Ultra Wide Band Communications

MATLAB Problems

ACTS Lab

DIET Department

Problem #1

Write a Matlab/Octave script that handles a given number **num** of sequences of positive integers (including 0) as required below:

1)Build a matrix A containing the **num** sequences, one for each row, knowing that each sequence must be of length **lseq** and can include values between 0 and **valmax**. Let us now define as energy of a sequence as the sum of the squared values of the elements of the sequence:

$$x = \{x_1, x_2, ..., x_N\} \rightarrow E = \sum_{k=1}^{N} (x_k)^2$$

Print on the screen the maximum value of energy and the corresponding sequence (e.g.: "*Maximum energy value is <E_{max}> for sequence corresponding to line <x>*").
N.B.: Use a *dedicated function* receiving a vector in input and returning its energy.

2)Create a vector containing the energy values for the **lseq** sequences corresponding to the columns of A and order its elements from the smallest to the largest; print the ordered vector on the screen.

3)Create a figure using the `bar` function to create a histogram with each bar representing a value of the energy vector obtained at step 2), with the constraint that only energies above the average of the values in the vector should be shown. The corresponding label in the x axis should show the index of the element in the vector.

N.B.: Use the following values: num=3, lseq=10, valmax=20

Problem #2

Write a Matlab/Octave script that generates a sequence of 100 random samples uniformly distributed in the interval [0,100], and evaluates the percentage of times either of two thresholds **Th1** and **Th2** defined in the following is passed.
Given the minimum value s_{min} and the maximum value s_{max} in the sequence of 100 numbers, the thresholds are defined as follows:

$$Th_1 = s_{min} + \frac{3}{5}\left(s_{max} - s_{min}\right)$$

$$Th_2 = s_{min} + \frac{4}{5}\left(s_{max} - s_{min}\right)$$

The thresholds must be generated by a Matlab function taking in input the values s_{min} and s_{max} and returning the thresholds, following thus a template like:

```
function [out1, out2] = func(a, b)
```

The script must use the function defined above and generate a plot showing the 100 samples and the two thresholds. The script should also print the percentage of times each of the two thresholds are passed.

The script should be written in two different versions:
1. Using cycles and **if** statements
2. Using the **find** function