Lab 3 (Week 5 - 6)

STAT 2601 - Business Statistics (2024 Fall)
School of Mathematics and Statistics, Carleton University

Date: October 15 - 18, 28, 2024

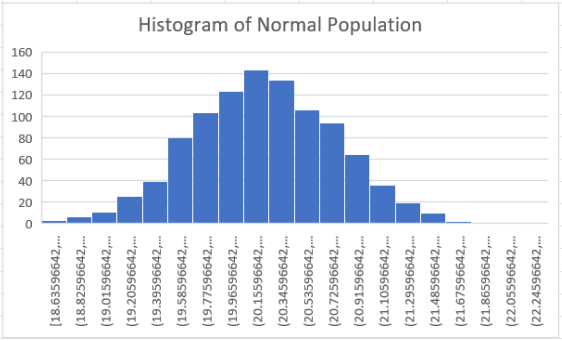
Q: Sampling from a Normal Population and Computing Confidence Intervals

- Suppose the random variable X is normally distributed with a mean of 20.30 and a standard deviation of 0.55. We are going to have EXCEL simulate 1000 values of X. Treating this data as population, find the population mean and draw a histogram of the population.

EXCEL Instructions

- **Generation of Normal Random Variables:**
  Type "=NORM.INV(RAND(),20.30,0.55)" in cell reference A1 and hit Enter > Hover over the bottom right corner of the cell A1 until a tiny + appears and drag the formula down 1,000 cells i.e., A1000.
- **Descriptive Statistics:**
  Select data "A1:A1000" > Data > Data Analysis > Descriptive Statistics > OK > Select the Data (without the variable name) by clicking on "↑" of the Input Range (or type $A$1:$A$1000) > "Summary Statistics" > OK.
- **Histogram:**
  Select data "A1:A1000" > Insert > Insert Statistics Chart > Histogram > Double click on Chart Title and type "Histogram of Normal Population.

Mean	20.29896406
Standard Error	0.018262414
Median	20.31353633
Mode	#N/A
Standard Deviation	0.577508232
Sample Variance	0.333515758
Kurtosis	0.120587715
Skewness	-0.045570709
Range	4.065137251
Minimum	18.40938406
Maximum	22.47452131
Sum	20298.96406
Count	1000



- Now use EXCEL to draw twenty (20) samples of size n = 30 from the Normal population. Assume the population standard deviation is unknown. For each sample, use EXCEL to calculate 95% t-based confidence interval estimate for the population mean. Report only the confidence interval for each sample and fill in the following table.

Samples	**Confidence Interval for μ**	**Covered μ (Y/N)?**
Sample 1		
Sample 2		
⋮ Sample 20		

EXCEL Instructions

- **Generation of Samples:**
  Create Sample Labels: Sample 1 - Sample 20 (Column C - V).
  Sample 1: Data > Data Analysis > Sampling > OK > Select the Data by clicking on "↑" of the Input Range (or type $A$1:$A$1000) > Random (Number of Samples) (30) > Output Range ($C$2:$C$31) > OK.
  Samples 2 - 20: Replicate the above steps to generate samples Sample 2 – 20 in columns D – V. When repeating the above steps, only output range needs to be updated for outputting the specified sample as other fields are auto populated from the last action. For instance, in case of sample 2, the output range will be ($D$2:$D$31).

- **Confidence Intervals:**
  Sample 1:

  (i) Type "=AVERAGE(C2:C31)" in cell C33 and hit Enter. (Sample Mean)

  (ii) Type "=STDEV.S(C2:C31)" in cell C34 and hit Enter. (Sample SD)

  (iii) Type "=30" in cell C35 and hit Enter. (Sample Size).

  (iv) Type "=TINV(0.05,C35-1)" in cell C36 and hit Enter. (95% t CV).

  (v) Type "=C33 + (C36*C34/SQRT(C35))" in cell C37 and hit Enter. (95% UCL for Population Mean)

  (vi) Type "=C33 - (C36*C34/SQRT(C35))" in cell C38 and hit Enter. (95% LCL for Population Mean).

  Samples 2 - 20:
  Replicate the above steps to generate confidence intervals for the remaining samples 2 – 20 in columns D – V. Now, select the cells "C33:C38", hover over the bottom right corner of the cell until a tiny "+" (called "fill-handle") appears and drag the formula down "V33:V38".

Confidence Interval and Coverage of μ:

Samples	**Confidence Interval for μ**	**Covered μ (Y/N)?**
Sample 1	(20.0909, 20.5364)	Yes
Sample 2	(19.8337, 20.2758)	No
Sample 3	(20.2289, 20.6487)	Yes
Sample 4	(19.9922, 20.373)	Yes
Sample 5	(20.1599, 20.5575)	Yes
Sample 6	(20.231, 20.6122)	Yes
Sample 7	(19.9867, 20.4182)	Yes
Sample 8	(19.9292, 20.4208)	Yes
Sample 9	(20.2524, 20.6458)	Yes
Sample 10	(19.99638, 20.39142)	Yes
Sample 11	(20.14127, 20.53553)	Yes
Sample 12	(20.02574, 20.36219)	Yes
Sample 13	(20.01655, 20.36226)	Yes
Sample 14	(20.17153, 20.50513)	Yes
Sample 15	(19.99438, 20.37197)	Yes
Sample 16	(19.95748, 20.38533)	Yes
Sample 17	(20.10625, 20.4528)	Yes
Sample 18	(19.95137, 20.4189)	Yes
Sample 19	(20.00492, 20.497)	Yes
Sample 20	(20.14361, 20.53585)	Yes

Empirical Coverage Rate: $\frac{19}{20} = 0.95$ (or 95%)

Note: The results will be different for each individual as the drawn samples are randomly chosen from the Normal population.