Part I) Confidence interval of unknown parameters of Normal distribution

Suppose that we know that the speed measurement on highway 80 is normally distributed and you measured nine cars whose speed were 54,79,65,53,65,54,52,62,75.

1. Confidence interval for mean of Normal distribution with unknown μ and known σ
   Assume that σ=10.
   • What is the 95% confidence interval of μ?
   • What is the 99% confidence interval of μ?

2. Confidence interval for mean of Normal distribution with unknown μ and unknown σ
   Assume that μ and σ is unknown.
   • What is the 95% confidence interval of μ?
   • **Challenge question (Extra pts.)** Is it larger or smaller than the 95% confidence interval in problem 1? Why?

3. Confidence interval for variance of Normal distribution with unknown μ and unknown σ
   Assume that μ and σ is unknown.
   • **Challenge question (Extra pts.)** What is the 95% confidence interval of σ?
     Hint: What is the distribution of variance?

Part II) Simulation of Confidence interval of unknown parameters of Normal distribution

Suppose that X~N(65,100). Generate 1,000 sets of random numbers where each set contains 9 samples from N(65,100)

1. Simulation of confidence Interval of μ from Normal distribution with unknown μ and known σ

    Assume that $\sigma=10$
    - Calculate 95% confidence interval of μ for each of 1,000 sets
    - What is the proportion of 1,000 sample sets that contains 65?

2. **Challenge question (Extra pts.)** Simulation of confidence Interval of μ from Normal distribution with unknown μ and unknown σ

    Assume that μ and σ is unknown.
    - Calculate 95% confidence interval of μ for each of 1,000 sets
    - What is the proportion of 1,000 sample sets that contains 65?

3. **Challenge question (Extra pts.)** Simulation of confidence Interval of σ from Normal distribution with unknown μ and unknown σ

    Assume that μ and σ is unknown.
    - Calculate 95% confidence interval of σ for each of 1,000 sets
    - What is the proportion of 1,000 sample sets that contains $\sigma^2=100$?