Stochastic Methods Lab, Jacobs University Bremen, Fall 2020

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Session 19
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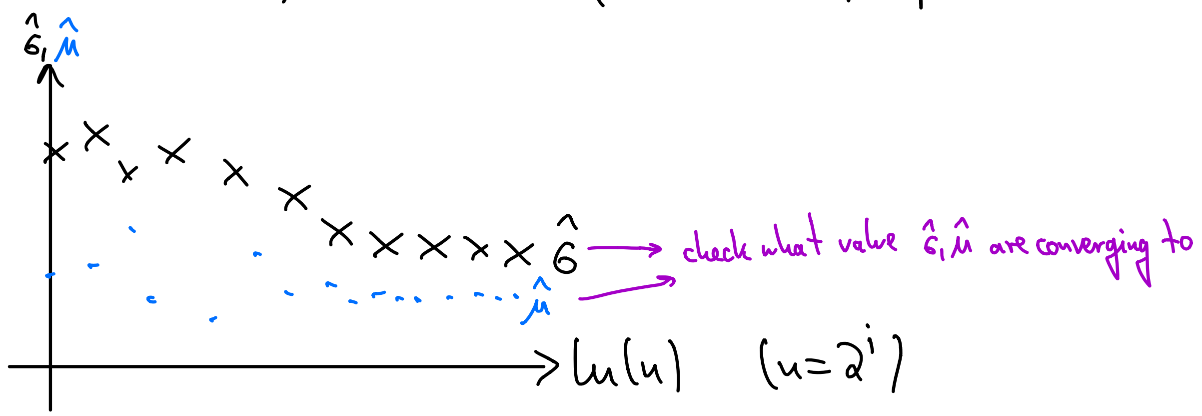
Homework:

a) one realization of GBM, size 2^k

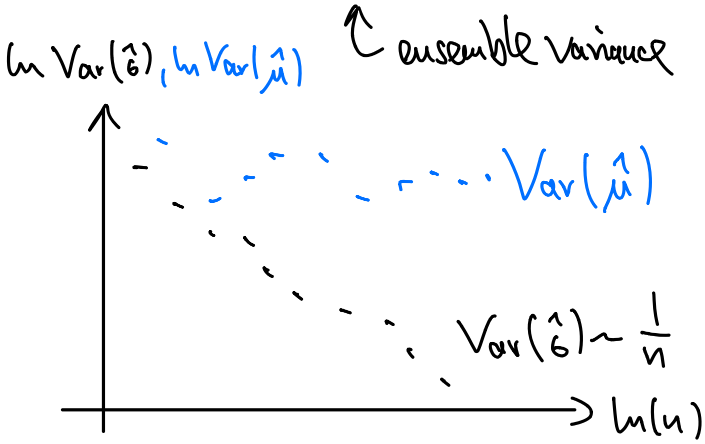
then estimate $\hat{\mu}, \hat{\sigma}$ for every 2^i-th sample point, $i = 0, \dots, k-1$



python: "semilogx(...,...)" for plot with logarithmic x-axis

b) ensemble of GBMs with some parameters

↳ $\mathrm{Var}(\hat{\sigma})$, $\mathrm{Var}(\hat{\mu})$ ← ensemble variance



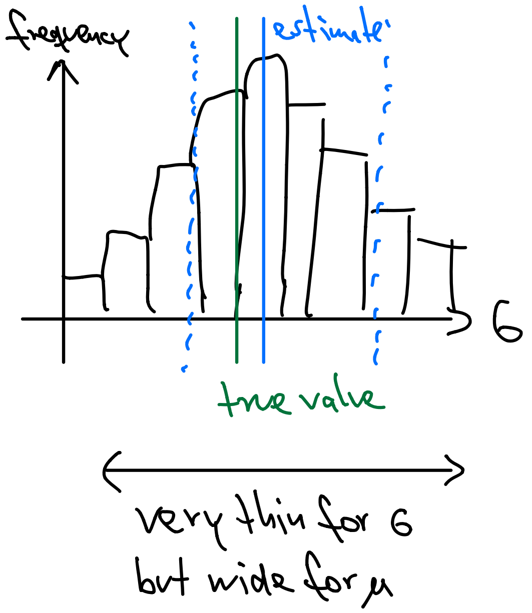
c) "Backtracking"

- given a single time series from part a) $\longrightarrow$ compute $\hat{\mu}, \hat{\sigma}$

- generate ensemble of GBMs with these parameters
- compute $Var(\hat{\mu}), Var(\hat{\sigma})$

$\Rightarrow$ test how reliable estimate was

python: hist(sigma_distribution, number of bins, histtype='stepfilled')



d), e), f) consider some noise sources:

- periodic noise : $S_{per} = \underset{\leftarrow GBM}{S} + c_1 \sqrt{\Delta t}\, \sin(2\pi \underset{\text{frequency}}{f}\, \text{arange}(N+1))$

- Gaussian noise : $S_{Gauss} = S + c_1 \sqrt{\Delta t}\, \text{normal}(0, 1, N+1)$

- how does the noise change estimates for $\hat{\mu}, \hat{\sigma}$?
- normality?
- independence?