Experiment Report

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Abstract

This article aims to conduct experiments and compare results for a particular mathematical theorem.

1 Introduction

By conducting experiments, the goal is to produce a experiment report for a particular mathematical theorem.

2 Math Environments

Consider approximation of the distribution function of $N(0,1)$,

$$\Phi(t) = \int_{-\infty}^{t} \frac{1}{\sqrt{2\pi}} e^{-y^2/2} dy, \tag{1}$$

by the Monte Carlo methods:

$$\hat{\Phi}(t) = \frac{1}{n} \sum_{i=1}^{n} I(X_i \leq t), \tag{2}$$

where X_i's are a random sample from $N(0,1)$, and $I(\cdot)$ is the indicator function.

3 Table

Experiment with the approximation at $n \in \{10^2, 10^3, 10^4\}$ at $t \in \{0.0, 0.67, 0.84, 1.28, 1.65, 2.32, 2.58, 3.09, 3.72\}$ to form a table. The table should include the True Value for Comparison.

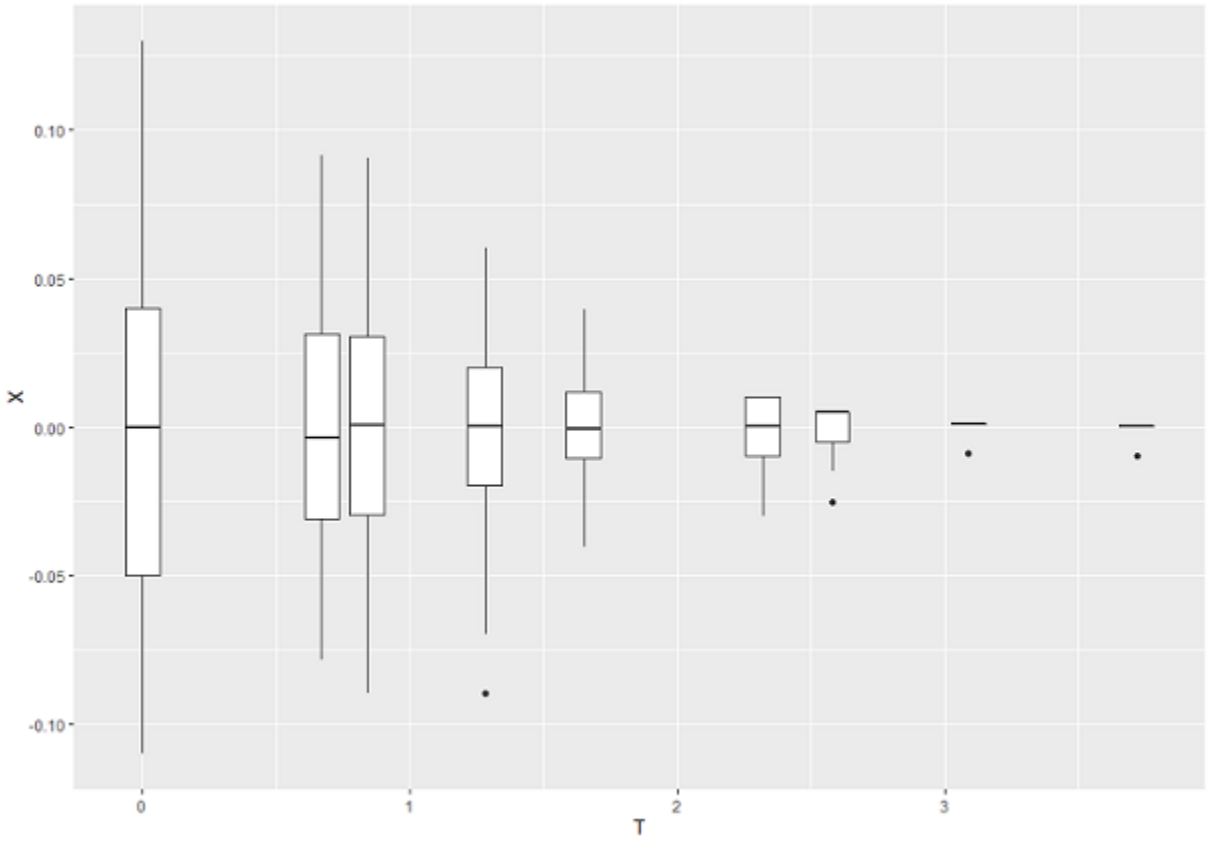
Table 1: The true value for comparison

t	true	value1	value2	value3
0.00	0.5000000	0.51	0.501	0.4935
0.67	0.7485711	0.70	0.738	0.7476
0.84	0.7995458	0.78	0.785	0.7975
1.28	0.8997274	0.92	0.896	0.8962
1.65	0.9505285	0.96	0.946	0.9469
2.32	0.9898296	0.98	0.990	0.9893

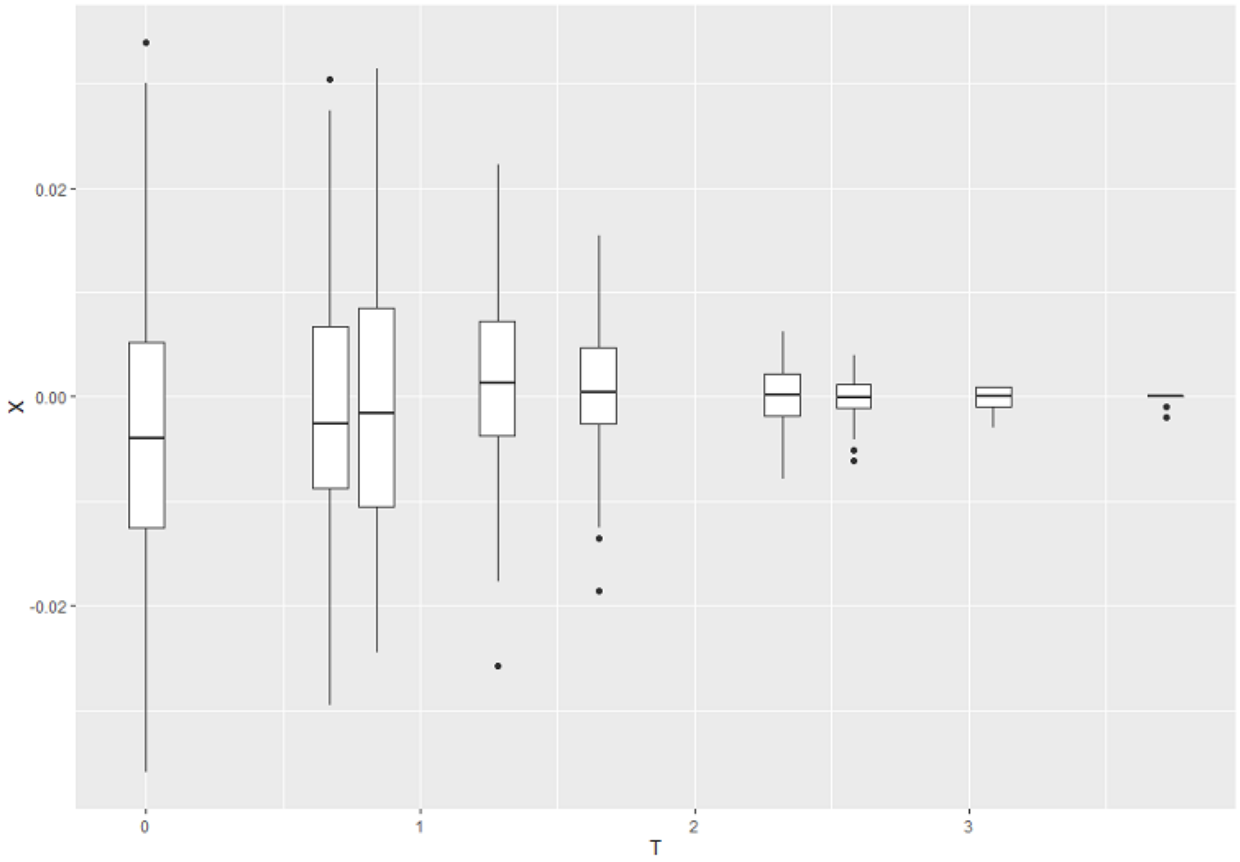
4 Figures

By repeating the experiment 100 times, draw box plots of the 100 approximation errors at each t using ggplot2 for each n.

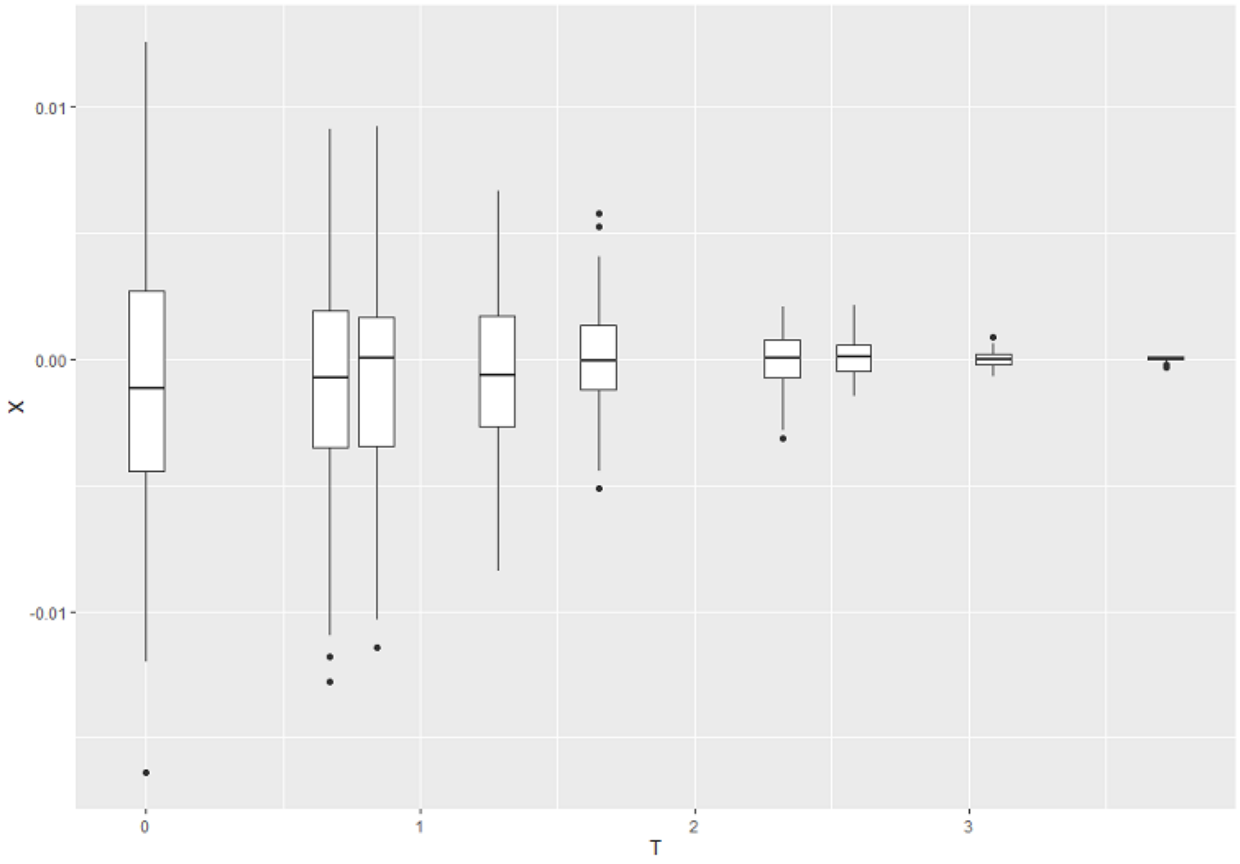
4.1 When n=10^2,



4.2 When n=10^3,



4.3 When n=10^4,



5 Conclusion

I form a table by experiencing with the approximation at different values of n and t, and draw box plots of the 100 approximation errors at each t using ggplot2 for each n. As you can see from the above three boxplots, the error range is smaller and closer to zero as n increases, and the error range is also smaller and closer to zero as t increases.