

### Computer Assignment 2: The Central Limit Theorem

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The Central Limit Theorem (CLT) is an extremely important result in probability theory. The essence of the CLT is that the distribution of the sum of a large number of independent random variables approaches a Gaussian. The objective of this assignment is to demonstrate (and visualize) this convergence using MATLAB. The following tasks/functions serve as a guide, however you are welcome to write your own code and approach if you wish. Submit all figures with the corresponding MATLAB code by the due date.

**Task 1:** Use Matlab to generate a sufficiently large matrix **A** of size  $N \times N$  with IID entries. The entries of the matrix **A** can follow the distribution of your choice, except Gaussian.

*Hint: Research these functions in Matlab to generate the random matrix entries: `expnd()`, `rand()`, `raylrnd()`, ..., and many more. You can use any distribution except Gaussian.*

**Task 2:** Form a vector **a** (of size  $N \times 1$ ) by selecting the first column of the matrix **A**, i.e. **a** = **A**(:,1). The entries of this vector should follow the distribution of **A**.

**Task 3:** Form a vector **z** (of size  $N \times 1$ ) by summing the columns (or rows) of the matrix **A**, i.e. **z** = `sum(A')`. The entries of this vector should follow the Gaussian distribution by the CLT.

**Task 4:**

Use the generated data in Tasks 2 and 3 to plot the PDF of **a** and **z**.

*Hint: you may find this Matlab function helpful for this Task `histogram(.)`.*

Use these figures as guide for Task 4. Your plots should look similar but not necessarily the same.

