

# Assignment\_C

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Q.1] 1. Perform the following steps and comment on the observation.

Step I. Generate one  $U(-100,100)$  random number. Call it m

```
## [1] "m = -47"
```

Step II. Generate one  $U(10,50)$  random number. Call it s.

```
## [1] "s = 20"
```

Step III. Generate one  $U(10,25)$  random number. Call it n.

```
## [1] "n = 13"
```

Step IV. Generate 1000  $N(m,s)$  random numbers. Call this the population.

```
## [1] -59.52908 -43.32713 -63.71257 -15.09438 -40.40984 -63.40937
```

Step V. Sample n numbers without replacement from the population.

```
## [1] "Head of sample: -41.5989019812554"
## [2] "Head of sample: -41.4417173509891"
## [3] "Head of sample: -30.0149922823928"
## [4] "Head of sample: -67.6580047716401"
## [5] "Head of sample: -38.8119632069813"
## [6] "Head of sample: -60.1782399955601"
## [7] "Head of sample: -65.6903515831049"
## [8] "Head of sample: -46.9516838211305"
## [9] "Head of sample: -33.2079955613181"
## [10] "Head of sample: -47.7848000546634"
## [11] "Head of sample: -53.6181560136553"
## [12] "Head of sample: -53.6800168473309"
## [13] "Head of sample: -42.781854714974"
```

Step VI. Construct 90%, 95%, and 99% confidence intervals for the population mean.

```
## [1] "For 90% interval: "
```

```
##
```

```
## One-sample z-Test
```

```
##
```

```
## data: population
```

```
## z = -74.682, p-value < 2.2e-16
```

```
## alternative hypothesis: true mean is not equal to 0
```

```

## 90 percent confidence interval:
## -48.27326 -46.19267
## sample estimates:
## mean of x
## -47.23296

## [1] "For 95% interval: "

##
## One-sample z-Test
##
## data: population
## z = -74.682, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
## -48.47255 -45.99337
## sample estimates:
## mean of x
## -47.23296

## [1] "For 99% interval: "

##
## One-sample z-Test
##
## data: population
## z = -74.682, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 99 percent confidence interval:
## -48.86206 -45.60387
## sample estimates:
## mean of x
## -47.23296

```

Step VII. Construct 90%, 95%, and 99% confidence intervals for the population variance.

```

## [1] "degree of freedom = 999"
## [1] "Population variance = 428.420318187078"
## [1] "For 90% interval: "

##
## Results of Hypothesis Test
## -----
##
## Null Hypothesis:                variance = 20
##
## Alternative Hypothesis:         True variance is not equal to 20
##
## Test Name:                     Chi-Squared Test on Variance
##
## Estimated Parameter(s):        variance = 428.4203
##
## Data:                          population
##

```

```

## Test Statistic:           Chi-Squared = 21399.59
##
## Test Statistic Parameter: df = 999
##
## P-value:                  0
##
## 90% Confidence Interval:   LCL = 398.6353
##                           UCL = 461.8795
##
## [1] "For 95% interval: "
##
## Results of Hypothesis Test
## -----
##
## Null Hypothesis:          variance = 20
##
## Alternative Hypothesis:    True variance is not equal to 20
##
## Test Name:                Chi-Squared Test on Variance
##
## Estimated Parameter(s):    variance = 428.4203
##
## Data:                     population
##
## Test Statistic:           Chi-Squared = 21399.59
##
## Test Statistic Parameter: df = 999
##
## P-value:                  0
##
## 95% Confidence Interval:   LCL = 393.1989
##                           UCL = 468.6209
##
## [1] "For 99% interval: "
##
## Results of Hypothesis Test
## -----
##
## Null Hypothesis:          variance = 20
##
## Alternative Hypothesis:    True variance is not equal to 20
##
## Test Name:                Chi-Squared Test on Variance
##
## Estimated Parameter(s):    variance = 428.4203
##
## Data:                     population
##
## Test Statistic:           Chi-Squared = 21399.59
##
## Test Statistic Parameter: df = 999
##
## P-value:                  0
##

```

```
## 99% Confidence Interval:      LCL = 382.8567
##                               UCL = 482.1786
```

Step VIII. Repeat steps V & VI 100/500/1000 times and count the number of times (and percentage) that the population mean is captured by the confidence interval.

```
## [1] "For n=100: Count = 93 , Percentage = 93 %"
## [1] "For n=500: Count = 476 , Percentage = 95.2 %"
## [1] "For n=1000: Count = 954 , Percentage = 95.4 %"
```

Step IX. Repeat steps V & VII 100/500/1000 times and count the number of times (and percentage) that the population variance is captured by the confidence interval.

```
## [1] "For n=100: Count = 0 , Percentage = 0 %"
## [1] "For n=500: Count = 0 , Percentage = 0 %"
## [1] "For n=1000: Count = 0 , Percentage = 0 %"
```

Q.2] In a filament cut test, a razor blade was tested six different times with ultimate forces corresponding to 8.5, 13.9, 7.4, 10.3, 15.7, 4.0.

a] find 95% confidence interval on mean using standard t-distribution

```
## [1] "For 95% interval: "

##
## Results of Hypothesis Test
## -----
##
## Null Hypothesis:      mean = 0
##
## Alternative Hypothesis: True mean is not equal to 0
##
## Test Name:           One Sample t-test
##
## Estimated Parameter(s): mean of x = 9.966667
##
## Data:                forces
##
## Test Statistic:      t = 5.666986
##
## Test Statistic Parameter: df = 5
##
## P-value:             0.002379959
##
## 95% Confidence Interval: LCL = 5.445722
##                          UCL = 14.487611
```

b] Find a 95% confidence interval on the mean using Efron's percentile method.

```
## BOOTSTRAP CONFIDENCE INTERVAL CALCULATIONS
## Based on 1000 bootstrap replicates
##
## CALL :
## boot.ci(boot.out = bs, conf = 0.95, type = "perc")
##
## Intervals :
## Level      Percentile
## 95%      ( 6.817, 13.300 )
## Calculations and Intervals on Original Scale
```

c) Find a 95% confidence interval on the mean using the BCa method and the ABC method.

```
## [1] "BCa test"

## BOOTSTRAP CONFIDENCE INTERVAL CALCULATIONS
## Based on 1000 bootstrap replicates
##
## CALL :
## boot.ci(boot.out = bsBCa, conf = 0.95, type = "bca")
##
## Intervals :
## Level      BCa
## 95%      ( 6.633, 13.000 )
## Calculations and Intervals on Original Scale

## [1] "ABC test"
## [1] 0.950000 6.863332 13.157697
```

d) Find a 95% confidence interval on the mean using the percentile-t method.

```
## [1] "percentile-t test:"
##          2.5%    97.5%
## mean 5.616667 14.31667
```