Monte Carlo simulations

Addressing actual coverage of confidence interval methods for a Bernoulli population

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Homework 1

Workflow

We simulated 9 different scenarios. Specifically we considered 3 different Bernoulli parameters for the population, then we obtained 3 samples of increasing sizes. We made 1000 Monte Carlo simulations for each scenario.

$\alpha = 0.05$

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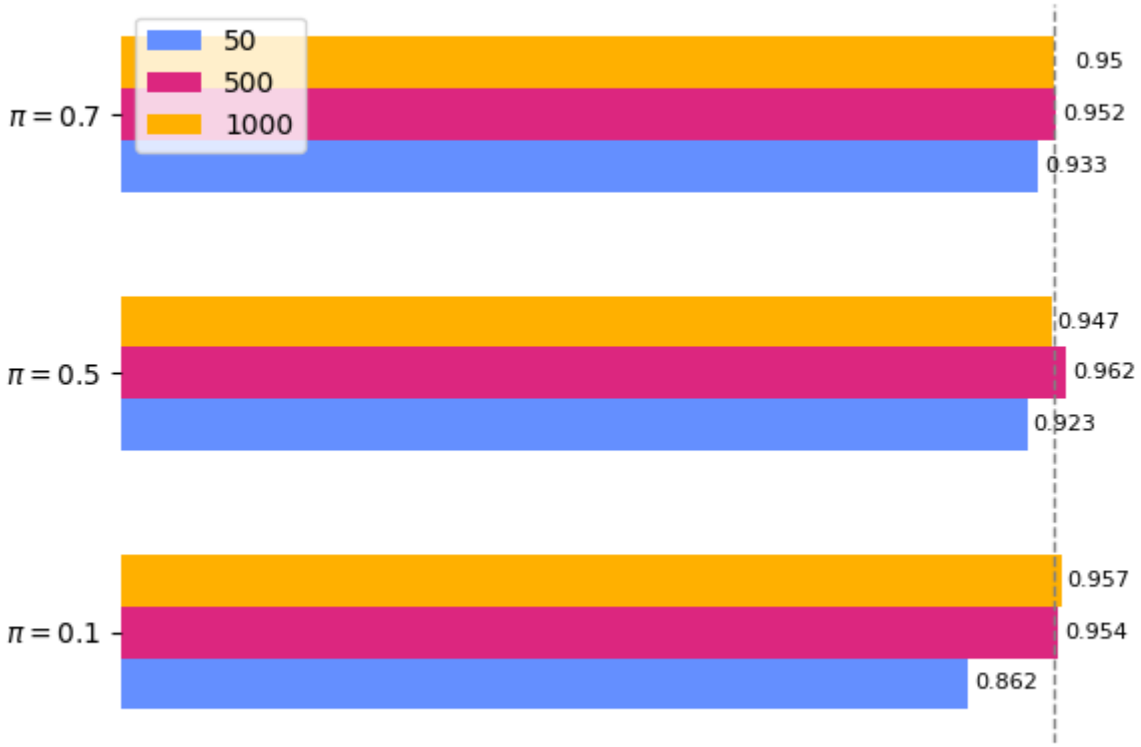
[1] "Actual coverage con pi = 0.1 e n = 50 :  0.872"
[1] "Actual coverage con pi = 0.1 e n = 500 :  0.951"
[1] "Actual coverage con pi = 0.1 e n = 1000 :  0.96"
[1] "Actual coverage con pi = 0.5 e n = 50 :  0.917"
[1] "Actual coverage con pi = 0.5 e n = 500 :  0.945"
[1] "Actual coverage con pi = 0.5 e n = 1000 :  0.945"
[1] "Actual coverage con pi = 0.7 e n = 50 :  0.941"
[1] "Actual coverage con pi = 0.7 e n = 500 :  0.947"
[1] "Actual coverage con pi = 0.7 e n = 1000 :  0.956"
```

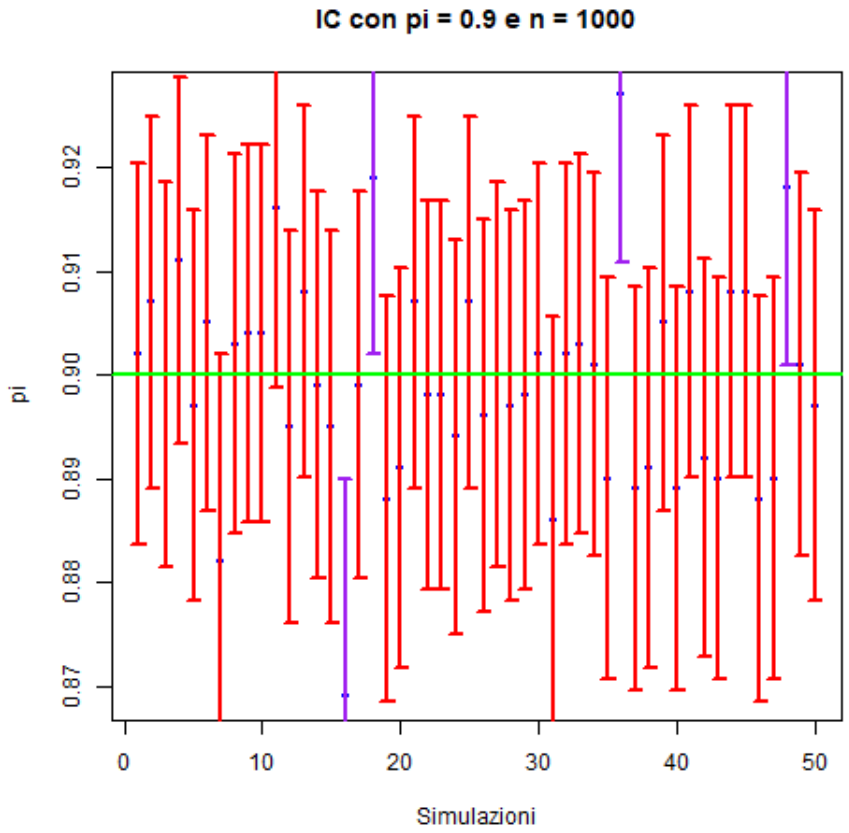
Results

As we can see, increasing the number of simulations can help obtain a more accurate estimate of the true coverage.



50 Monte Carlo simulations for CI

Actual coverage: 0.92 (46 CIs out of 50 contain the true pi value)
Theoric coverage: 0.95



We chose 50 iterations to show graphically what's happening:

In this case we have an **underestimation**, which may be due to an **insufficient number of Monte Carlo iterations**.

References

Homework1_2.pdf

ChatGPT