SANS - HW1

alba.canete.garrucho and riccardo.cecco

November 2021

1 Discrete Random Variables

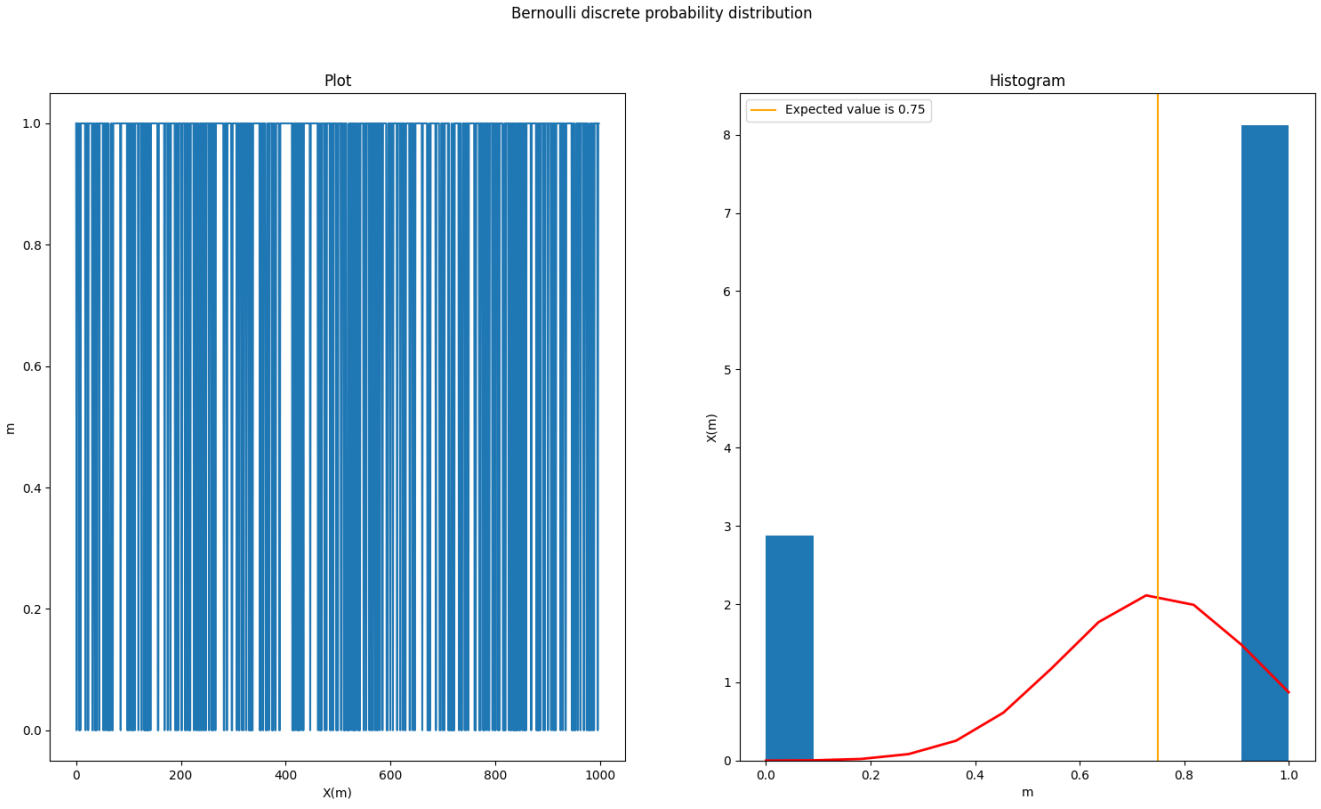

Figure 1: Bernoulli discrete probability distribution

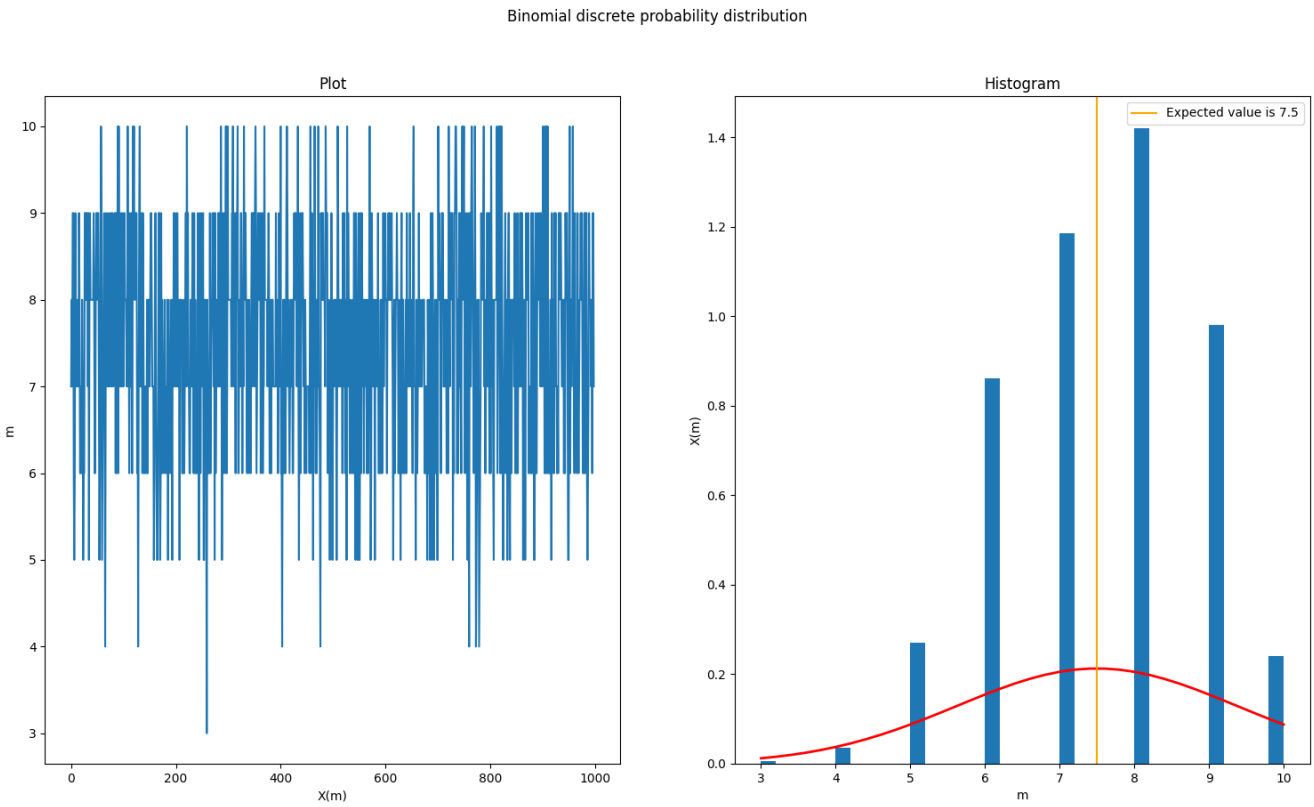

Figure 2: Binomial discrete probability distribution

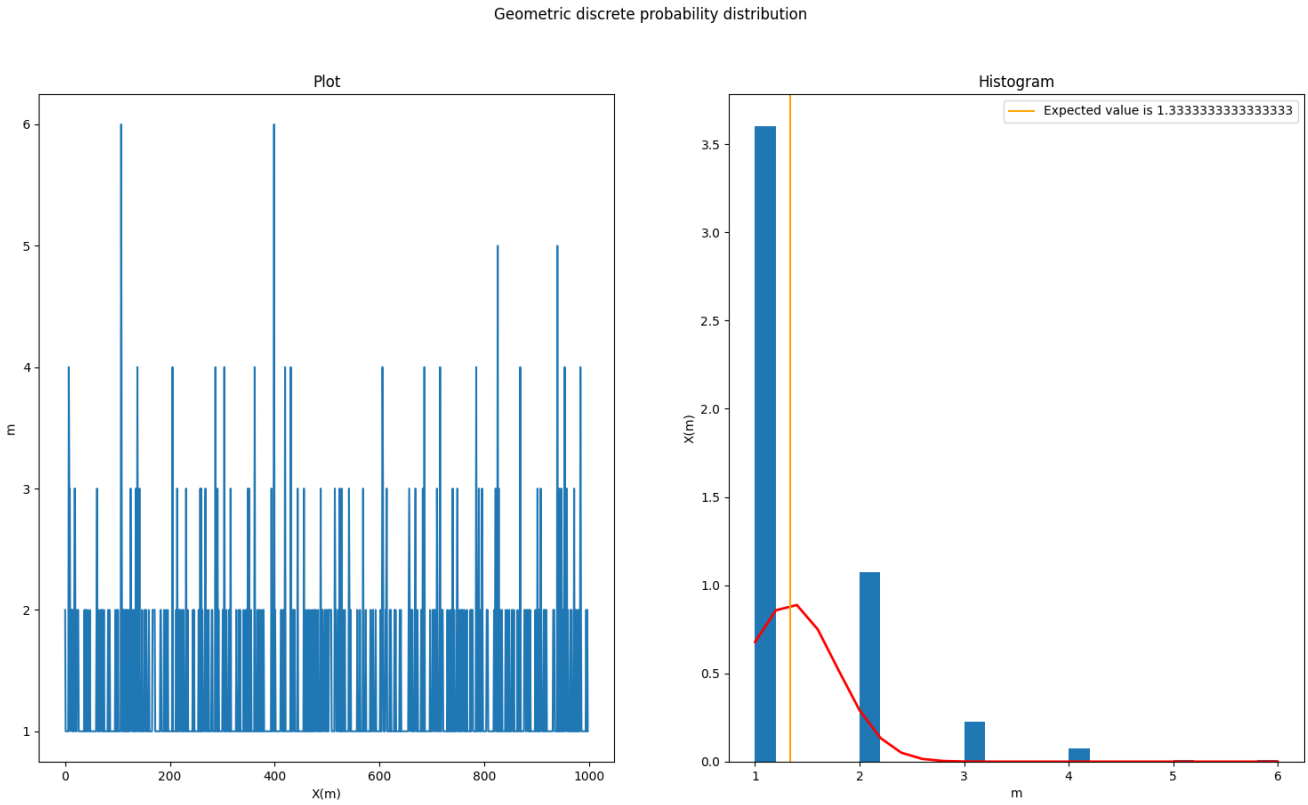

Figure 3: Geometric discrete probability distribution

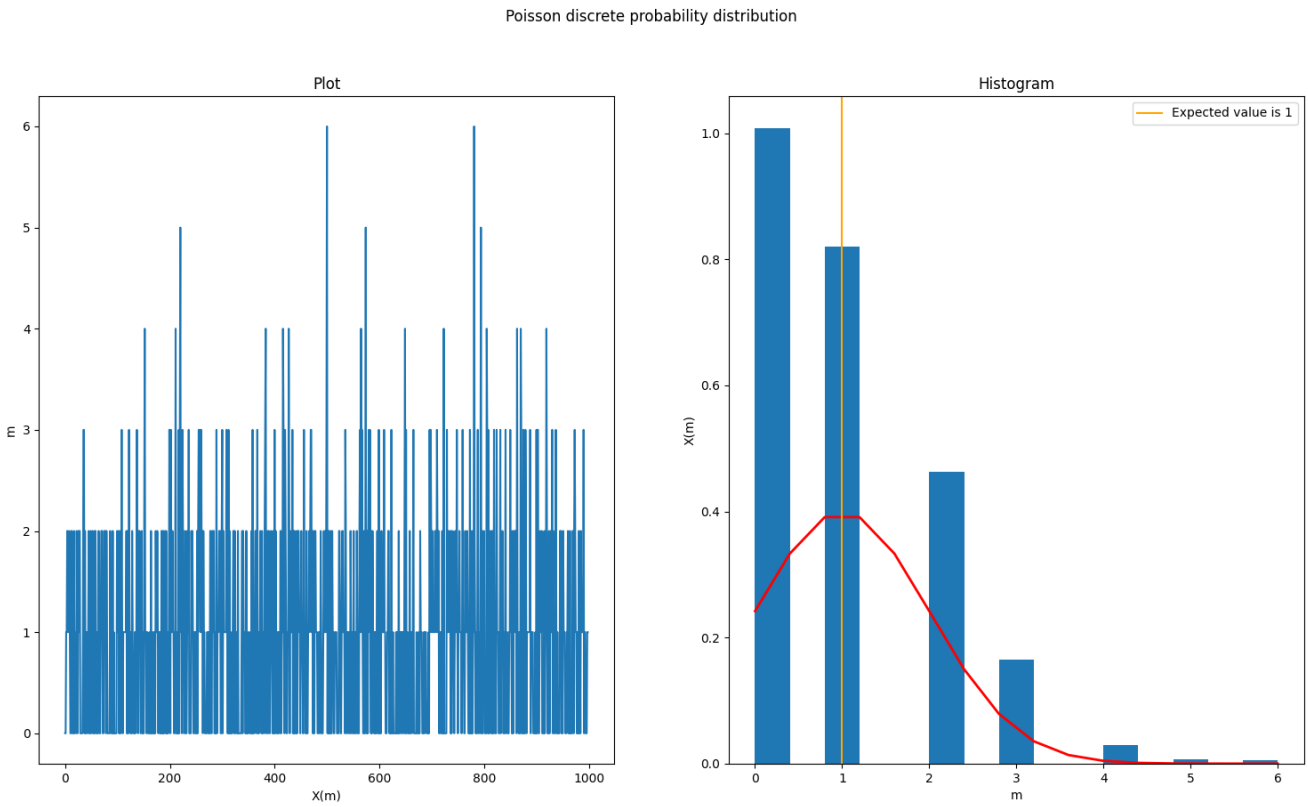

Figure 4: Poisson discrete probability distribution

2 Continuous Random Variables

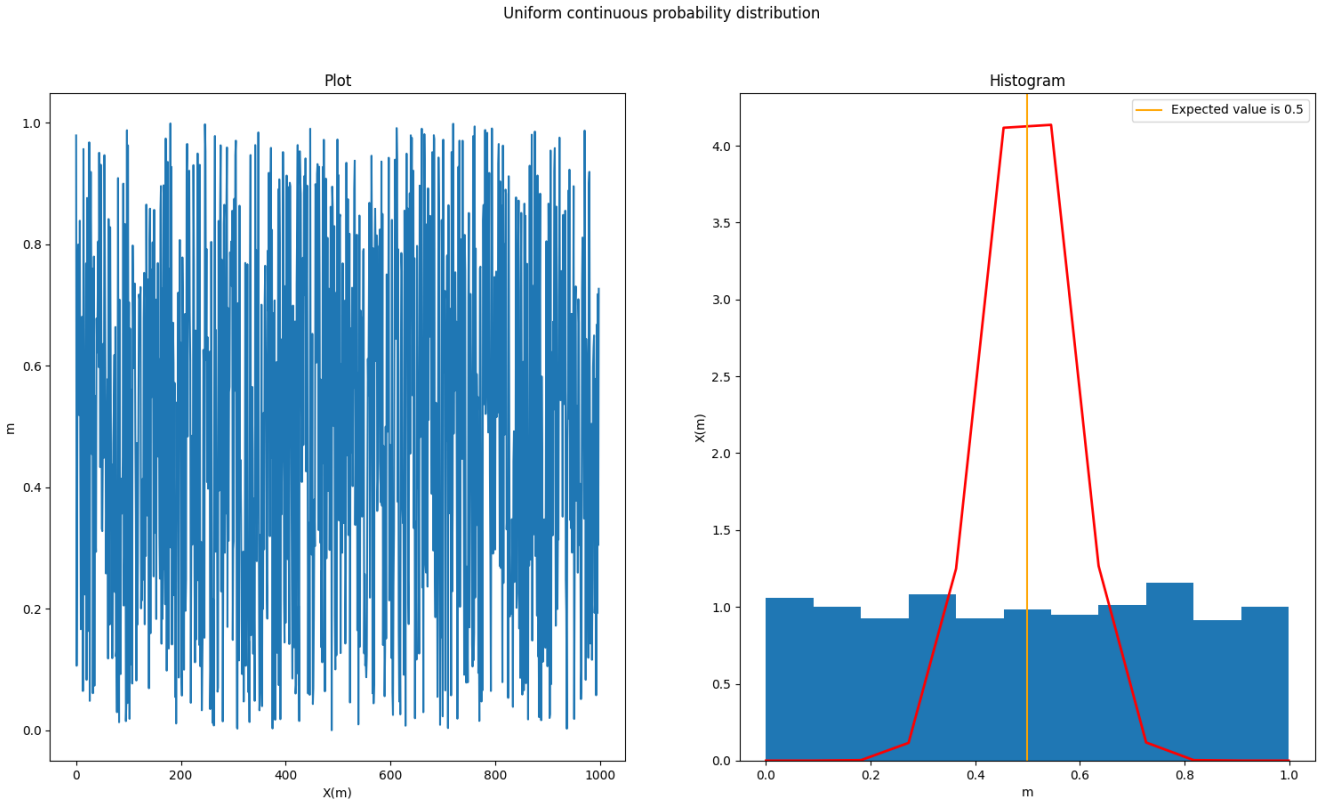

Figure 5: Uniform continous probability distribution

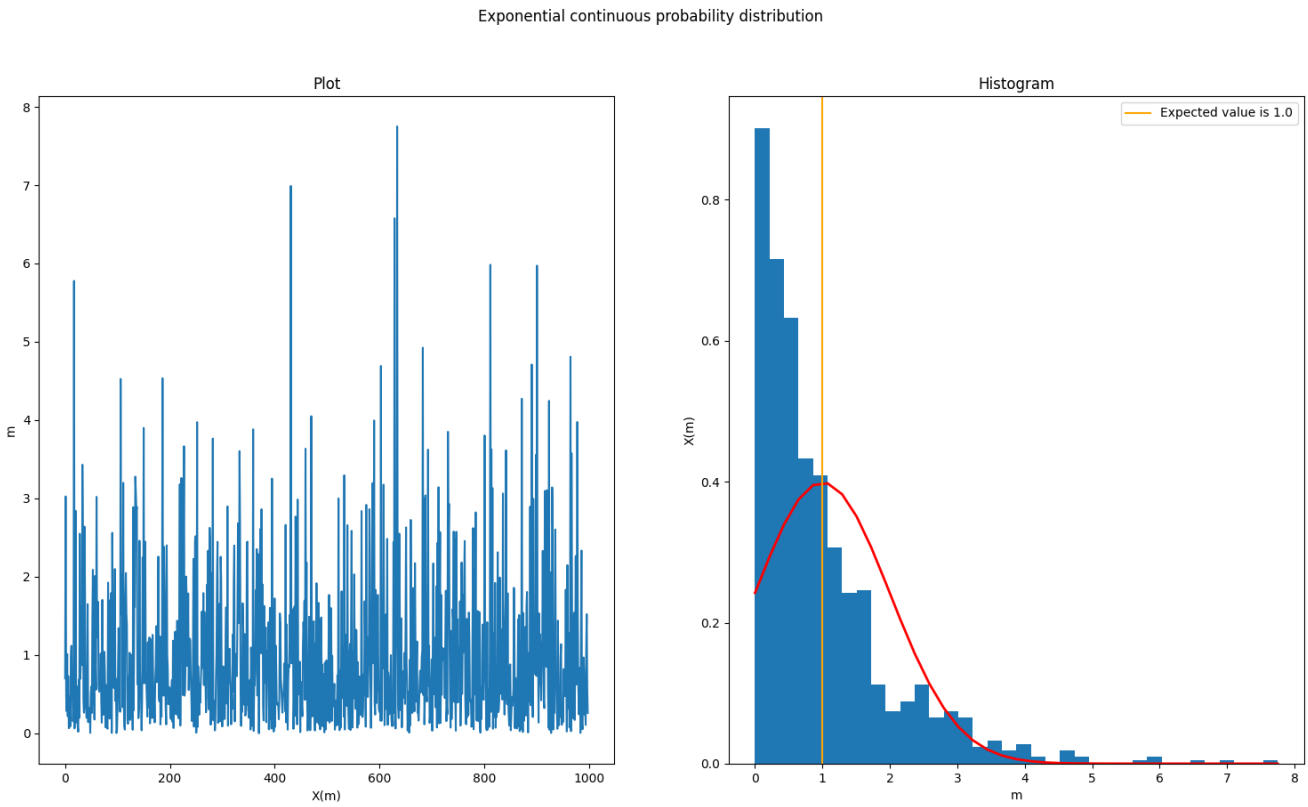

Figure 6: Exponential continous probability distribution

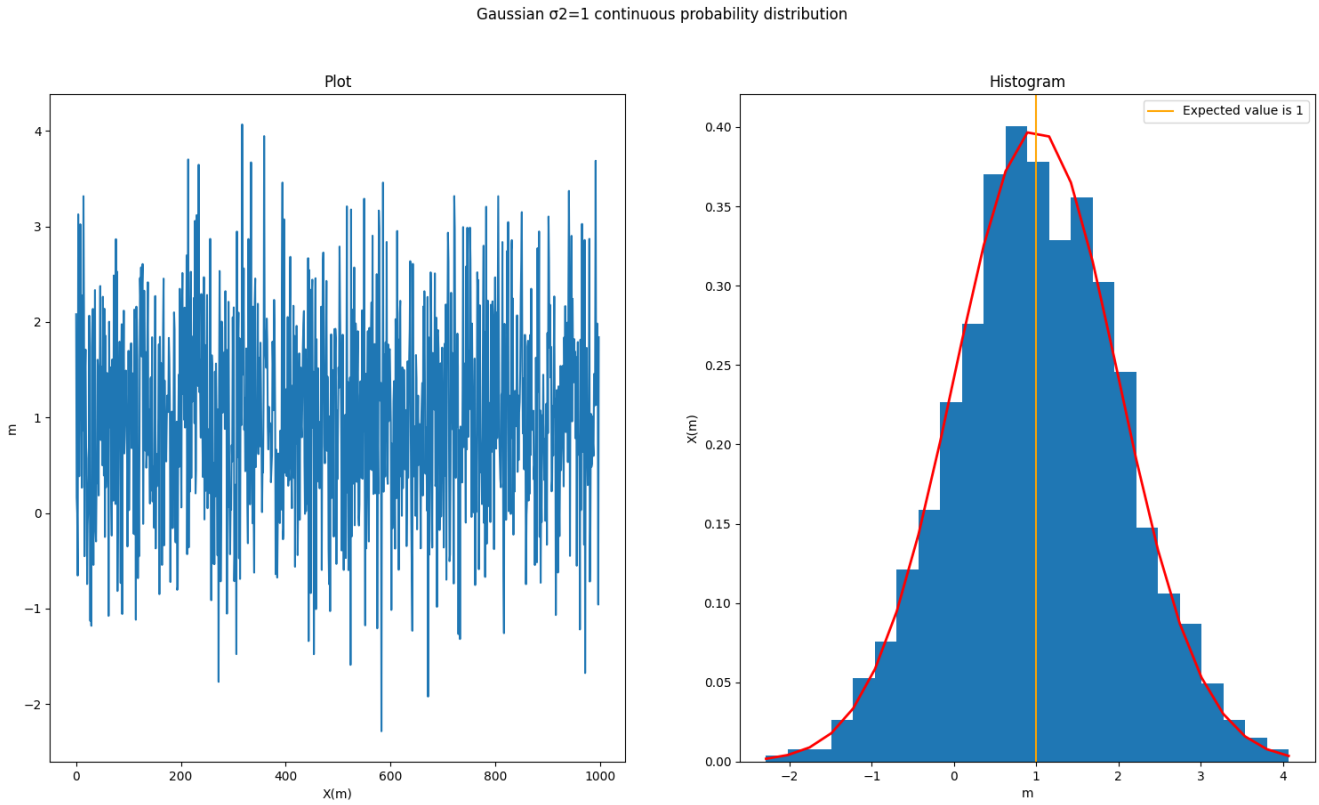

Figure 7: Gaussian with continous probability distribution

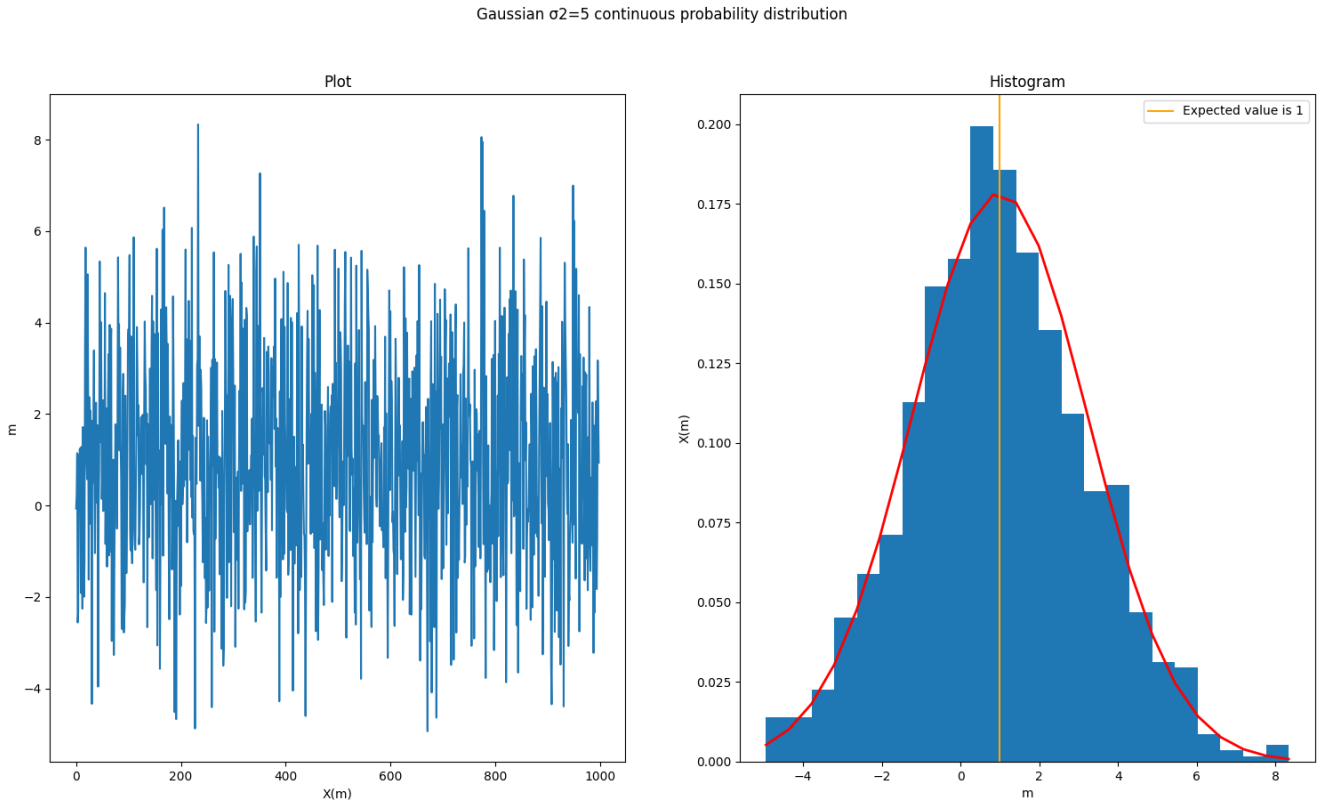

Figure 8: Gaussian with continous probability distribution

3 Law of Large Numbers, LLN

The (Weak) Law of Large Numbers (LLN) says that the distribution of X_n^* concentrates around its average for large n.

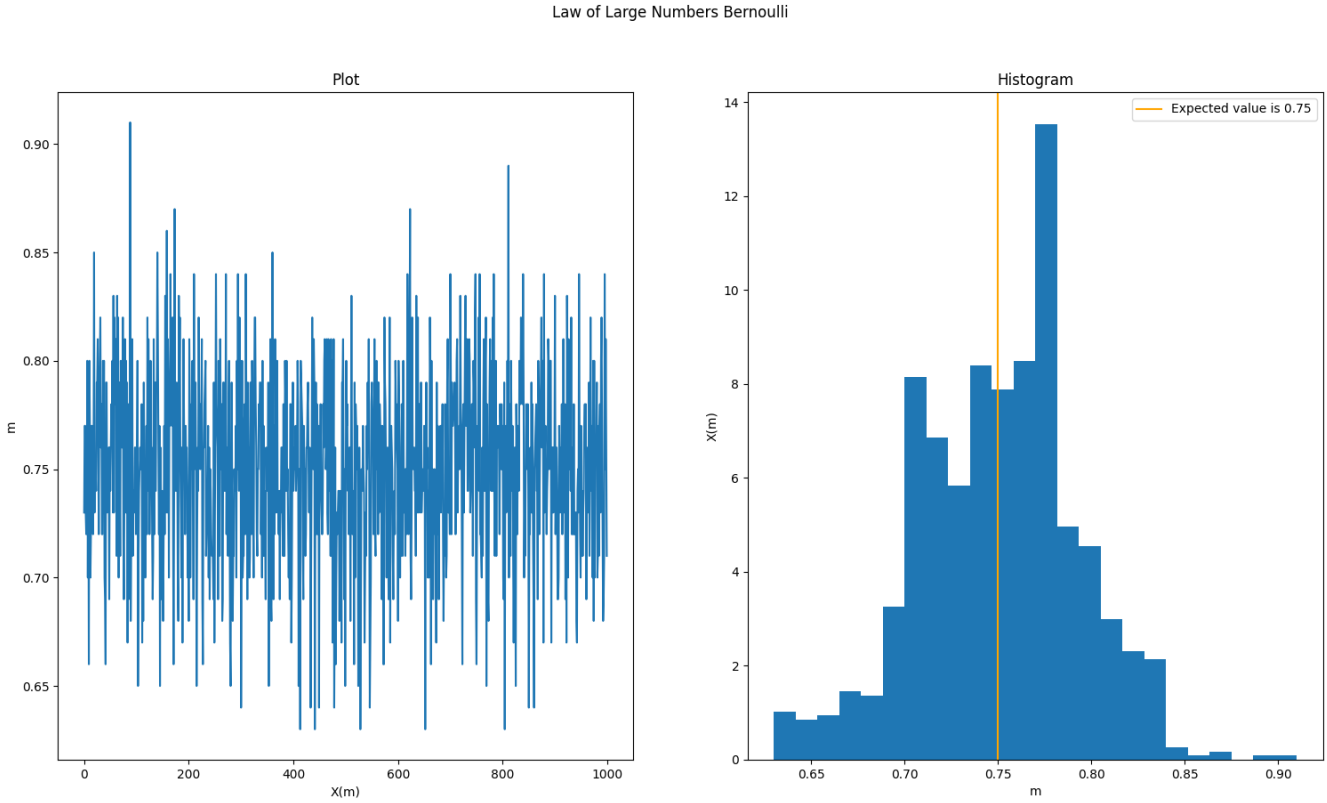

Figure 9: Law of Large number for Bernoulli discrete probability distribution

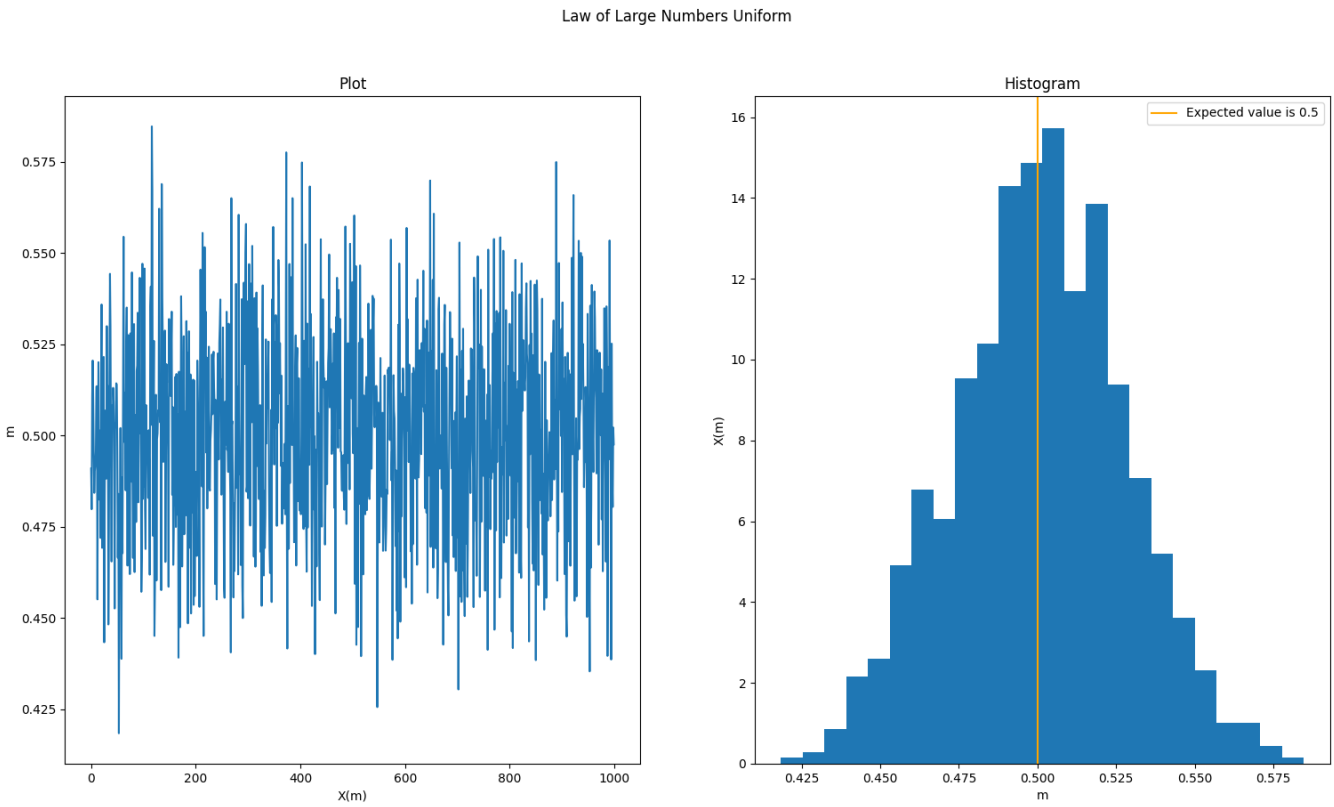

Figure 10: Law of Large number for Uniform continuous probability distribution

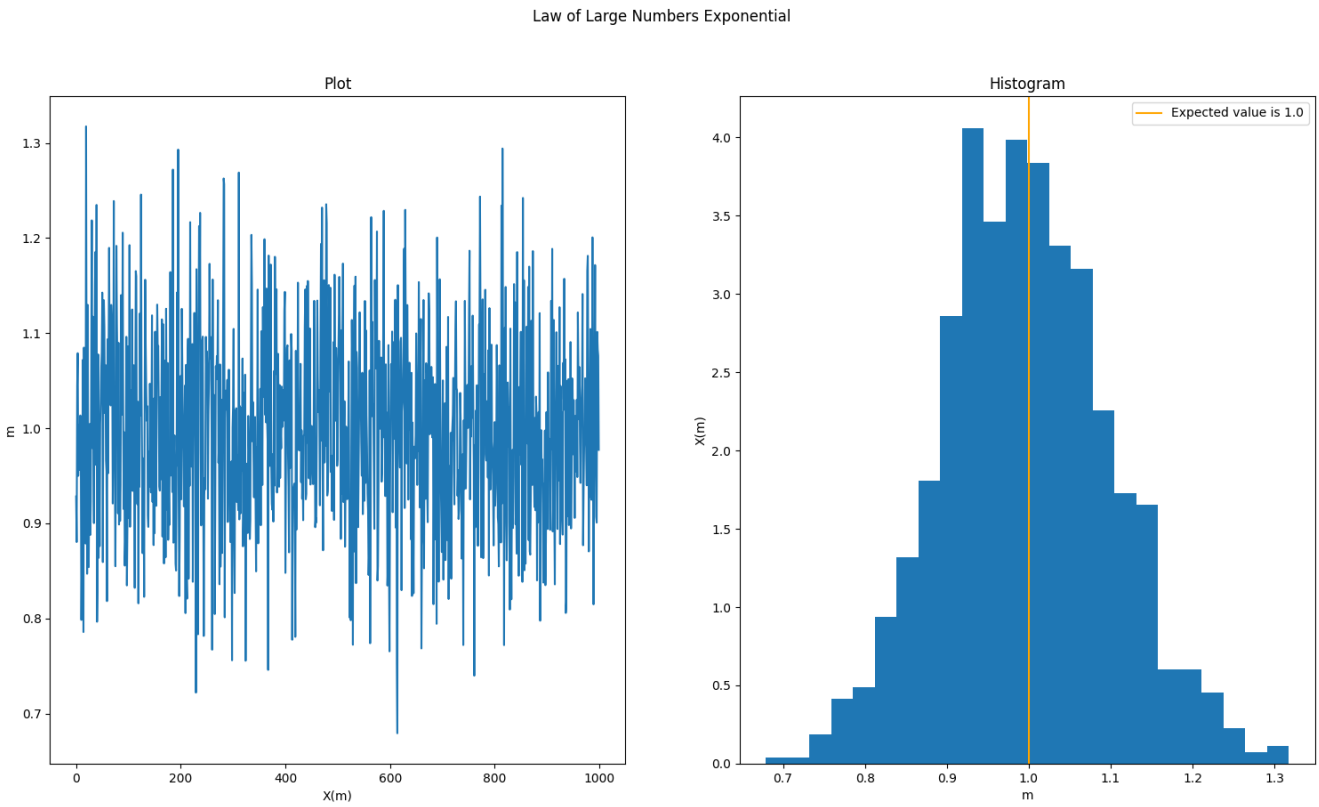

Figure 11: Law of Large number for Exponential continuous probability distribution

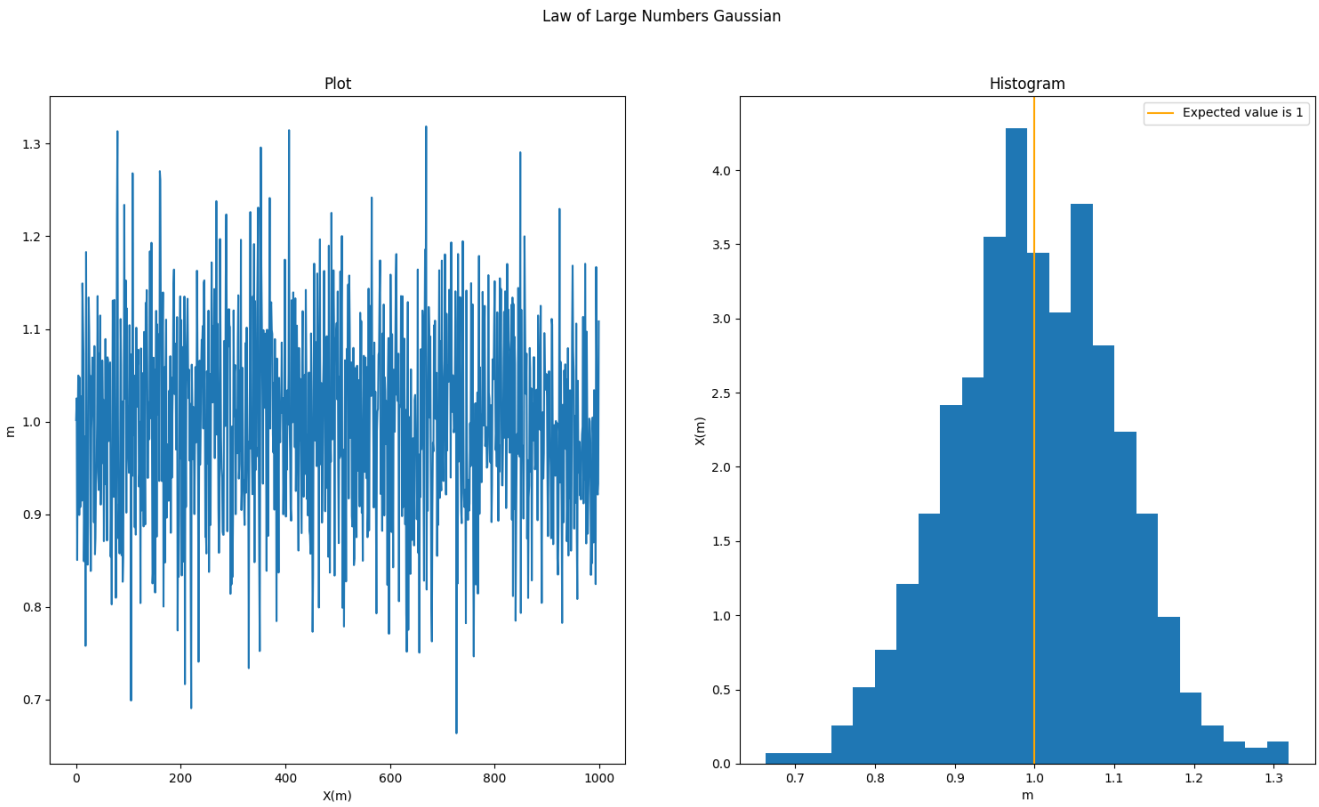

Figure 12: Law of Large number for Gaussian continuous probability distribution

4 Central Limit Theorem, CLT

The Central Limit Theorem states that the shape on the limit does not depend on the shape of the initial distribution. It will always be Gaussian.

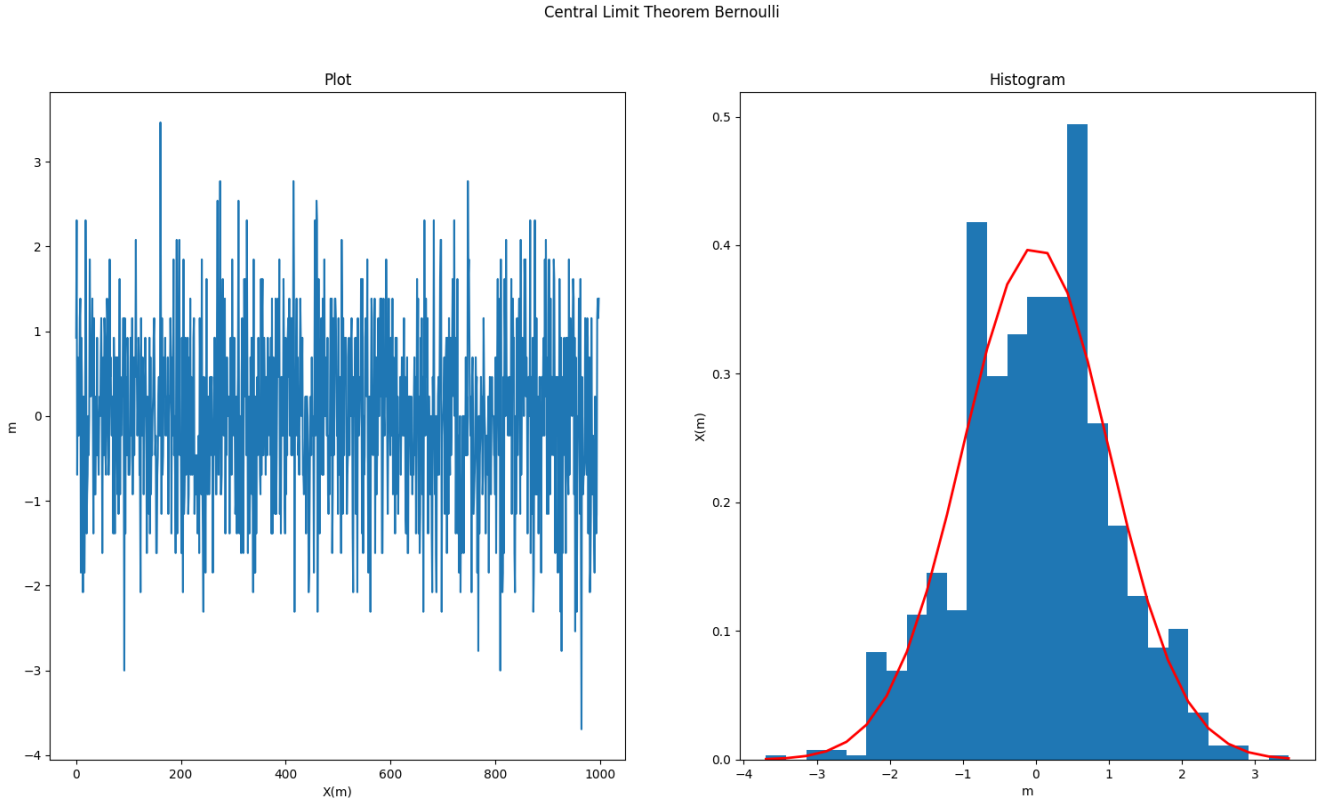

Figure 13: Central Limit Theorem Bernoulli distribution

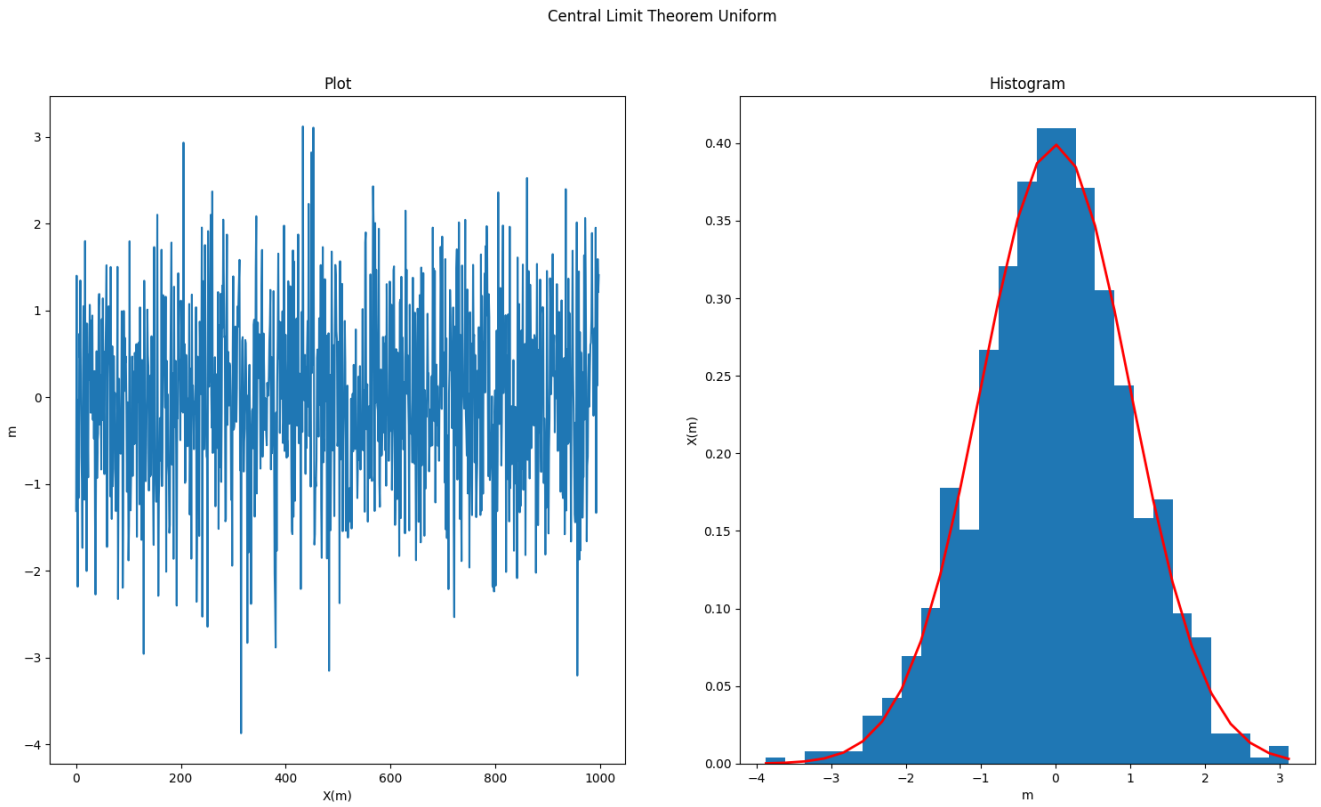

Figure 14: Central Limit Theorem Uniform distribution

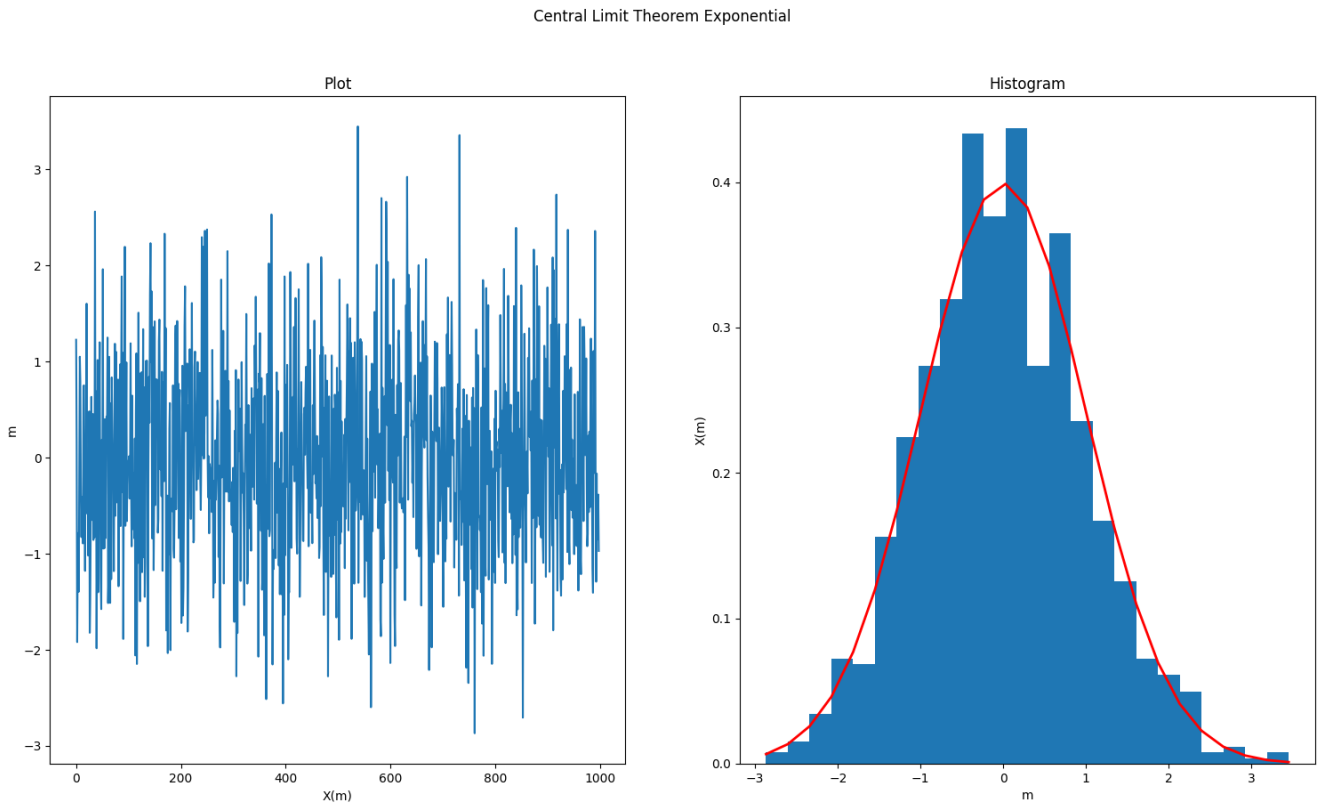

Figure 15: Central Limit Theorem Exponential distribution

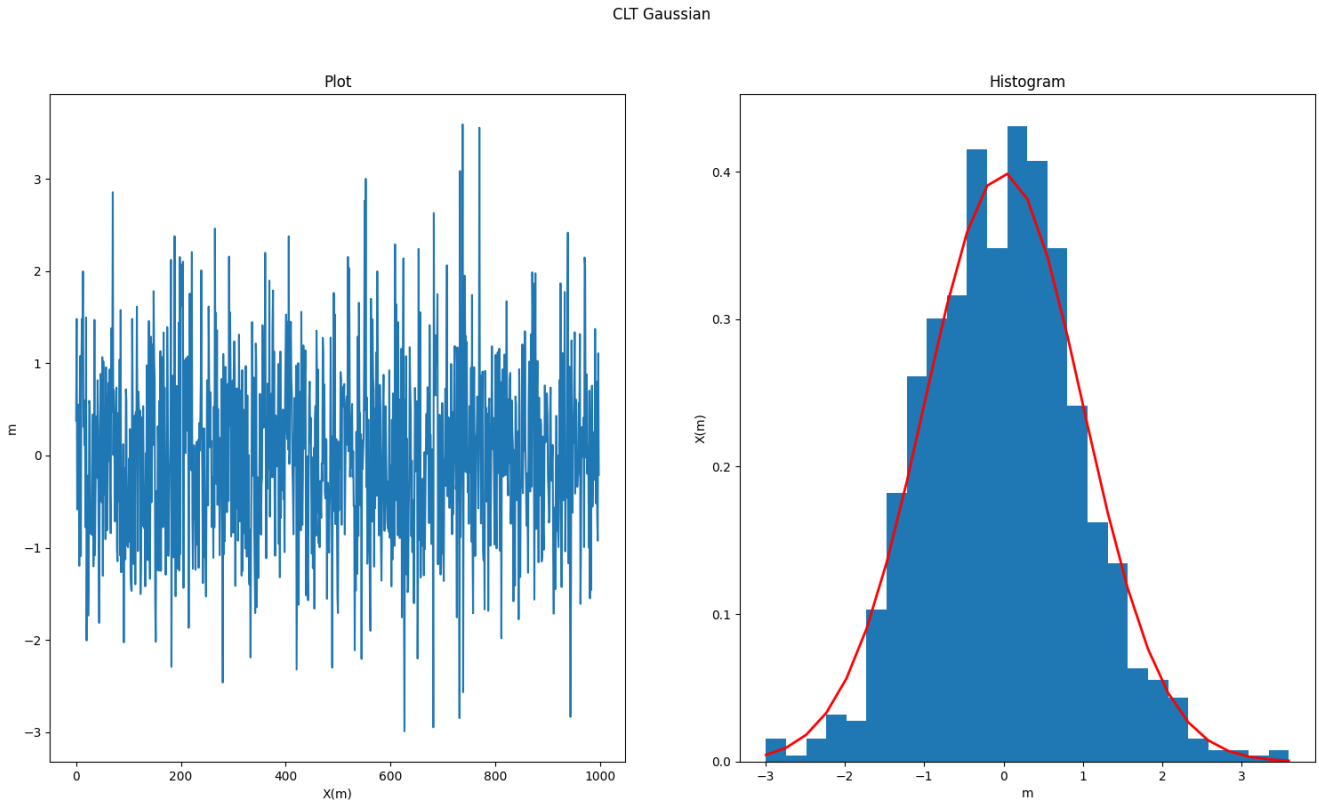

Figure 16: Central Limit Theorem Gaussian distribution

5 Multivariate Gaussian

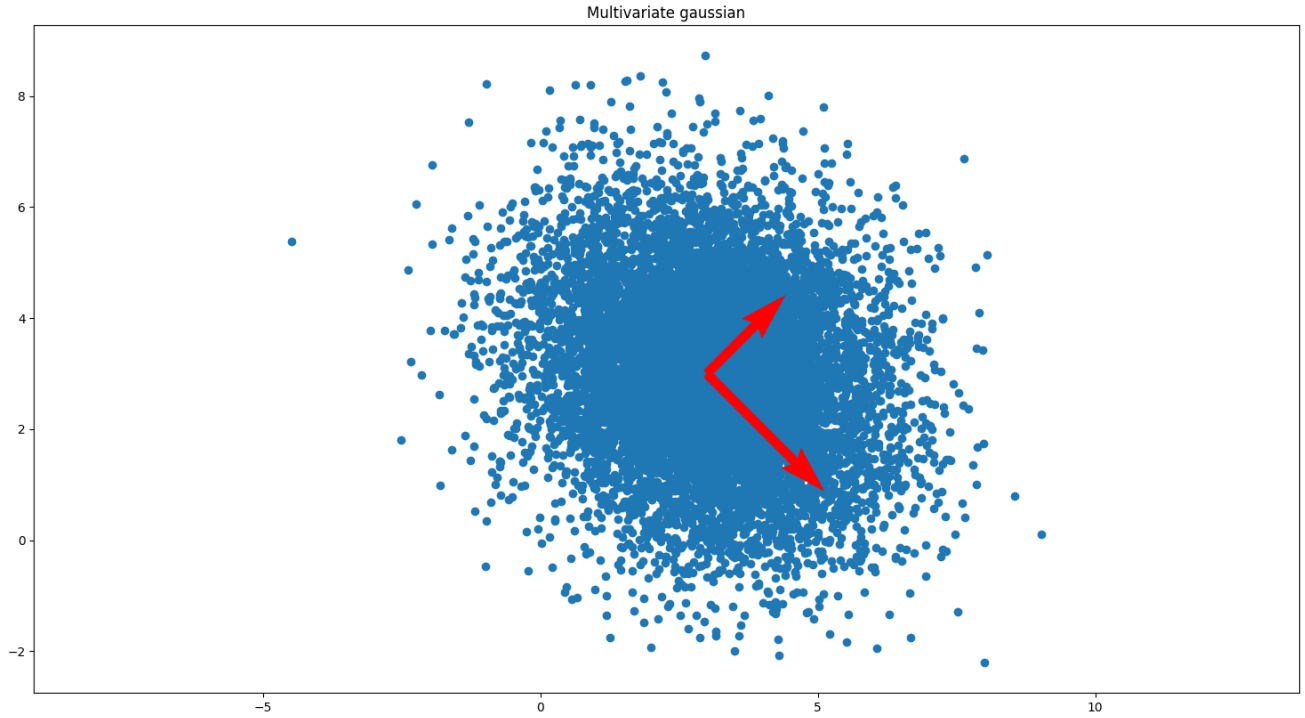

Figure 17: Multivariate Gaussian

6 Subspaces, eigenvalues and eigenvectors

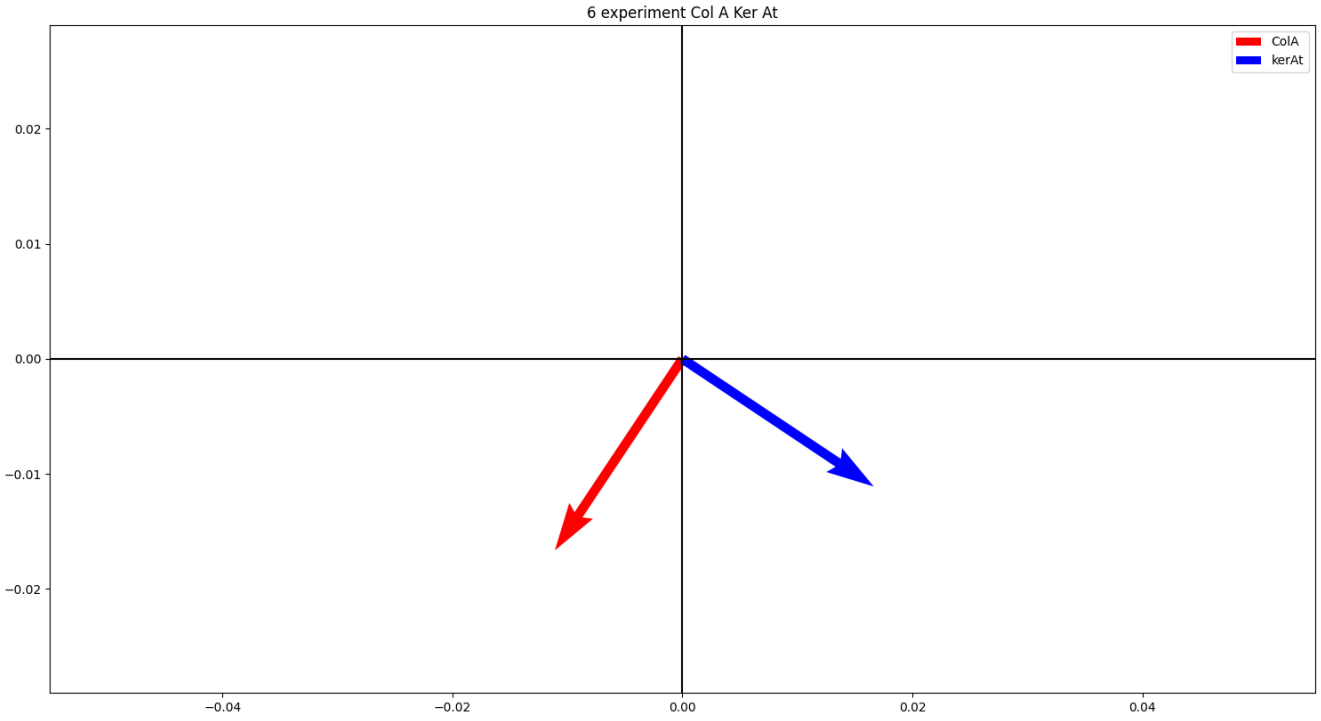

Figure 18: Col(A) Ker(A^t)

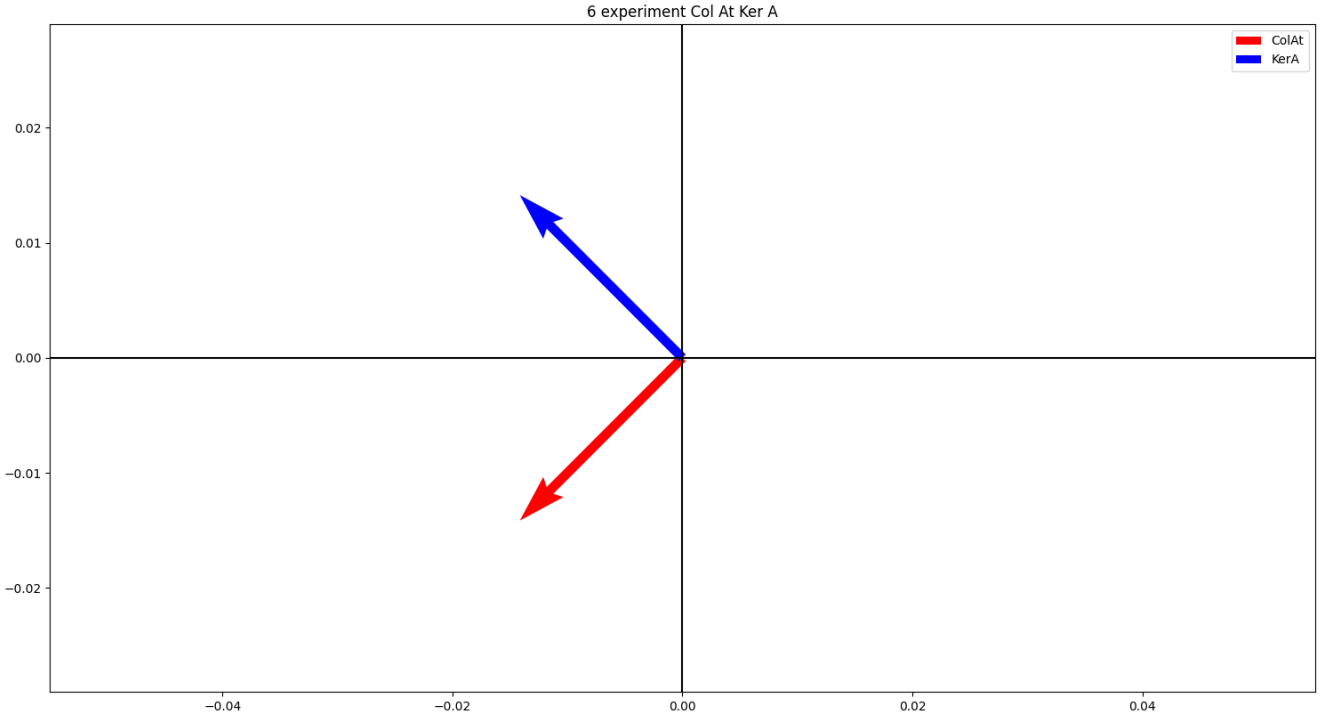

Figure 19: Col(A^t) Ker(A)

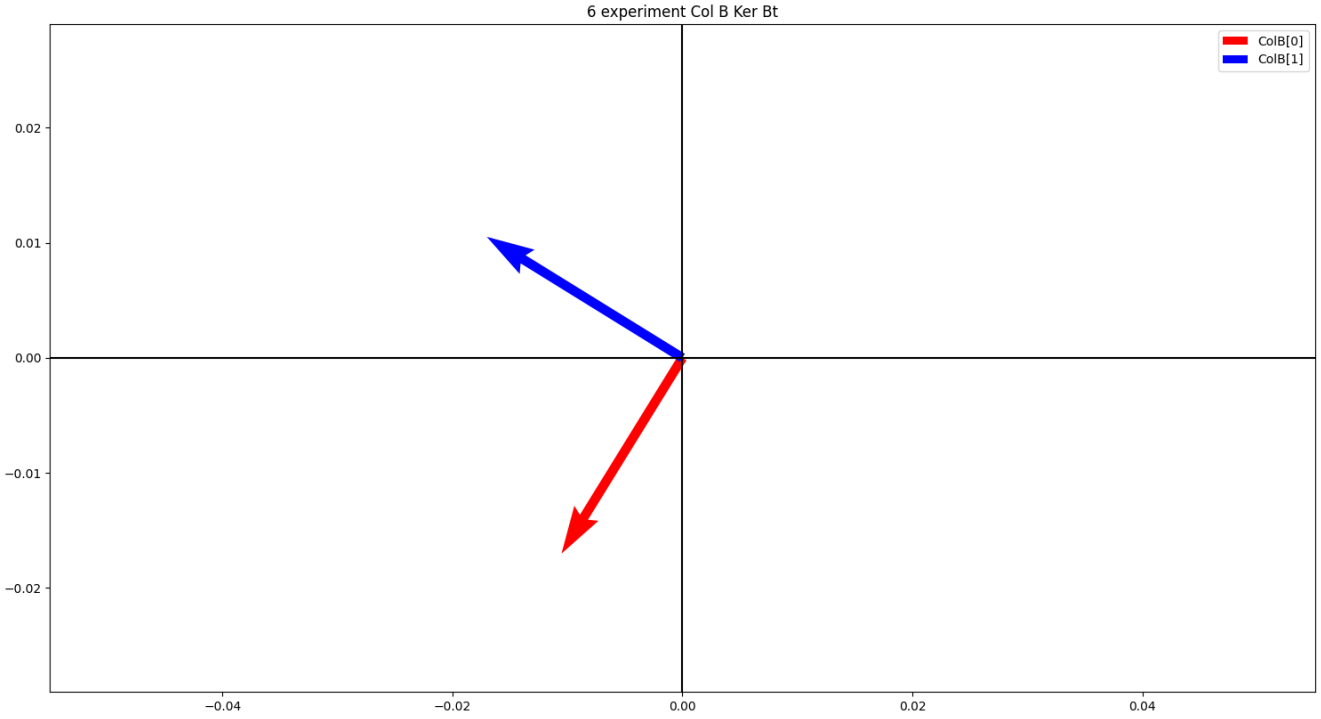

Figure 20: Col(B) Ker(B^t)

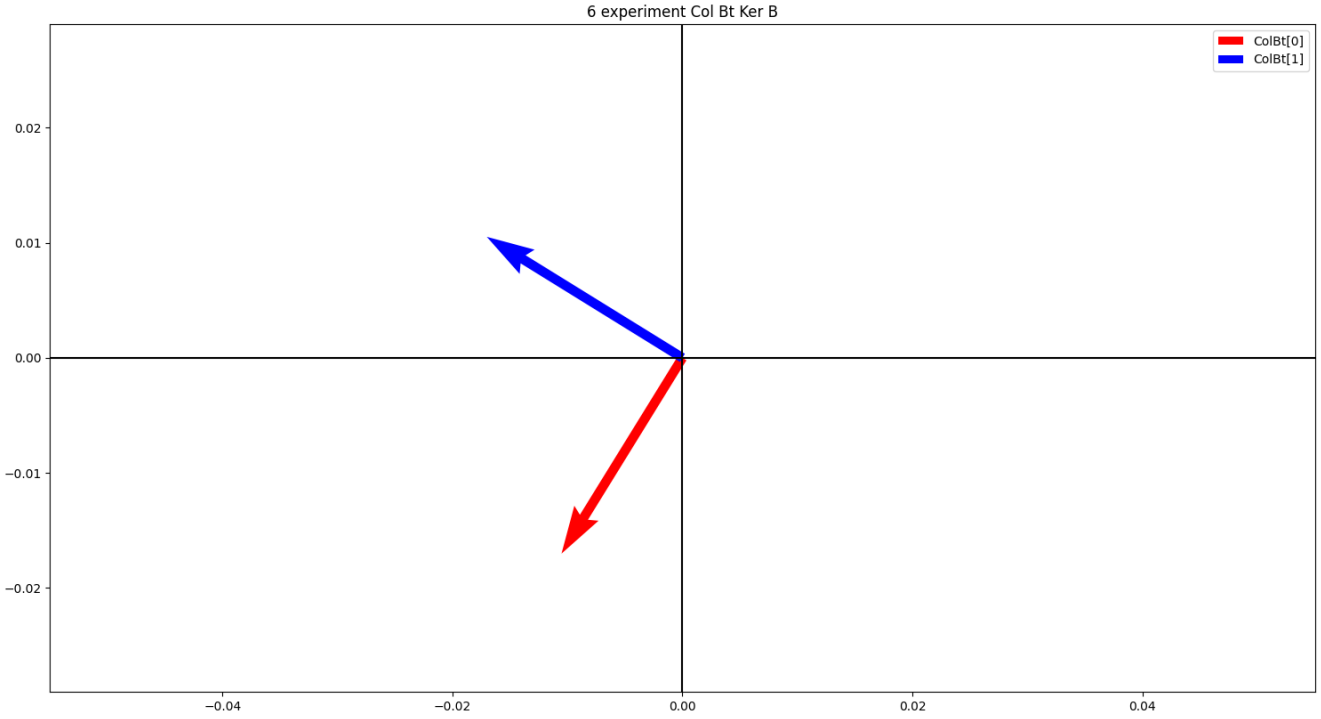

Figure 21: Col(B^t) Ker(B)

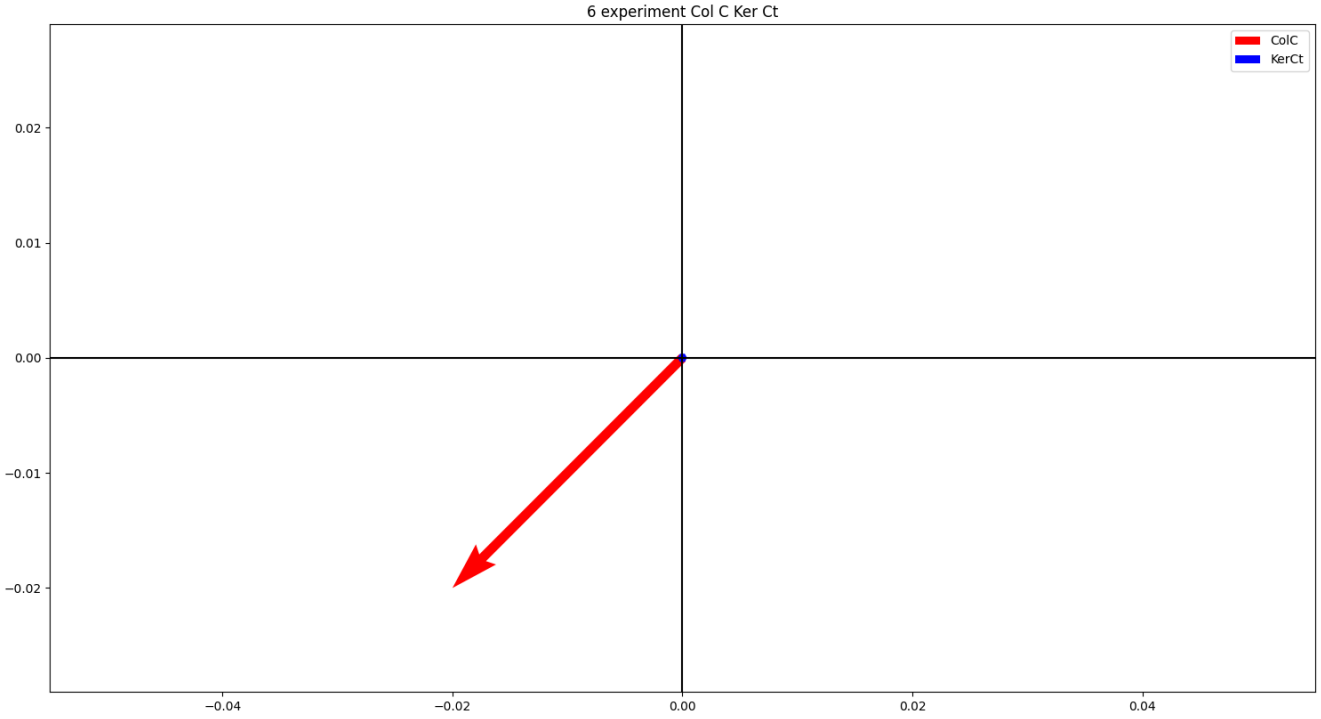

Figure 22: Col(C) Ker(C^t)

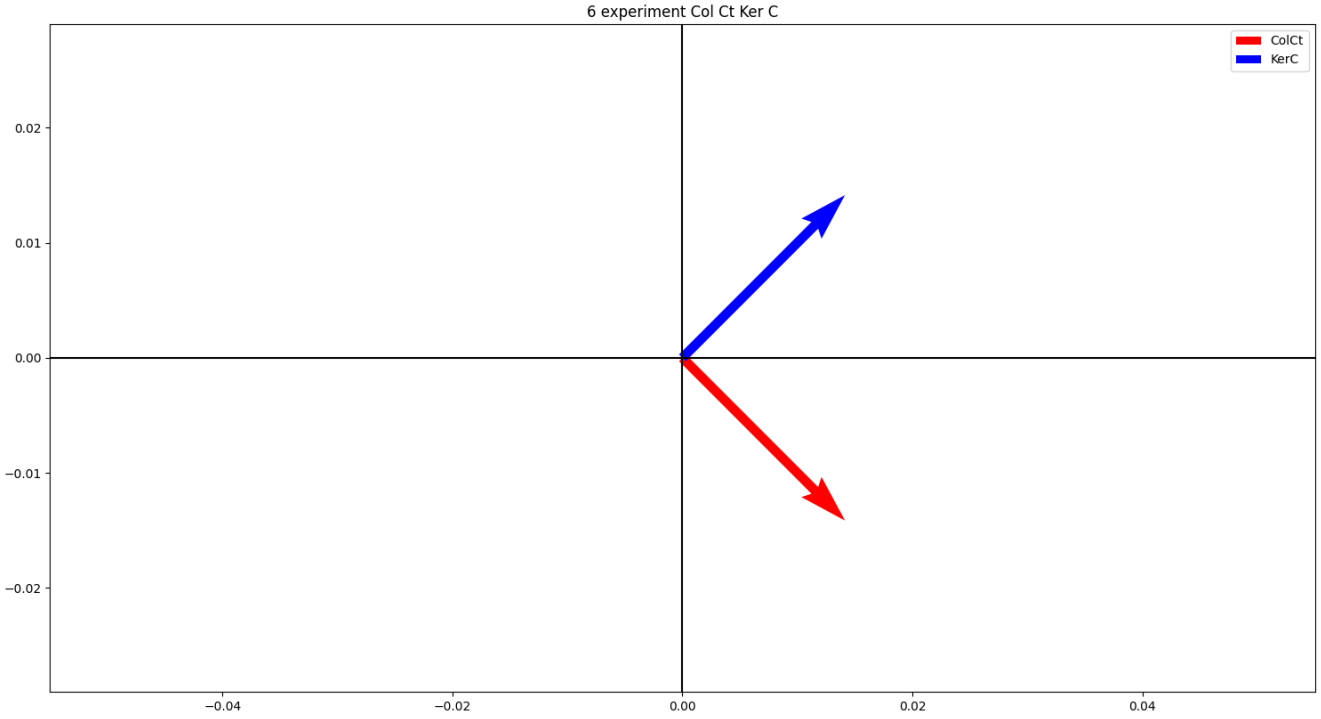

Figure 23: Col(C^t) Ker(C)

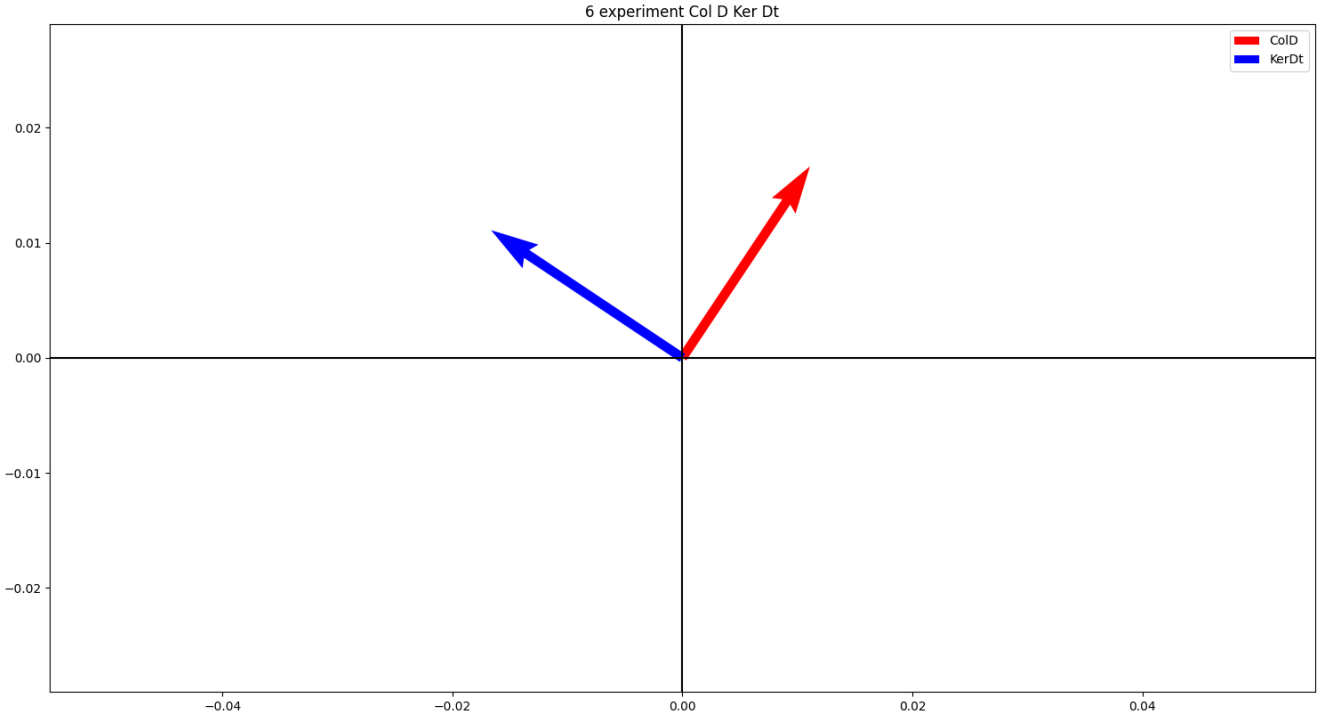

Figure 24: Col(D) Ker(D^t)

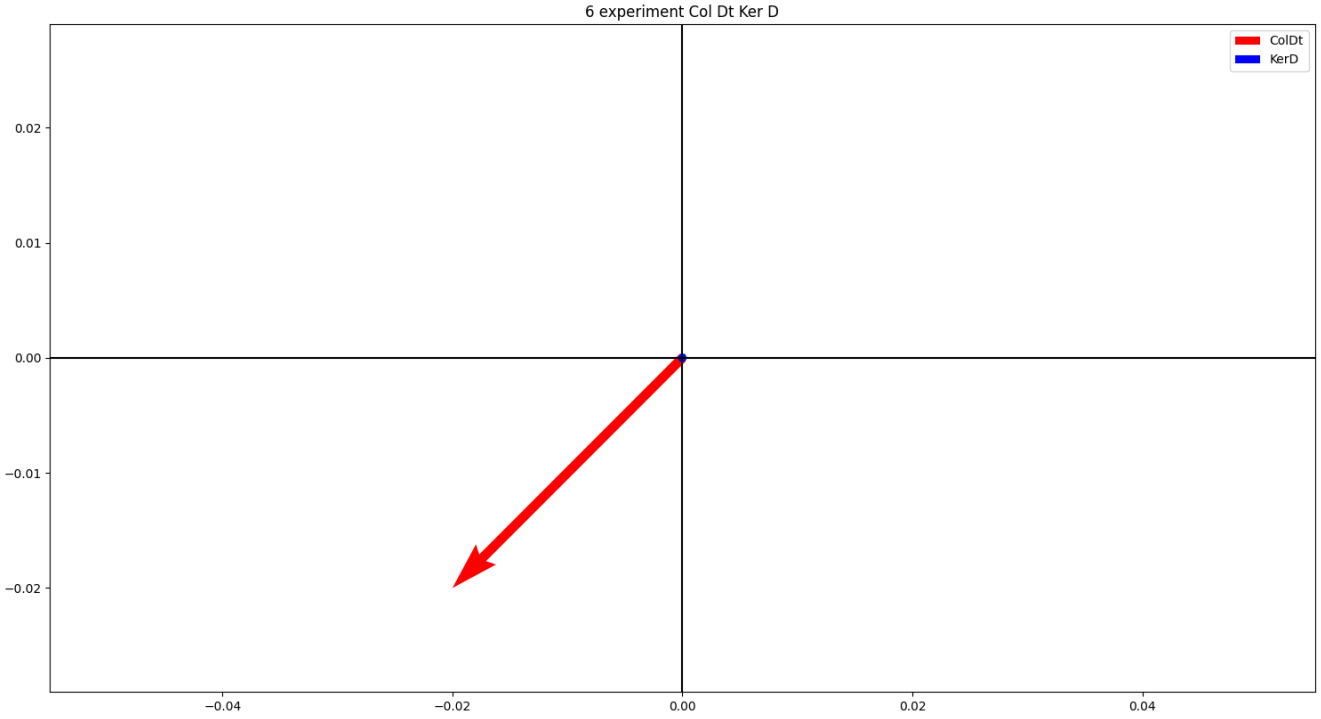

Figure 25: Col(D^t) Ker(D)

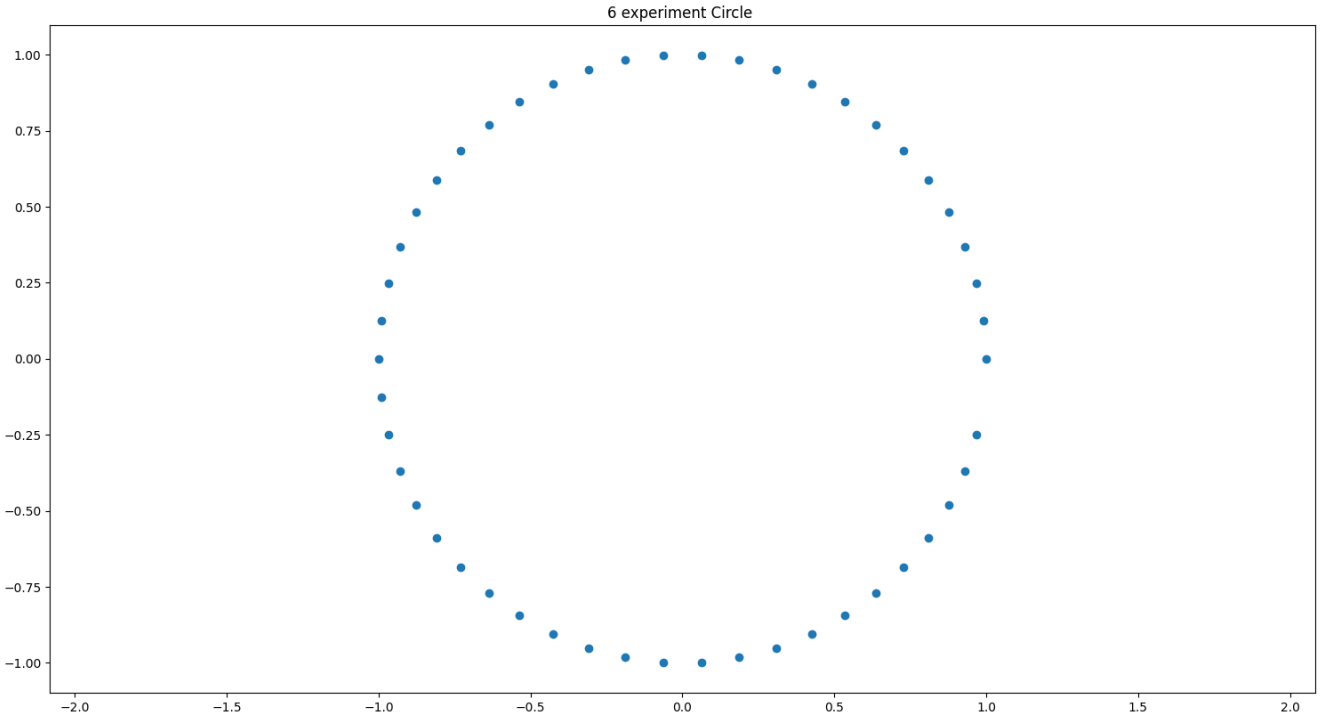

Figure 26: Circle

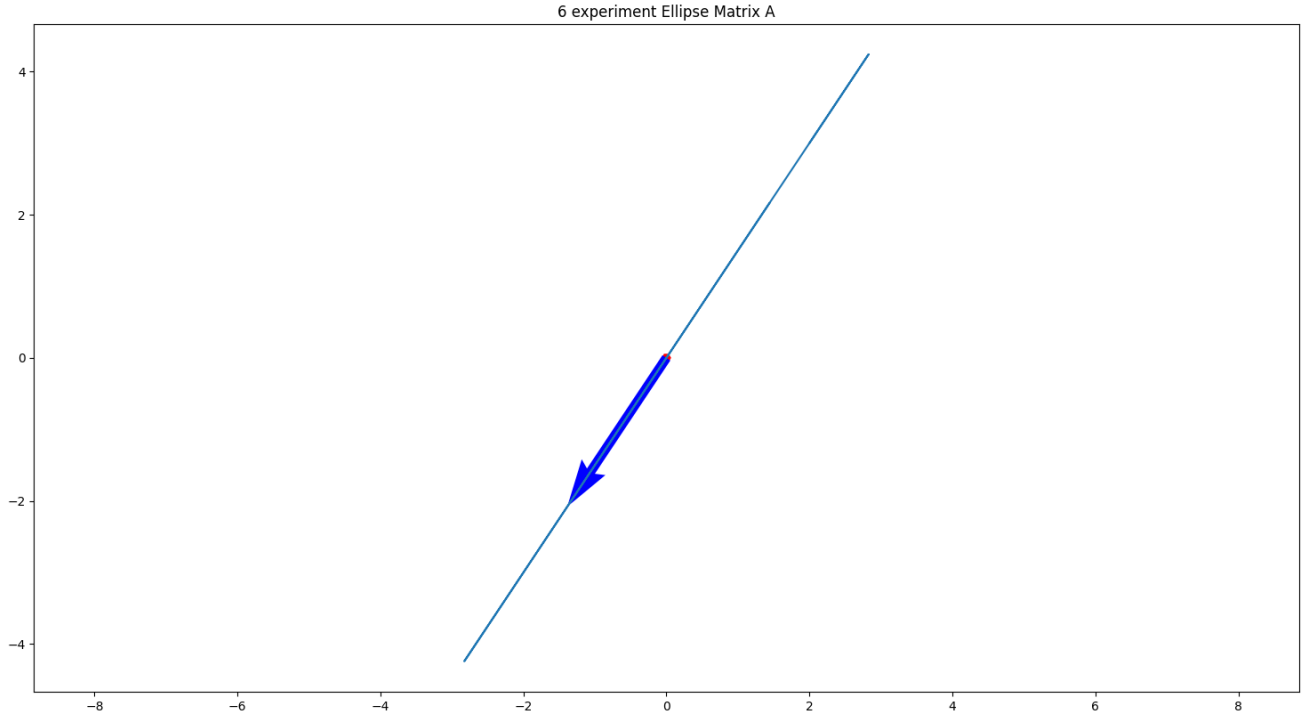

Figure 27: A*x(n)

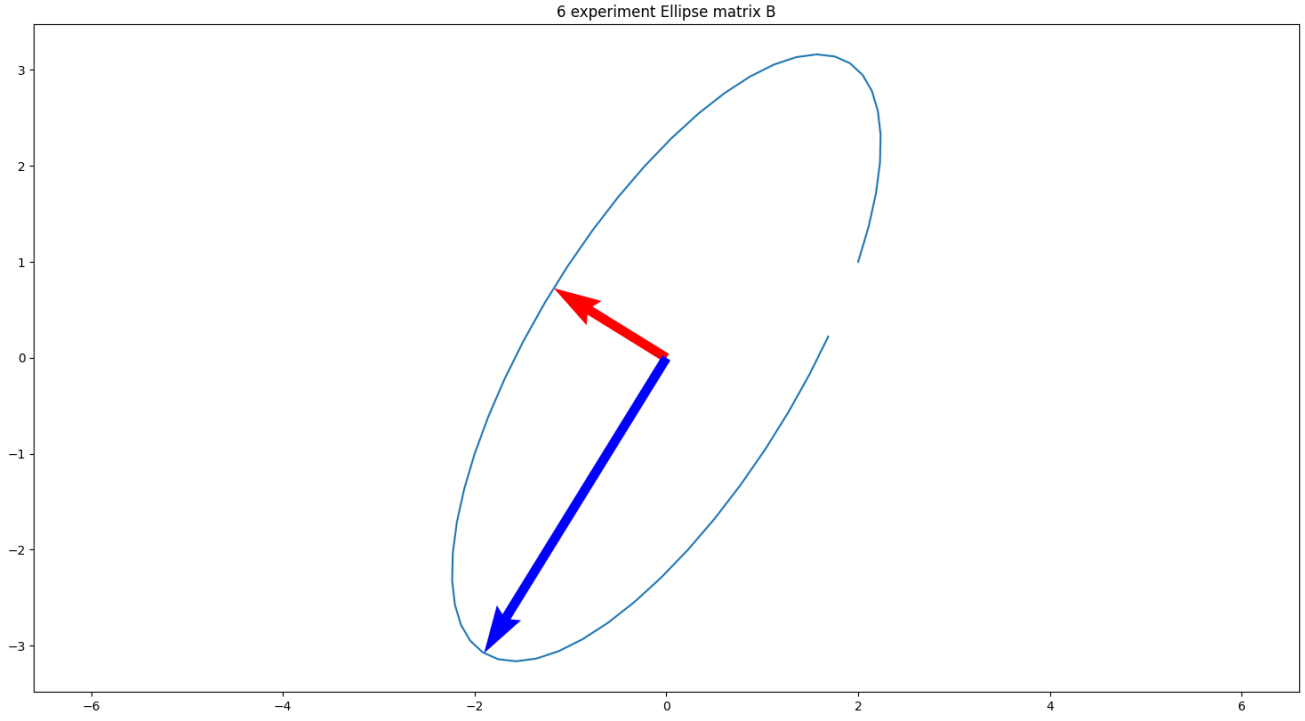

Figure 28: B*x(n)

7 Orthogonal, symmetric and positive definite matrices

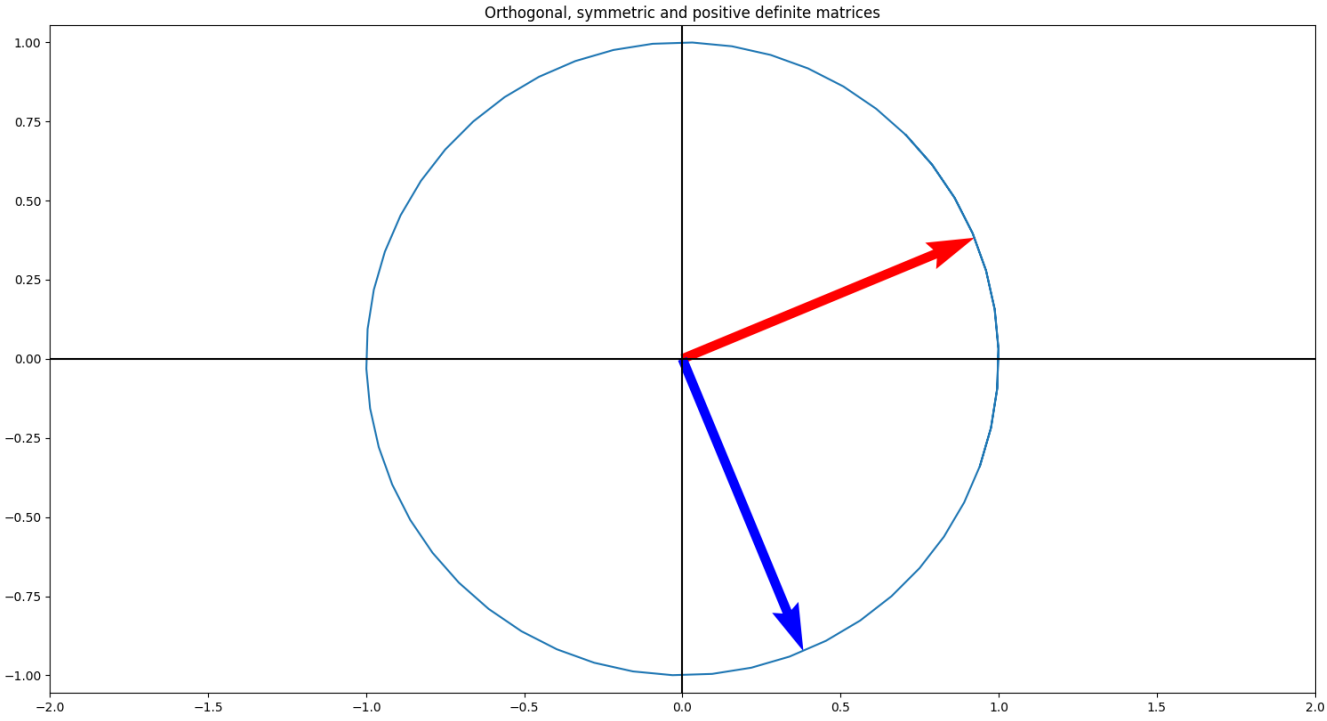

Figure 29: Matrix A

Eigenvalues

- 1
- -1

Eigenvectors

- 0.92388, -0.38268
- 0.38268, 0.923388

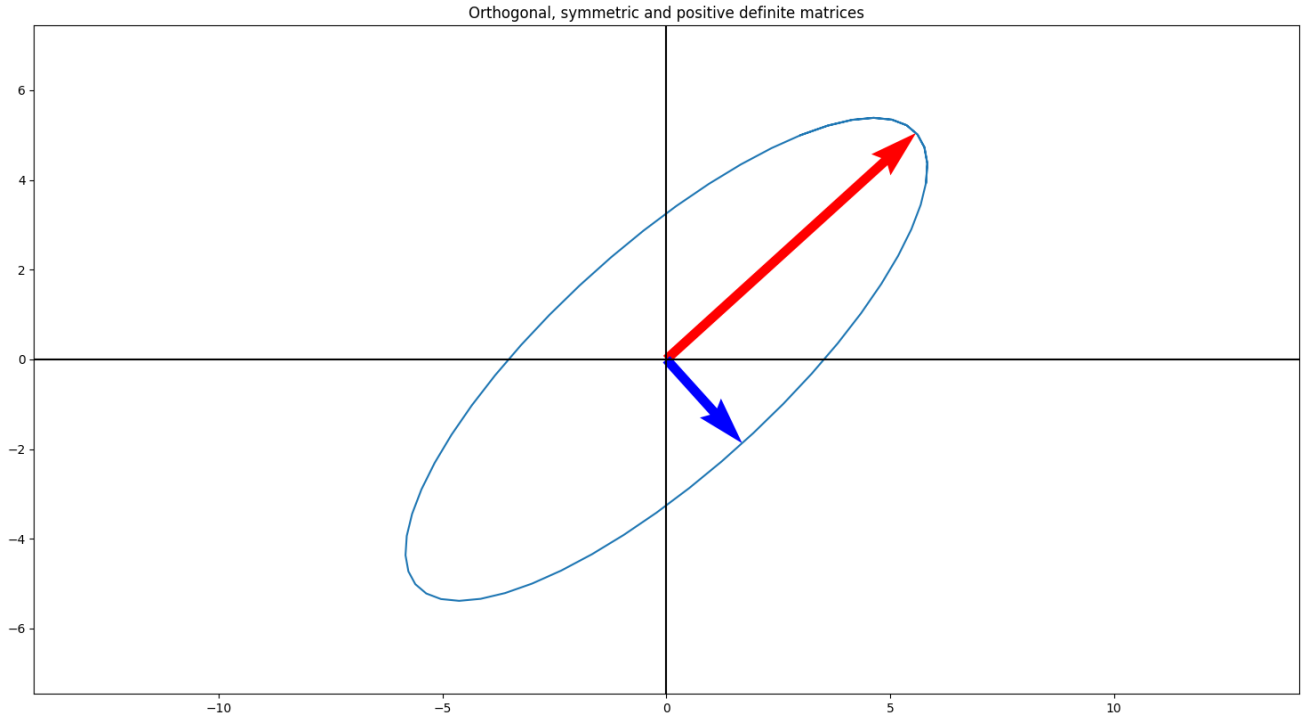

Figure 30: Matrix B

Eigenvalues

- -2.524937810560445
- 7.524937810560445

Eigenvectors

- 0.71445, -0.67101
- 0.67101, 0.71445

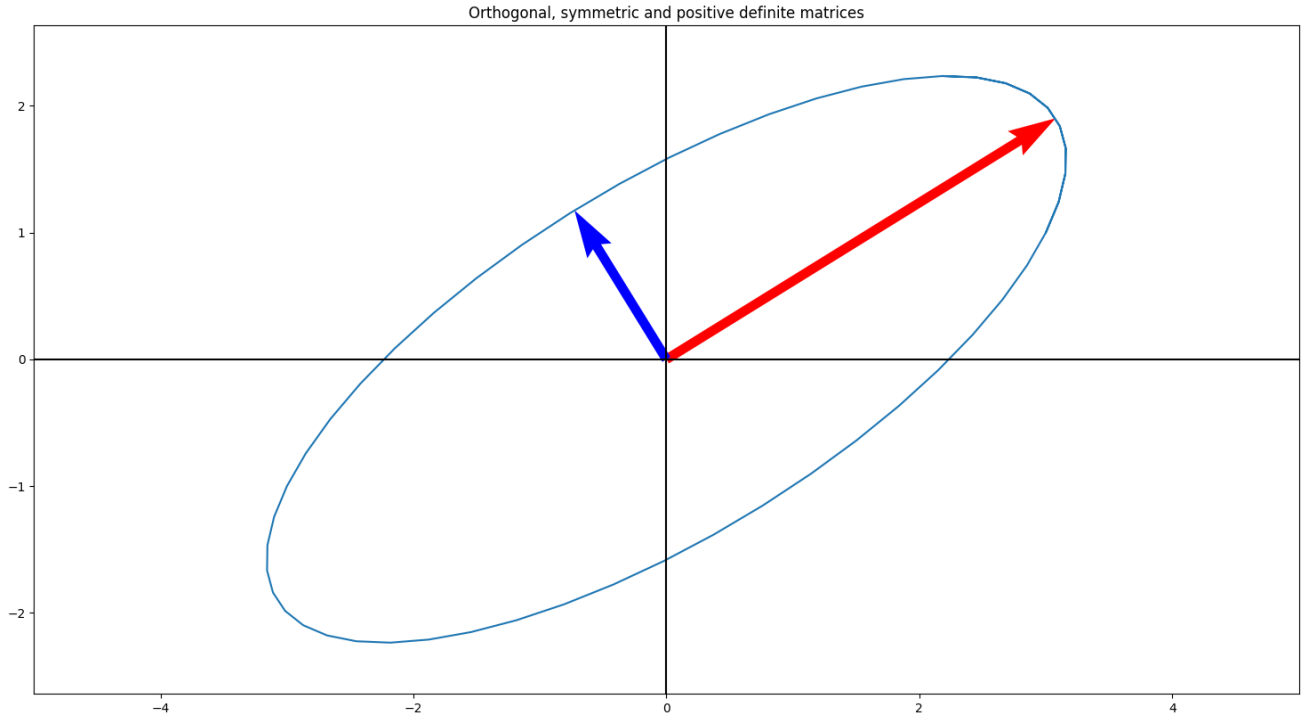

Figure 31: Matrix C

Eigenvalues

- 3.61803
- 1.38197

Eigenvectors

- 0.85065, -0.52573
- 0.52573, 0.85065