MA323 – Monte-Carlo Simulation

Lab - 10

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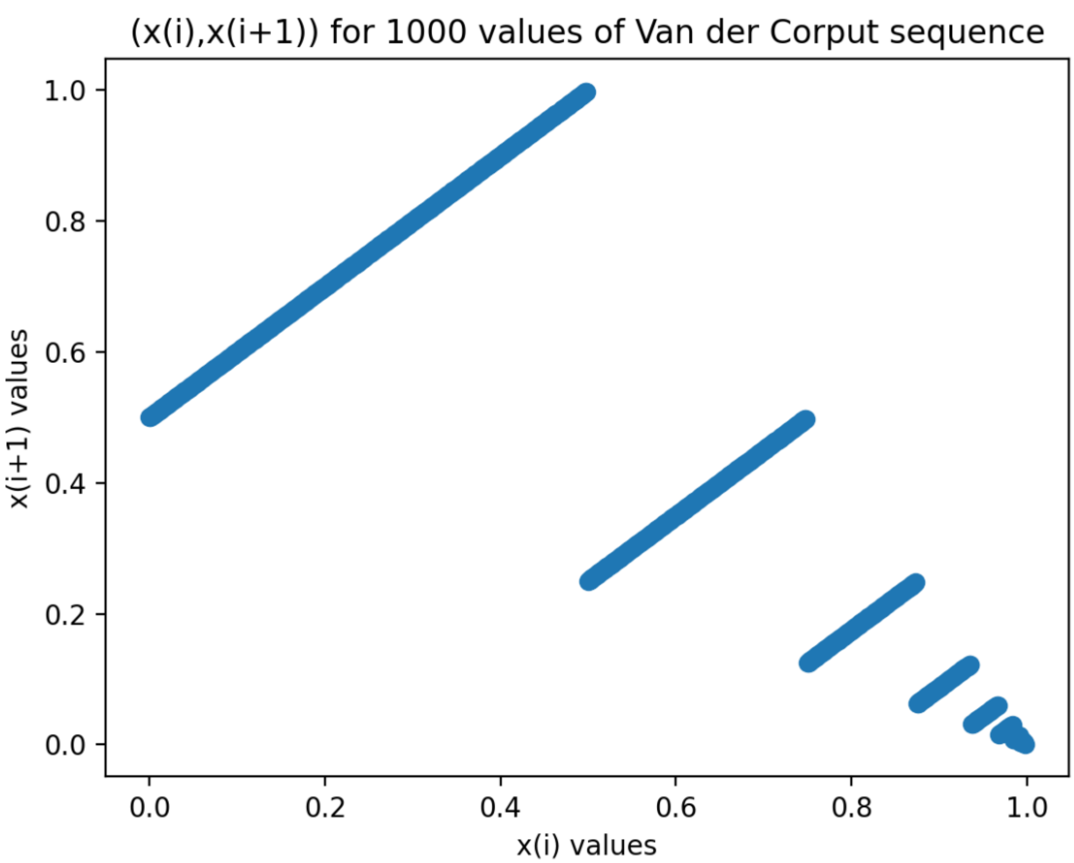
Question – 1

By taking the radical inverse function $x_i := \varphi_2(i)$, the first 25 values of Van der Corput sequence we get are as follows: -

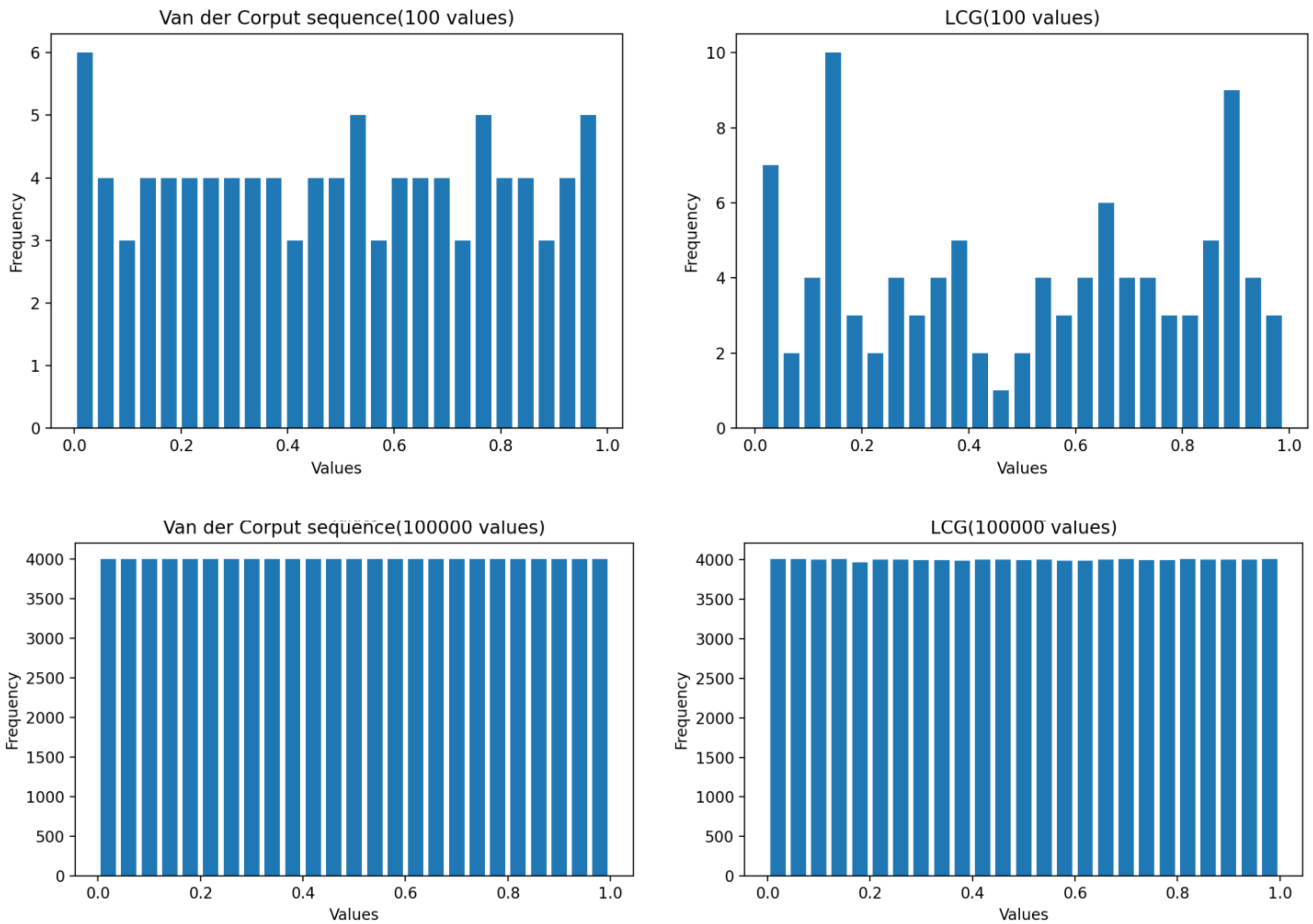
[0, 0.5, 0.25, 0.75, 0.125, 0.625, 0.375, 0.875, 0.0625, 0.5625, 0.3125, 0.8125, 0.1875, 0.6875, 0.4375, 0.9375, 0.03125, 0.53125, 0.28125, 0.78125, 0.15625, 0.65625, 0.40625, 0.90625, 0.09375]

After generating first 1000 values and plotting the overlapping pairs (x_i, x_{i+1}) as 2-D scatter plot we observe a clear pattern shown below: -



Question – 2

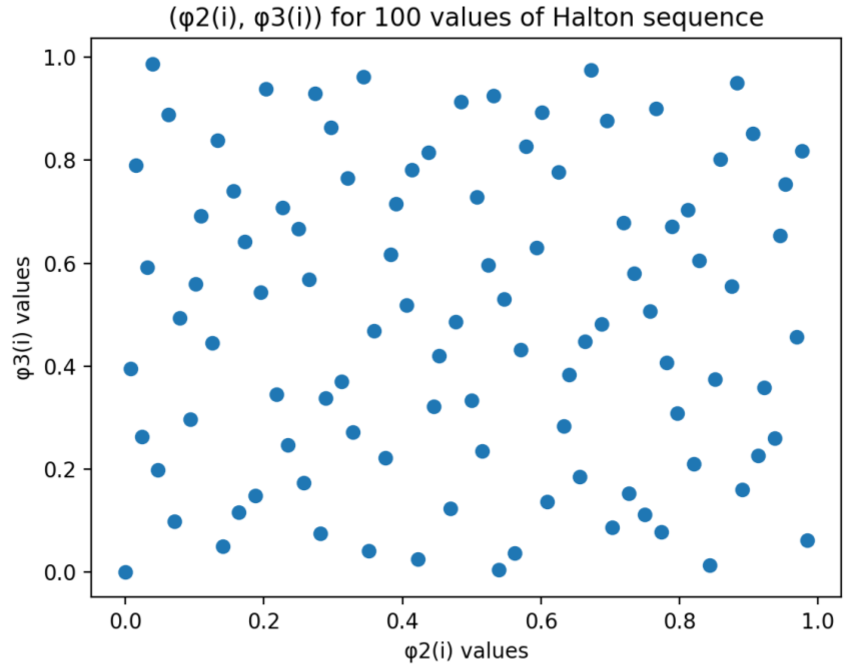
We generate first 100 and 100000 values of the Van der Corput sequence, and taking the LCG as $x_{i+1} = (1229*x_i+13)\ \%\ 4096$ with $x_0 = 67$, generate first 100 and 100000 values by LCG. On plotting these values side by side, we get following distributions: -

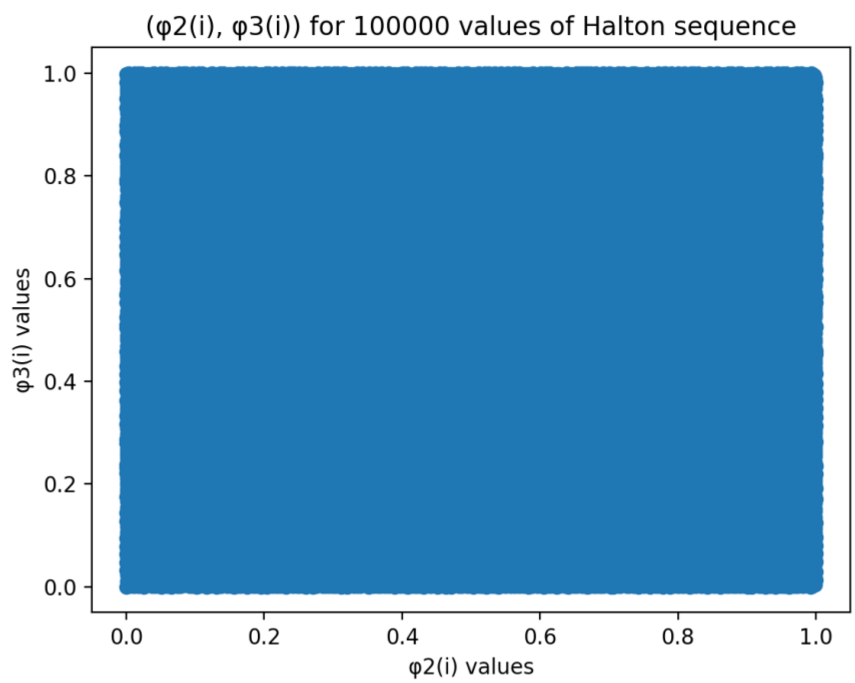


It can be observed that for n = 100, neither Van der Corput nor LCG are close to actual uniform distribution. However, for n = 100000, Van der Corput is closer to uniform distribution than LCG.

Question – 3

The Halton sequence x_i: = (φ_2(i), φ_3(i)) (as points in R^2) is generated for 100 and 100000 values from the radical inverse functions for base 2 and 3 (as 2 and 3 are relatively prime).





1. For n=100, the plot is less dense and does not show any clear pattern, but for the case of n=100000, the points cover the whole of hyper-cube R^2 which in is a square!
2. The density of the points is uniform for both cases, thus proving that the Halton sequence converges to uniform distribution and is a low-discrepancy sequence.