Inverse CDF

December 27, 2022

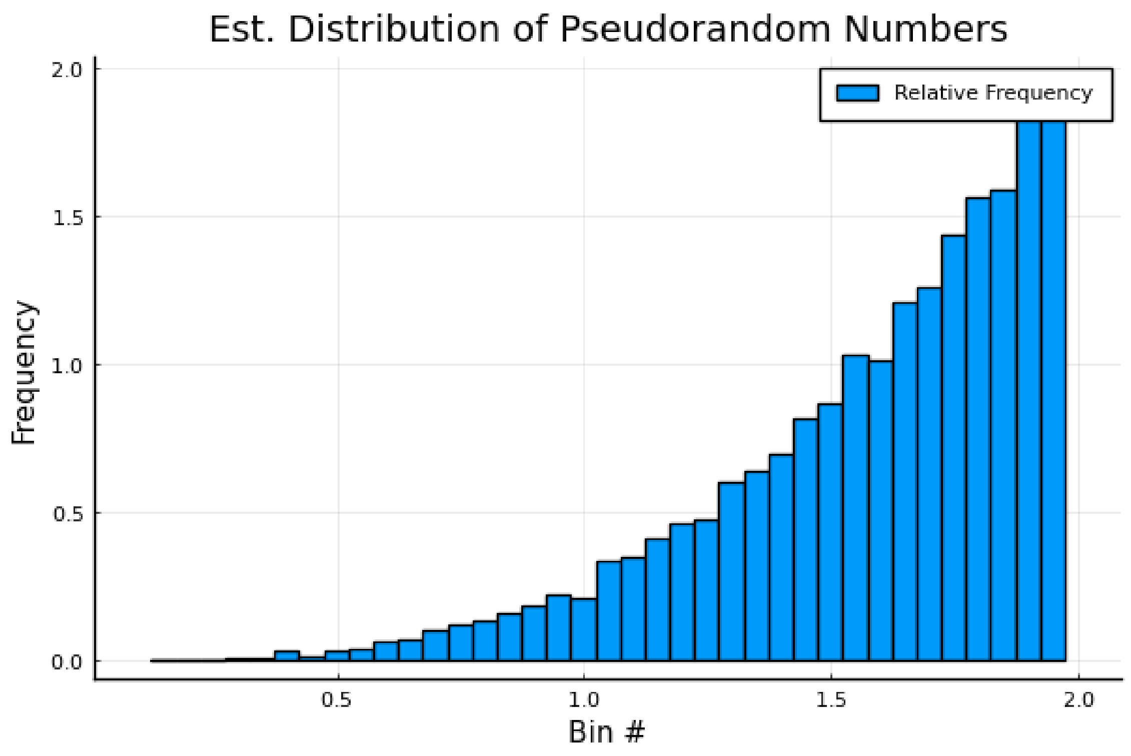
[1]:
```
# libraries
using Random
Random.seed!(3); # for reproducibility
using Plots
pyplot();
```

[2]:
```
# repeat the find interval helper functions as in part 1
"""
Helper function, finds the index of the sub-interval
x falls in.
"""
function find_interval(intervals, x)
    i = searchsortedlast(intervals, x)
    i == length(intervals) && (i = 0)
    return(i)
end

"""
Partitions the interval [lower, upper] based on
nbins, and count the relative frequencies of rand_nums
in each bin.
"""
function count_frequency(rand_nums, lower=0, upper=1, nbins=20)
    N = length(unif_numbers)
    interval_length = (upper - lower) / nbins
    all_bins = collect(lower:interval_length:upper)
    all_counts = Vector{Float64}(undef, nbins)
    # find which bin each number is in
    all_bin_nums = zeros(0)
    for x in rand_nums
        append!(all_bin_nums, find_interval(all_bins, x))
    end
    all_bin_nums = Vector{Int64}(all_bin_nums)
    # relative frequency
    all_counts = Dict{Int64, Float64}([(i, count(x->x==i, all_bin_nums)) for i␣
 ↪in all_bin_nums])
    all_counts = sort(collect(all_counts), by = x->x[1])
    all_counts = Dict{Int64, Float64}([(x[1], x[2]) for x in all_counts])
    all_freq = ( collect(values(all_counts)) / N ) / interval_length
    return(all_freq)
end

# generate random seed
unif_numbers = rand(10^4);
# apply inverse transform
x = 2*(unif_numbers.^(1/4));
# plot histogram
histogram(x, bins = range(minimum(x)-0.05,maximum(x), step = 5 / 100),
    normalize = true, label = "Relative Frequency")
title!("Est. Distribution of Pseudorandom Numbers", xlabel="Bin #",␣
 ↪ylabel="Frequency")
```

[2]:



[12]:
```
est_mean = sum(x) / length(x);
est_variance = sum((x .- est_mean).^2) / ( length(x) - 1 );
println("*> Est. Mean = ", est_mean)
println("*> Est. Var  = ", est_variance)
```

```
*> Est. Mean = 1.6053308315363621
*> Est. Var  = 0.10365923540971544
```