0*

***Sample size (n=5)***

***.***

*|\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_| 🡪 x  
2.0 3.0 4.0 5.0 6.0 7.0 8.0*

*d)   
sample size (n=1) 🡪P(x= ) = 1/5 = 0.2  
sample size (n=2) 🡪 P(x= ) = 2/10 = 0.2  
sample size (n=3) 🡪 P(x= ) = 2/10 = 0.2  
sample size (n=4) 🡪 P(x= ) = 1/5 = 0.2  
sample size (n=5) 🡪 P(x= ) = 1/1 = 1.0*

*e)  
sample size (n=1) 🡪P(E <= 0.5) = 0/5 = 0  
sample size (n=2) 🡪P(E <= 0.5) = 4/10 = 0.4  
sample size (n=3) 🡪P(E <= 0.5) = 3/10 = 0.3  
sample size (n=4) 🡪P(E <= 0.5) = 3/5 = 0.6  
sample size (n=5) 🡪P(E <= 0.5) = 1/1 = 1.0*

***11. NBA Champs. The winner of the 2008–2009 National Basketball Association (NBA) championship was the Los Angeles Lakers. One starting lineup for that team is shown in the following table.***

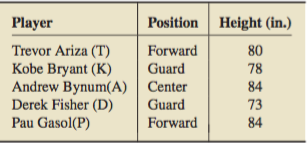
*a. Find the population mean height of the five players.*

*b. For samples of size 2, construct a table similar to Table 7.2 on page 299. Use the letter in parentheses after each player’s name to represent each player.*

*c. Draw a dot-plot for the sampling distribution of the sample mean for samples of size 2.*

*d. For a random sample of size 2, what is the chance that the sample mean will equal the population mean?*

*e. For a random sample of size 2, obtain the probability that the sampling error made in estimating the population mean by the sample mean will be 1 inch or less; that is, determine the probability that x ̄ will be within 1 inch of μ. Interpret your result in terms of percentages.*

1. **

*b)*

|  |  |  |
| --- | --- | --- |
| *Sample* | *Heights* | *x* |
| *T,K* | *80,78* | *79* |
| *T,A* | *80,84* | *82* |
| *T,D* | *80,73* | *76.5* |
| *T,P* | *80,84* | *82* |
| *K,A* | *78,84* | *81* |
| *K,D* | *78,73* | *75.5* |
| *K,P* | *78,84* | *81* |
| *A,D* | *84,73* | *78.5* |
| *A,P* | *84,84* | *84* |
| *D,P* | *73,84* | *78.5* |

*c)*

***. . .  
 . . . . . . .***

*|\_\_\_\_\_\_|\_\_\_\_\_\_|\_\_\_\_\_\_|\_\_\_\_\_\_|\_\_\_\_\_\_|\_\_\_\_\_\_|\_\_\_\_\_\_|\_\_\_\_\_\_|\_\_\_\_\_\_|\_\_\_\_\_\_|\_\_\_\_\_\_|\_\_\_\_\_\_| 🡪 x*

*73 74 75 76 77 78 79 80 81 82 83 84 85*

*d) sample size (n=2) 🡪 P(x= ) = 0/10 = 0 (no sample mean is equal to the population mean)*

*e) sample size (n=2) 🡪P(E <= 1.0) = 1/10 = 0.1 (10% chance that a mean of two selected players will be within 1 inch of the population mean)*

***Section 2***

***38. Refer to Exercise 7.8 on page 302.***

*a. Use your answers from Exercise 7.8(b) to determine the mean, μx ̄, of the variable x ̄ for each of the possible sample sizes.*

*b. For each of the possible sample sizes, determine the mean, μx ̄, of the variable x ̄, using only your answer from Exercise 7.8(a).*

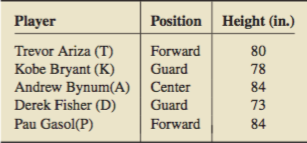
1. *sample size (n=1) μx =   
   sample size (n=2) μx = sample size (n=3) μx = = 4.96*

*sample size (n=4) μx =*

*sample size (n=5) μx  =*

*b) μx  for sample size n=1,2,3,4,5 🡪 μx = 5 = μ*

***41. NBA Champs. The winner of the 2008–2009 National Basketball Association (NBA) championship was the Los Angeles Lakers. One starting lineup for that team is shown in the following table.***

******

*a. Determine the population mean height, μ, of the five players.*

*b. Consider samples of size 2 without replacement. Use your answer to Exercise 7.11(b) on page 302 and Definition 3.11 on page 128 to find the mean, μx ̄, of the variable x ̄.*

*c. Find μx ̄, using only the result of part (a).*

1. *μx =*
2. *μx = μ=*

***Section 3***

***63. A variable of a population has a mean of μ = 100 and a standard deviation of   
σ = 28.***

*a. Identify the sampling distribution of the sample mean for samples of size 49.*

*b. In answering part (a), what assumptions did you make about the distribution of the variable?*

*c. Can you answer part (a) if the sample size is 16 instead of 49?*

*Why or why not?*

1. *μx = μ = 100  
   σx =  =*

*We will have sampling distribution of the sample as a normal distribution with a mean of 100 and standard deviation of 4.*

1. *That it is a normal distribution*
2. *No, because 16 < 30 (lowest sample size needed for normal distribution), so it is not normally distributed then*

***70. New York City 10-km Run. As reported by Runner’s World magazine, the times of the finishers in the New York City 10-km run are normally distributed with a mean of 61 minutes and a standard deviation of 9 minutes. Do the following for the variable “finishing time” of finishers in the New York City 10-km run.***

*a. Find the sampling distribution of the sample mean for samples of size 4.*

*b. Repeat part (a) for samples of size 9.*

*c. Construct graphs similar to those shown in Fig. 7.4 on page 311.*

*d. Obtain the percentage of all samples of four finishers that have mean finishing times within 5 minutes of the population mean finishing time of 61 minutes. Interpret your answer in terms of sampling error.*

*e. Repeat part (d) for samples of size 9.*

*a) μx = μ = 61  
 σx =    
Sampling distribution of a sample is normal distribution with mean 61 and standard deviation 4.5*

*b) μx = μ = 61  
 σx =    
Sampling distribution of a sample is normal distribution with mean 61 and standard deviation 3.*

*c) normal curve (61, 4.5) normal curve (61, 3)*

*\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_\_|\_\_\_ \_\_|\_\_\_|\_\_\_|\_\_\_|\_\_\_|\_\_\_|\_\_\_|\_\_  
 47.5 52 56.5 61 65.5 70 74.5 52 55 58 61 64 67 70*

*n = 4 n=9*

*d) μx = μ = 61  
 σx =*

*z =   
 z =   
 area (-1.11 < z <1.11) = area(z <1.11 – z < -1.11) = 0.8665 – 0.1335 = 0.733 🡪 73.3 % of all four finishers have mean within 5 minutes of the population mean of 61 minutes.*

*e) μx = μ = 61  
 σx =*

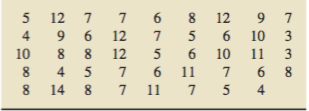
*z =   
 z =*

*area (-1.67 < z <1.67) = area(z <1.67 – z < -1.67) = 0.9525 – 0.0475 = 0.905 🡪 90.5 % of all 9 finishers have mean within 5 minutes of the population mean of 61 minutes.*

***Chapter #8***

***Section 1***

***4. Cottonmouth Litter Size. In the article “The Eastern Cottonmouth (Agkistrodon piscivorus) at the Northern Edge of Its Range” (Journal of Herpetology, Vol. 29, No. 3, pp. 391–398), C. Blem and L. Blem examined the reproductive characteristics of the eastern cottonmouth, a once widely distributed snake whose numbers have decreased recently due to encroachment by humans. A simple random sample of 44 female cottonmouths yielded the following data on number of young per litter.***

******

***a.*** *Use the data to obtain a point estimate for the mean number of young per litter, μ, of all female eastern cottonmouths. (Note: xi = 334.)****b.*** *Is your point estimate in part (a) likely to equal μ exactly? Explain your answer.*

*a) x=*

*b) The point estimate and μ are not exactly equal, because there is always some sampling error that when taken into account, makes two mentioned variable be slightly different.*

***6. Cottonmouth Litter Size. Refer to Exercise 8.4. Assume that σ = 2.4.***

*a. Obtain an approximate 95.44% confidence interval for the mean number of young per litter of all female eastern cottonmouths.  
b. Interpret your result in part (a).  
c. Why is the 95.44% confidence interval that you obtained in part (a) not necessarily exact?*

*a) CL = 95.44 % 🡪 area (0.9544) 🡪 z = 2  
 CI 🡪 x – z( x+ z( 🡪 7.6 – 2(,   
 7.6 + 2(*

*b) We are 95.44% sure that the mean number of young per litter of all female eastern cottonmouths in between 0.36 and 14.84.*

*c) Because there is a sampling error present.*

*10.* ***Serum Cholesterol Levels. Information on serum total cholesterol level is published by the Centers for Disease Control and Prevention in National Health and Nutrition Examination Survey. A simple random sample of 12 U.S. females 20 years old or older provided the following data on serum total cholesterol level, in milligrams per deciliter (mg/dL).***

**

***a.*** *Obtain a normal probability plot of the data****b.*** *Based on your result from part (a), is it reasonable to presume that serum total cholesterol level of U.S. females 20 years old or older is normally distributed? Explain your answer.****c.*** *Find and interpret a 95.44% confidence interval for the mean serum total cholesterol level of U.S. females 20 years old or older. The population standard deviation is 44.7 mg/dL.****d.*** *In Exercise 6.94, we noted that the mean serum total cholesterol level of U.S. females 20 years old or older is 206 mg/dL. Does your confidence interval in part (c) contain the population mean? Would it necessarily have to? Explain your answers.*

*a) Included in the excel file  
b) Yes, because the plot is approximately normally distributed.  
c) CL = 95.44 % 🡪 area (0.9544) 🡪 z = 2  
 x – z( x+ z(  
 x = 194.1 – 2( = 168.3  
 x = 194.1 + 2( = 219.9  
95.44 % of U.S. females who are 20 years old or older have the mean serum total cholesterol level within 168.3 and 219.9*

*d) Yes, it is contained within previously defined confidence interval, but it does not have to necessarily be within the defined interval, because we still have the flexibility of one more standard deviation. (3 standard deviation – 99.74 %)*

***Section 2***

***20. In each part, assume that the population standard deviation is known. Decide whether use of the z-interval procedure to obtain a confidence interval for the population mean is reasonable. Explain your answers.***

*a. The variable under consideration is very close to being normally distributed, and the sample size is 10.  
b. The variable under consideration is very close to being normally distributed, and the sample size is 75.  
c. The sample data contain outliers, and the sample size is 20.*

*a) No. Because the sample size is less than 30, which is a necessary sample size to have a normal distribution.  
b) Yes. Because the sample size if greater than 30, so we have a normal distribution.  
c) No. Because we have the outliners and sample size less than 30 (not a normal distribution)*

***21. In each part, assume that the population standard deviation is known. Decide whether use of the z-interval procedure to obtain a confidence interval for the population mean is reasonable. Explain your answers.***

*a. The sample data contain no outliers, the variable under consideration is roughly normally distributed, and the sample size is 20.  
b. The distribution of the variable under consideration is highly skewed, and the sample size is 20.  
c. The sample data contain no outliers, the sample size is 250, and the variable under consideration is far from being normally distributed.*

*a) Yes, because we have a roughly considered distribution, and the data contains no outliners.  
b) No, because we don’t have a normal distribution (data (variable under consideration) is highly skewed) and sample size is small.  
c) Yes, because the sample size is large and it does not contain any outliners.*

***In each of Exercises 8.25–8.30, we provide a sample mean, sample size, population standard deviation, and confidence level. In each case, use the one-mean z-interval procedure to find a confidence interval for the mean of the population from which the sample was drawn.***

***25. x ̄=20, n=36, σ=3, confidence level=95%***

*x – z( x+ z(  
 CI = 95 % 🡪 area (0.95) 🡪 z = 1.96  
 20 – 1.96( = 19.02  
 20 + 1.96( = 20.98  
Confidence Interval (19.02, 20.98)*

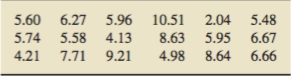
***27. x ̄=30, n=25, σ=4, confidence level=90%***

*x – z( x+ z(  
 CI = 90 % 🡪 area (0.9) 🡪 z = 1.65  
 30 – 1.65( = 28.69   
 30 + 1.65( = 31.32  
Confidence Interval (28.69, 31.32)*

***29. x ̄=50, n=16, σ=5, confidence level=99%***

*x – z( x+ z(  
 CI = 99 % 🡪 area (0.99) 🡪 z = 2.57  
 50 – 2.57( = 46.79  
 50 + 2.57( = 53.21  
Confidence Interval (46.79, 53.21)*

***31. Venture-Capital Investments. Data on investments in the high-tech industry by venture capitalists are compiled by VentureOne Corporation and published in America’s Network Telecom Investor Supplement. A random sample of 18 venture- capital investments in the fiber optics business sector yielded the following data, in millions of dollars.***

******

*a. Determine a 95% confidence interval for the mean amount, μ, of all venture-capital investments in the fiber optics business sector. Assume that the population standard deviation is $2.04 million. (Note: The sum of the data is $113.97 million.)*

*b. Interpret your answer from part (a).*

*a) x =   
 CI = 95% 🡪 area (0.95) 🡪 z = 1.96  
 x – z( x+ z(  
 6.33 – 1.96( = 5. 39  
 6.33 + 1.96( = 7.27  
Confidence Interval (5.39, 7.27)*

*b) We are 95% sure that mean of all venture-capital investments is in between 5.39 and 7.27 mil.*

***33. Toxic Mushrooms? Cadmium, a heavy metal, is toxic to animals. Mushrooms, however, are able to absorb and accumulate cadmium at high concentrations. The Czech and Slovak governments have set a safety limit for cadmium in dry vegetables at 0.5 part per million (ppm). M. Melgar et al. measured the cadmium levels in a random sample of the edible mushroom Boletus pinicola and published the results in the paper “Influence of Some Factors in Toxicity and Accumulation of Cd from Edible Wild Macrofungi in NW Spain (Journal of Environmental Science and Health, Vol. B33(4), pp. 439–455). Here are the data obtained by the researchers.***

******

*Find and interpret a 99% confidence interval for the mean cadmium level of all Boletus pinicola mushrooms. Assume a population standard deviation of cadmium levels in Boletus pinicola mushrooms of 0.37 ppm. (Note: The sum of the data is 6.31 ppm.)*

*x =   
CI = 99% 🡪 area (0.99) 🡪 z = 2.57  
x – z( x+ z(  
0.53 – 2.57( = 0.25  
6.31 + 2.57( = 0.80  
We are 99% sure that the mean cadmium level of all Boletus pinicola mushrooms is within 0.25 and 0.80 ppm.*

***Section 3***

***54. A confidence interval for a population mean has a margin of error of 0.047.***

*a. Determine the length of the confidence interval.  
b. If the sample mean is 0.205, obtain the confidence interval.  
c. Construct a graph similar to Fig.8.6 on page 338.*

*a) \*margin of error is equal to half the length of the confidence interval  
E = 🡪 CI = 2E = 2 x 0.047 = 0.094*

*b) CI = x – E, x + E 🡪 CI = 0.205 – 0.047 = 0.158  
 CI = 0.205 + 0.047 = 0.252*

*c) 0.047 0.047*

*\_\_\_|\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_|\_\_\_\_\_  
 0.158 0.205 0.252  
(0.205 – 0.047) x (0.205 + 0.047)  
 x – E x + E*

***56. A confidence interval for a population mean has a length of 162.6.***

*a. Determine the margin of error.  
b. If the sample mean is 643.1, determine the confidence interval.   
c. Construct a graph similar to Fig.8.6 on page 338.*

*a) CI = 2E 🡪 E = CI/2 = 162.6 / 2 = 81.3*

*b) CI = x – E, x + E 🡪 CI = 643.1 – 81.3 = 561.8  
 CI = 643.1 + 81.3 = 724.4*

*c) 81.3 81.3*

*\_\_\_|\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_|\_\_\_\_\_  
 561.8 643.1 724.4  
(643.1 – 81.3) x (643.1 + 81.3)  
 x – E x + E*

***65. Political Prisoners. In Exercise 8.35, you found a 95% confidence interval of 18.8 months to 48.0 months for the mean duration of imprisonment, μ, of all East German political prisoners with chronic PTSD.***

*a. Determine the margin of error, E.  
b. Explain the meaning of E in this context in terms of the accuracy of the estimate.  
c. Find the sample size required to have a margin of error of 12 months and a 99% confidence level. (Recall that σ =42 months.)  
d. Find a 99% confidence interval for the mean duration of imprisonment, μ, if a sample of the size determined in part (c) has a mean of 36.2 months.*

*a) E = z( z = 1.96, σ = 42, n = 32  
 E = 1.96 () = 14.56*

*b) We are 95% sure that the error made in estimation is at most 14.56 months.*

*c) n =*

*d) CI = 99% 🡪 area (0.99) 🡪 z = 2.57, n = 81, σ = 42  
 E = 2.57 () = 11.9  
 CI = x – E, x + E 🡪 CI = 36.2 – 11.9 = 24.3  
 CI = 36.2 + 11.9 = 48.1*

***Section 4***

***82. For a t-curve with df = 17, use Table IV to find each t -value.***

***a. t0.05  
b. t0.025   
c. t0.005***

*a) 1.740  
b) 2.110  
c) 2.898*

***84. For a t-curve with df = 8, find each t-value, and illustrate your results graphically.***

*a. The t-value having area 0.05 to its right  
b. t0.10  
c. The t-value having area 0.01 to its left (Hint: A t-curve is symmetric about 0.)  
d. The two t-values that divide the area under the curve into a middle 0.95 area and two outside 0.025 areas*

*a) t = 1.860  
b) t = 1.397  
c) t = -2.896  
d) t = 2.306*

***In each of Exercises 8.87–8.92, we have provided a sample mean, sample size, sample standard deviation, and confidence level. In each case, use the one-mean t-interval procedure to find a confidence interval for the mean of the population from which the sample was drawn.***

***88. x ̄=25, n=36, s=3, confidence level=95%***

*x – t (, x + t (  
 area = (1 – 0.95 0 / 2 = 0.025 n =25 🡪 df = n-1 = 24 🡪 t = 2.064  
 25 – 2.064( = 23.97  
 25 + 2.064( = 26.03  
Confidence Interval (23.97, 26.03)*

***90. x ̄=35, n=25, s=4, confidence level=90%***

*x – t (, x + t (  
 area = (1 – 0.90) / 2 = 0.05, n =25 🡪 df = n-1 = 24 🡪 t = 1.711  
 35 – 1.711( = 33.63  
 35 + 1.711( = 36.37  
Confidence Interval (33.63, 36.37)*

***95. Sleep. In 1908, W. S. Gosset published the article “The Probable Error of a Mean” (Biometrika, Vol. 6, pp. 1–25). In this pioneering paper, written under the pseudonym “Student,” Gosset introduced what later became known as Student’s t-distribution. Gosset used the following data set, which gives the additional sleep in hours obtained by a sample of 10 patients using laevohysocyamine hydrobromide.***

******

*a. Obtain and interpret a 95% confidence interval for the additional sleep that would be obtained on average for all people using laevohysocyamine hydrobromide. (Note: x ̄ = 2.33 hr; s = 2.002 hr.)*

*b. Was the drug effective in increasing sleep? Explain your answer.*

*a) area = (1- 0.95) / 2 = 0.025 df = n-1 = 10 -1 = 9, t = 2.262  
 x – t (, x + t (  
 2.33 – 2.262( = 0.9,  
 2.33 + 2.262( = 3.8  
We are 95% sure that the additional sleep obtained on average for all people using laevohysocyamine hydrobromide is within 0.9 and 3.8 hours.*

*b) Since we are 95% sure that the mean is within 0.9 and 3.8, we can confirm that the drug was effective in increasing the sleep.*