CS215 Assignment1 Problem 4

Anish Kulkarni and Parth Pujari

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1   M shaped PDFs

The code from Draws.m does the following:

Generates a random number between -1 and 1 ($rand() - 0.5) * 2$)

If the generated number is positive, finds its square root

If negative, finds the square root of its absolute value

Assuming we have n numbers uniformly distributed throughout -1 to 1. We have dx/n numbers between x and $x + dx$, and similarly $2xdx/n$ numbers between x^2 and $x^2 + 2xdx$. On taking their square root, these $2xdx/n$ numbers fall into the range x to $x + dx$. Therefore, in any interval dx, the number of random values generated would be $2xdx/n$ which is proportional to x. Hence the histogram is the graph $y = |x|$.

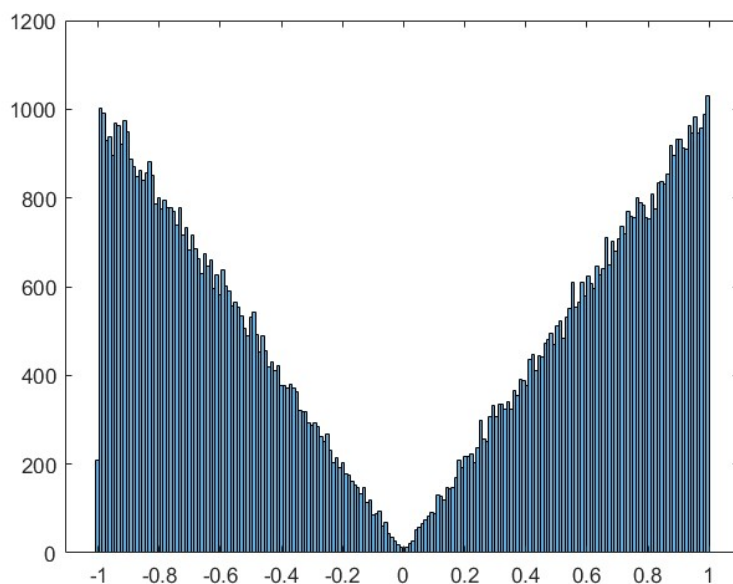The following are the histogram and the cdf for the mentioned distribution.
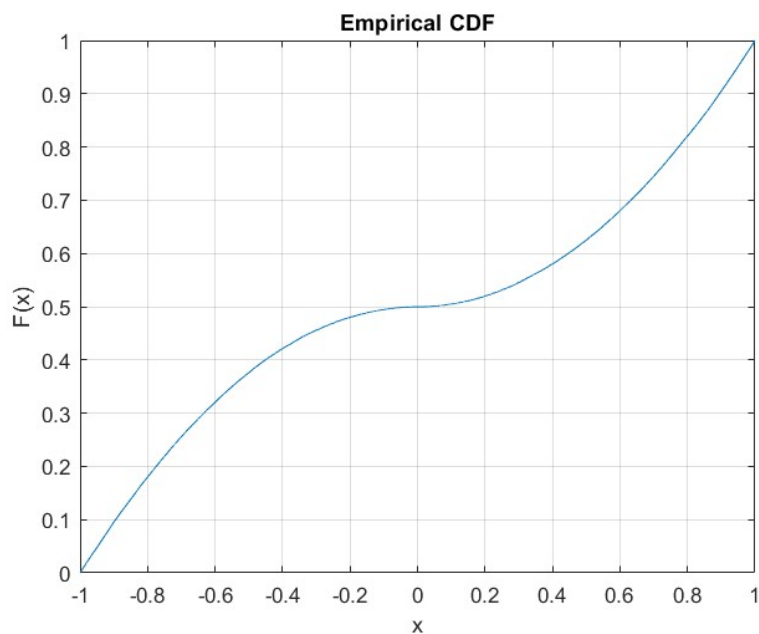

Figure 1: M shaped histogram

Figure 2: Cumulative Distribution Function

2   Average Plots

The function AvgDraws(N) returns the average of N draws from the Draws function mentioned above.
AvgPlots takes 10^4 such averages of 1, 2, 4, 8, ...64 variables generated from Draws() and plots their histograms and CDFs. Our histograms agree with the Central Limit theorem, approaching the bell curve on increasing the number of variables whose averages are being calculated.
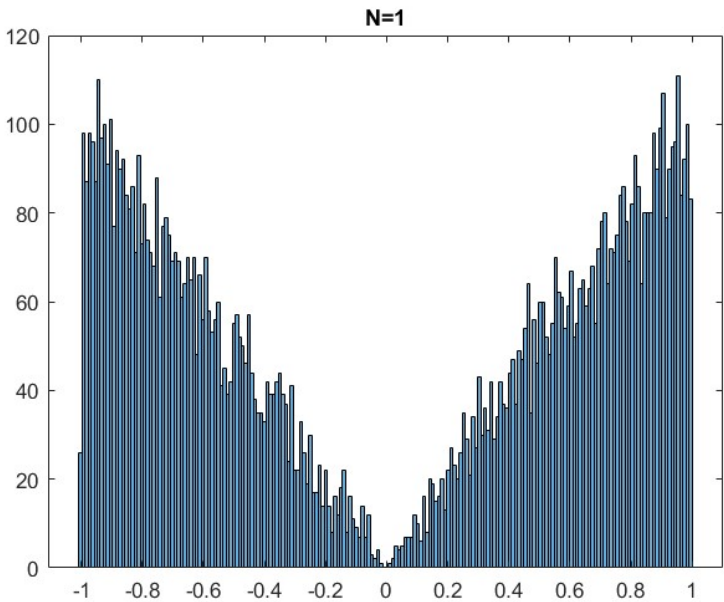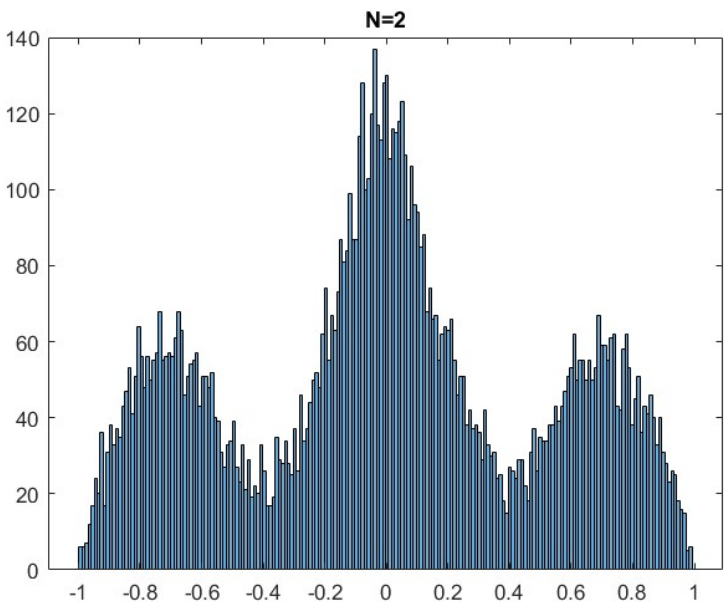The following figures show the histograms and the CDFs of the generated variables.
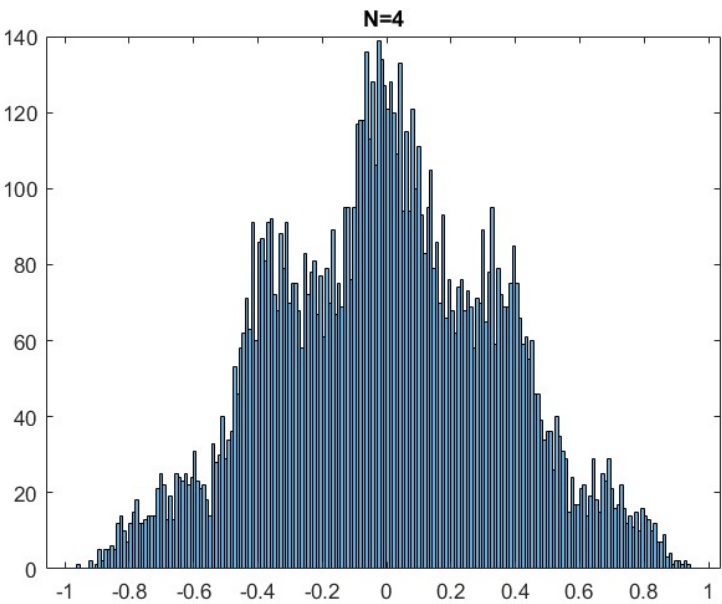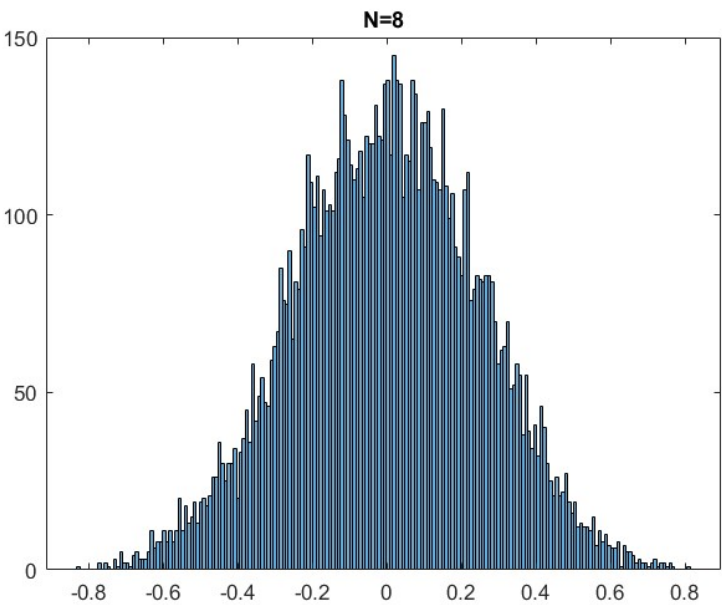
Figure 3: N=1

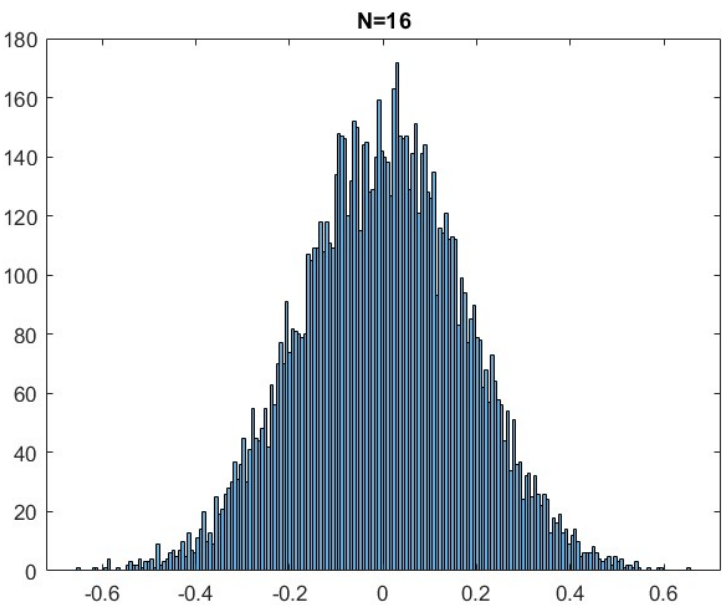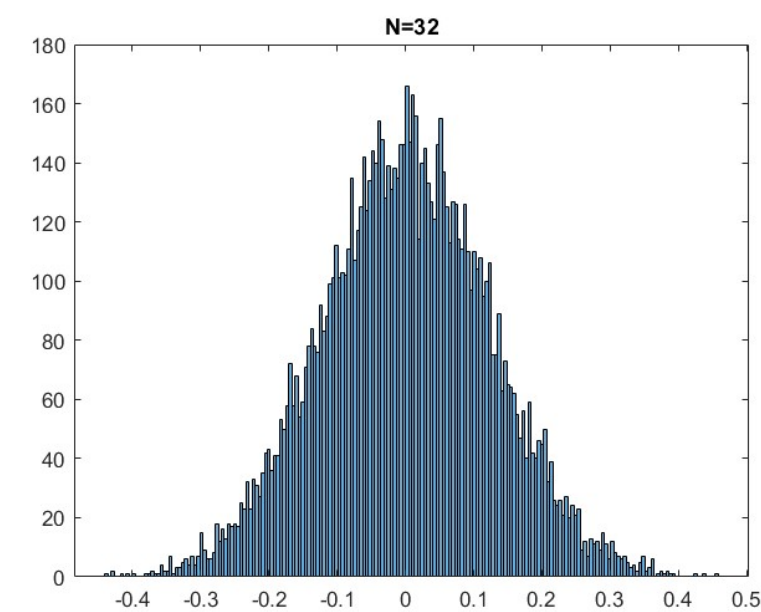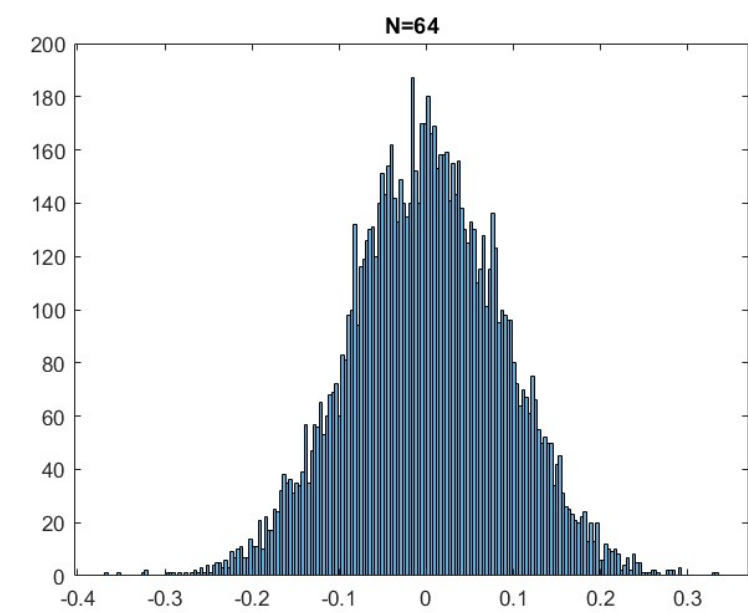Figure 4: N=2

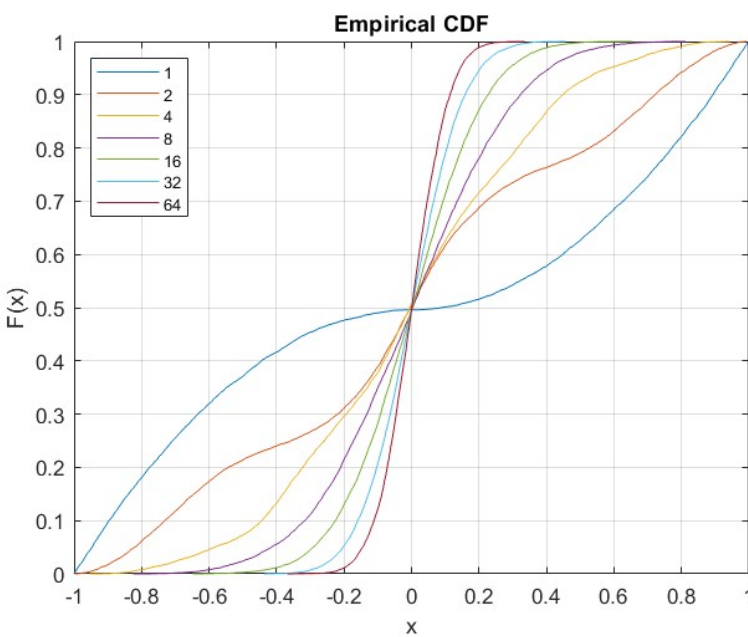Figure 5: N=4

Figure 6: N=8

Figure 7: N=16

Figure 8: N=32

Figure 9: N=64

Figure 10: CDF