1 Convolution of Uniform Distributions

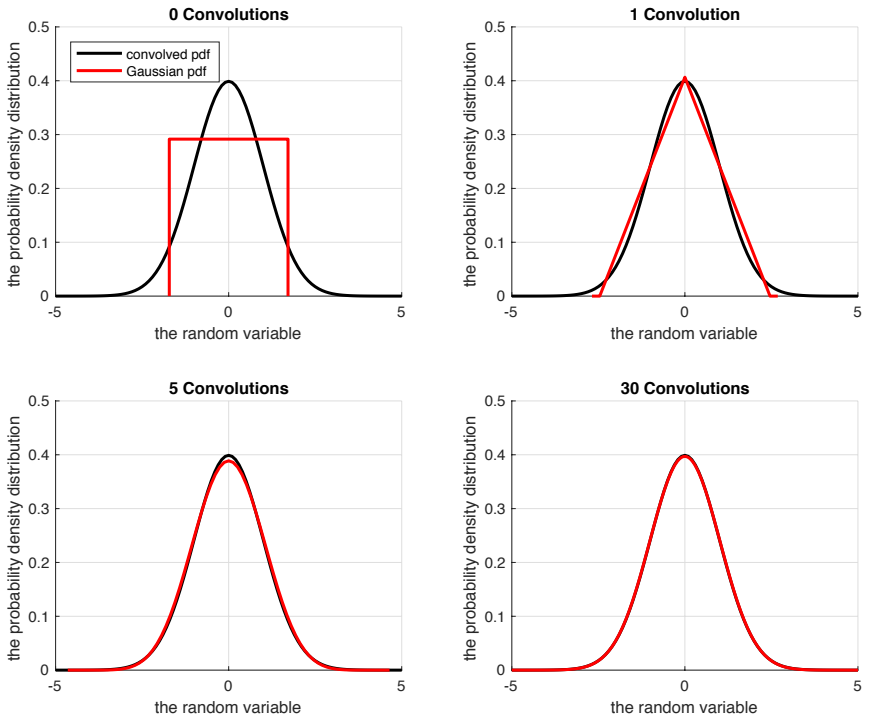

Figure 1: Convolutions of uniform pdf (red) compared to the Gaussian pdf (black). All pdf's are adjusted for $\mu = 0$ and $\sigma^2 = 1$. Note the clear convergence of the convolved pdf to the Gaussian pdf, demonstrating the Central Limit Theorem.

2 Convolution of Non-Uniform Distributions

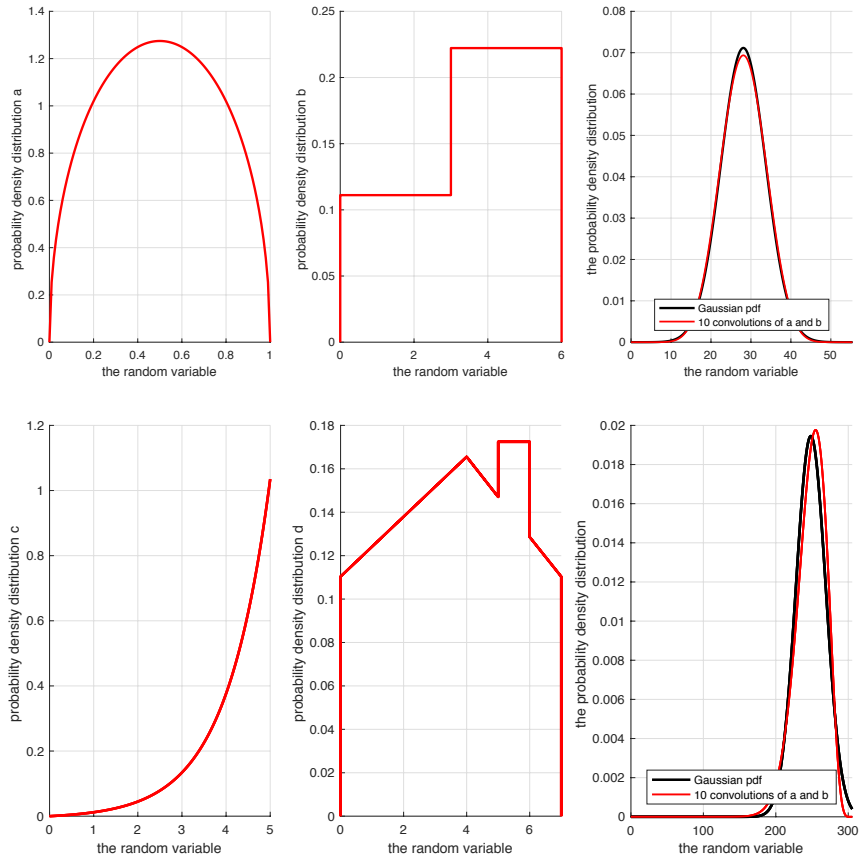

Figure 2: Convolutions of non-uniform pdf's (red) compared to the Gaussian pdf (black). Top: A semi-circular pdf convolved with a step-shaped pdf; Bottom: An exponential-shaped pdf convolved with a house-shaped pdf. Note that despite having different and somewhat arbitrary shape and location, there is still convergence to the Gaussian pdf after 30 convolutions.

3 χ^2 Test Against "TRUE" Distribution

Demonstration of χ^2 test of whether random samples of a normally distributed population came from that "TRUE" population. Sample frequency in binned areas was compared to "TRUE" frequency of the area under the pdf curve within those bin edges (Figure **??**) and a χ^2 value was calculated using **equation (6)**.

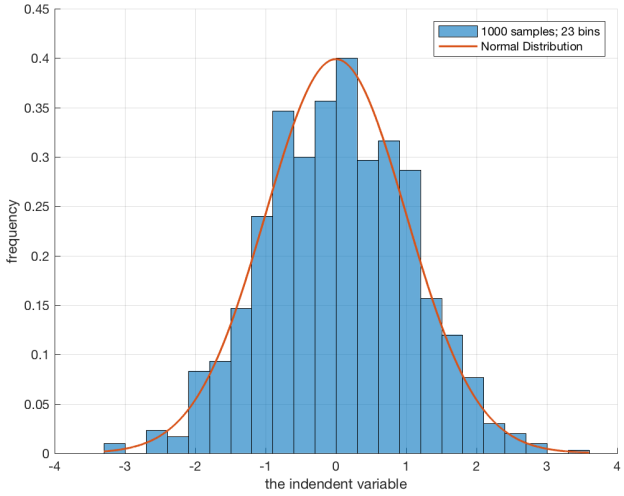

Figure 3: Example of samples drawn (blue histogram) compared to the pdf from which they were taken (red line).

The test is done by comparing the χ^2 value from our samples to the χ^2_{k-3} pdf. The probability of obtaining a higher χ^2 value than the one observed is calculated from the area under the curve of the χ^2_{k-3} pdf from the χ^2 to ∞ (Figure 4).

SOME RESULTS FROM (3):
Gaussian compared to TRUE distribution: 1000 samples
fraction that pass at 95% confidence
0.7540
0.7550
0.7640
0.7490

" " " at 80% confidence
0.5340
0.5080

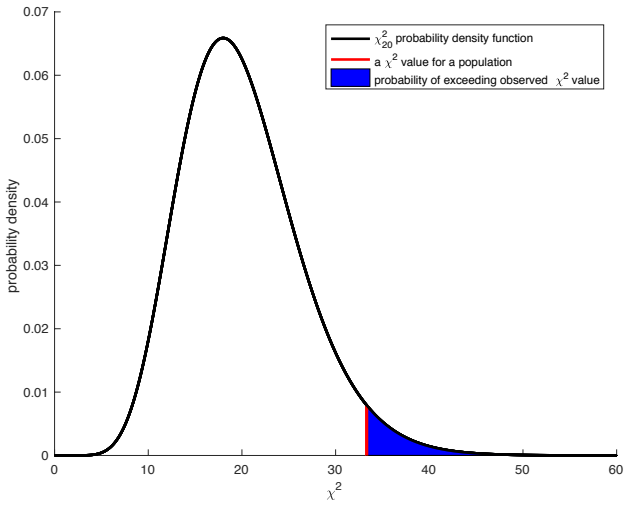

Figure 4: Example an observed χ^2 value compared to the χ^2_{k-3} pdf, with the shaded area representing the probability used in the test.

0.5420
0.5440

4 χ^2 Test Against "FALSE" Distribution

Demonstration of χ^2 test of whether random samples pulled from a Rayleigh pdf came from a "FALSE" population (i.e. a Gaussian pdf of the same μ and σ^2). Sample frequency in binned areas was compared to "FALSE" frequency of the area under the pdf curve within those bin edges (Figure 5) and a χ^2 value was calculated using **equation (6)**.

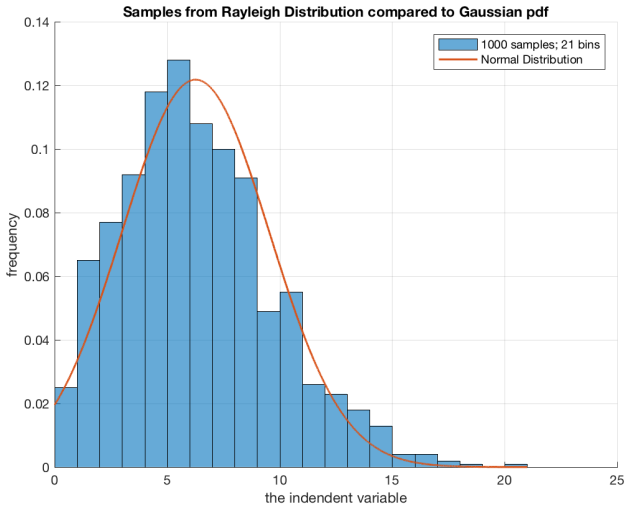

Figure 5: Example of samples drawn (blue histogram) compared to the "FALSE" pdf from which they were NOT taken (red line).

SOME RESULTS FROM (4)
Rayleigh distribution compared to Gaussian: 95% confidence
50 samples
0.5060
0.4760
0.4940
75 samples
0.4690
0.4480
0.4400
100 samples
0.3540
0.3750

0.3550
250 samples
0.1410
0.1310
0.1210
500 samples
0.0210
0.0180
0.0190
750 samples
0.0030
0
0.0020
1000 samples
none pass