

1130-EMARO-MSA-1004 # Signal Processing

Kokpit / Moje kursy / 1130-EMARO-MSA-1004 # Signal Processing. / Tutorials / T2: Signals

T2: Signals

Task 1

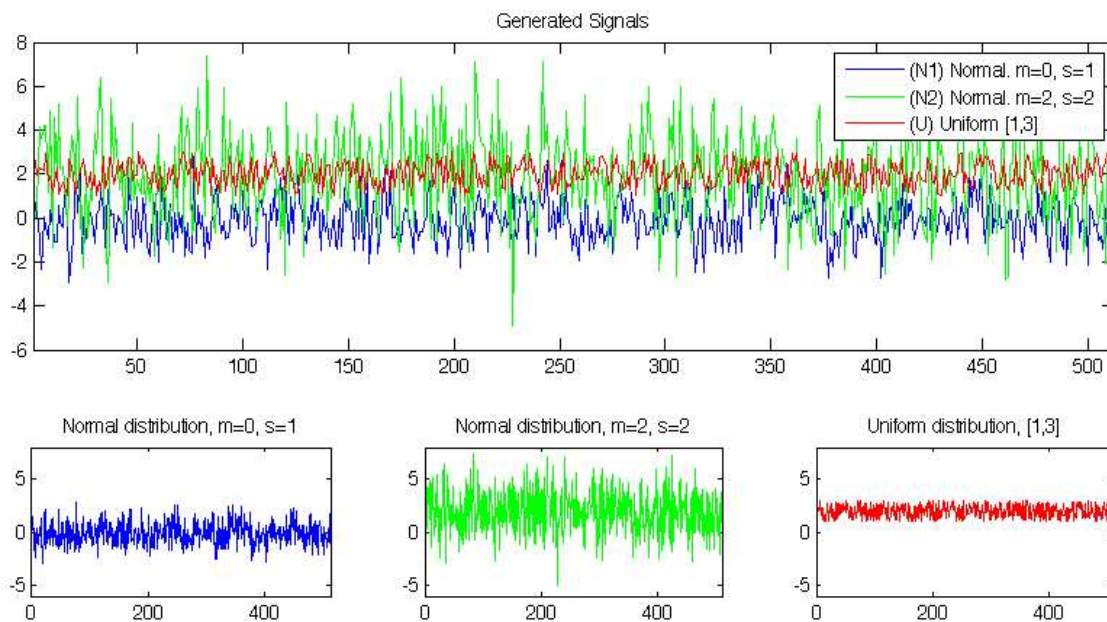
Generate a random noise digital signal having normal distribution with different parameter sets (use [random](#) function):

- **N1** - mean = 0 and standard deviation = 1.0.
- **N2** - mean = 2 and standard deviation = 2.

Use 512 samples.

- **U** - Generate 512 samples of a signal uniformly distributed in the interval [1, 3].

Compute the real mean and standard deviation of every generated signal. **What are the differences between observed statistics and underlying processes?** Plot the generated signals with the equal scale of amplitude.



Function prototype:

```
% N1, N2 and U are vectors of given length N
function [N1, N2, U] = generate_signals(N)
...
end
```

Task 2

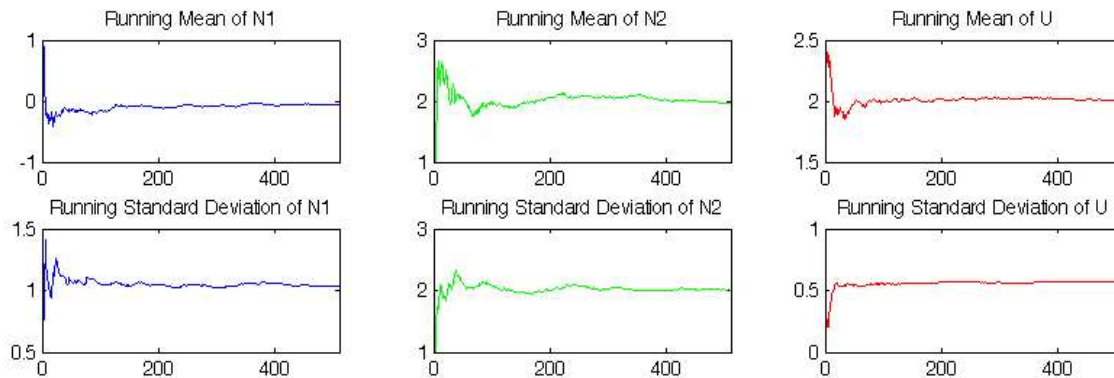
For the signals **N1**, **N2** and **U** generated in the previous exercise compute their **running statistics** (mean and standard deviation) and plot the results.

Example: for sample data given below:



[1, 2, 3, 2, 3, 4]

A- A+ R A A



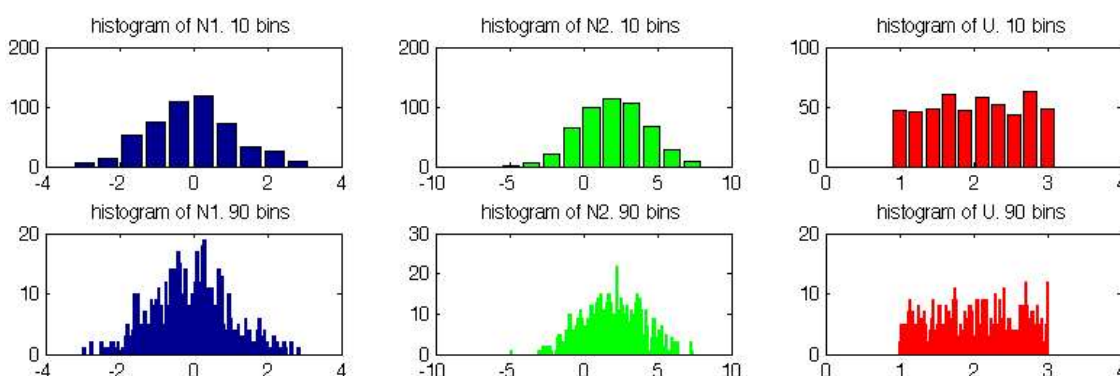
Function prototype:

```
% RM is the vector of running mean
% RS is the vector of running standard deviation
function [RM, RS] = running_statistics(x)
% prepare output vectors
RM = zeros(size(x));
RS = zeros(size(x));

% calculate running statistics
for i = 1:length(x)
    RM(i) = ...
    RS(i) = ...
end
end
```

Task 3

For the signal amplitudes **N1**, **N2** and **U** generated in the previous exercise compute their [histograms](#) with 90 bins and 10 bins.

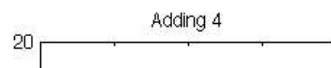
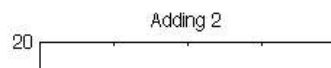
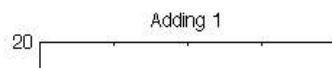


Task 4

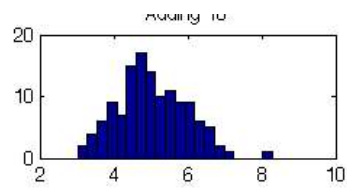
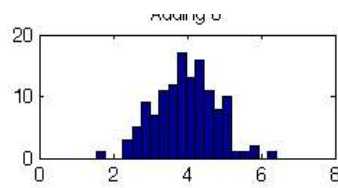
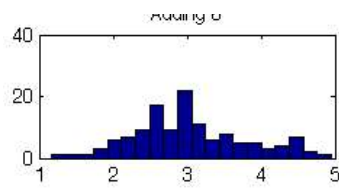
Use the random number generator to generate 128 numbers between zero and one with an equal probability (uniform distribution). Create and plot the histogram of this sample vector. Repeat the process for 256 samples and add every two consecutive values obtained from the random number generator to create a sample of a new signal. Plot again its histogram.

Repeat this procedure for 4x128, 6x128, and 8x128 random numbers, while adding four, six, and eight consecutive values, appropriately, to generate a sample. **Observe the results and comment on the different histograms.**





A- A A+ R A A A



Function prototype:

```
% res is the output vector
% mult is the number of values added (1, 2, 4, 6, 8)
function res = generate(mult)
    ...
end
```

Points will be cut for

- repetitive code fragments, use loops instead (e.g. for, while)
- hardcoded values