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DISCRETE TIME SIGNALS AND SYSTEMS

Project 2, submission by Saturday, April 25th

Total Marks: 100 (Up to two people)

Class,

Instructions: please prepare a zip file containing both the report and matlab file of project. The submitted file should have a name containing students last name and R number. In case of two students working on the project, the submitted file should be named with last names of both the students.

For second project, find frequency response of the system given by following equation using MATLAB. Clearly plot both amplitude and phase response waveforms with labels assigned.

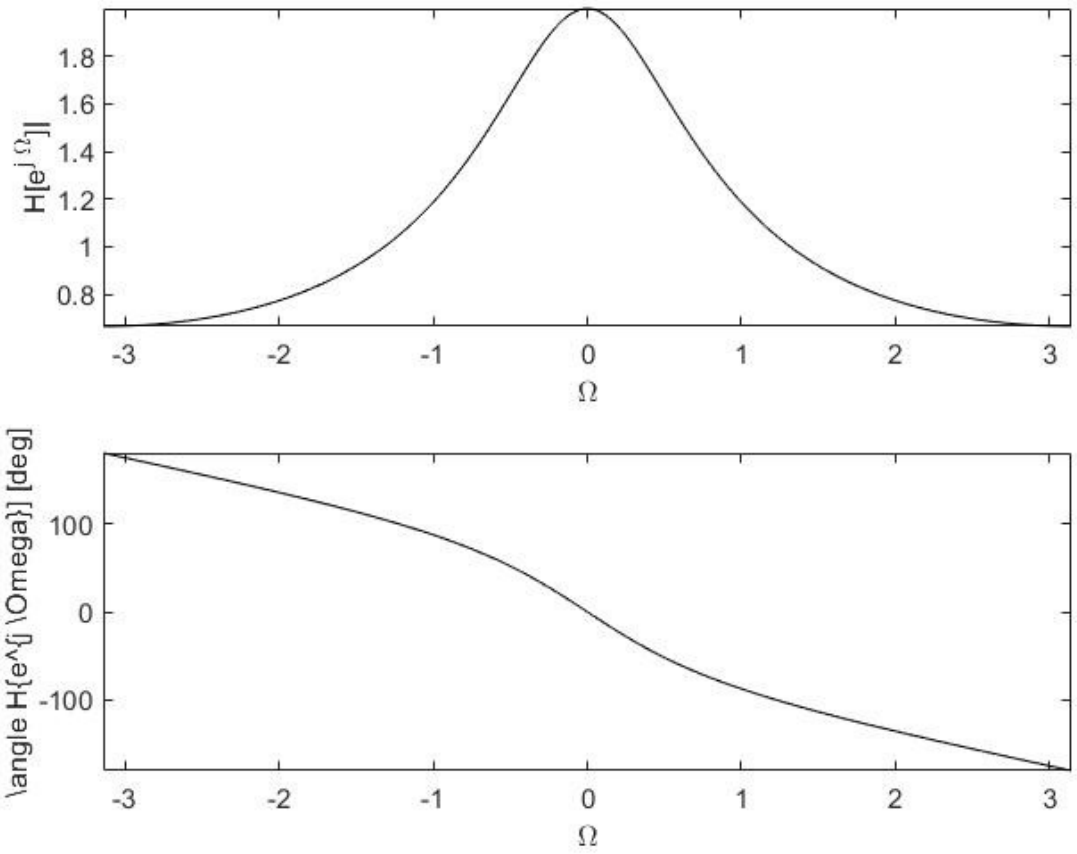
$$y[n+1] - 0.5\,y[n] = x[n]$$

You need to implement it in two ways, one with MATLAB inbuilt command (search for it) and in second one, you need to derive the expression and plot it. You need to show the plots from both implementations in your report. You can work in a group of up to two people. In case of two people, make sure to put name of both the participants in the report. You need to submit a zipped file with both your matlab code and the report.

Implementation Two:

According to https://www.mathworks.com/help/signal/ug/frequency-response.html, the freqz uses an FFT-based algorithm to calculate the Z-transform frequency response of a digital filter.

Part Two. (Source code available in Part2_Proj2.m file).



$$(E - 0.5)y[n] = E^0$$

$$H[z] = \frac{1}{z - 0.5}$$

$$= \frac{z^{-1}}{1 - 0.5z^{-1}}$$

$$\frac{1}{z} = \frac{1}{e^{j\Omega}}$$

$$z = e^{j\Omega}$$

$$\frac{z^{-1}}{1 - 0.5z^{-1}} = \frac{1}{[cos(\Omega) - 0.5] + jsin(\Omega)}$$

$$|H(z)| = \frac{1}{\sqrt{(cos(\Omega) - 0.5)^2 + sin(\Omega)^2}}$$

$$= \frac{1}{\sqrt{cos(\Omega)^2 - 2cos(\Omega) \cdot 0.5 + (0.5)^2 + sin(\Omega)^2}}$$

$$= \frac{1}{\sqrt{1.25 - cos(\Omega)}}$$

$$Phase\_Angle(\Omega) = -tan^{-1}\left[\frac{sin(\Omega)}{cos(\Omega) - 0.5}\right]$$