Atilim University
EE306 Digital Signal Processing Laboratory

Experiment-3
Analysis of Discrete-Time Systems

1) X(t)=sinc(t)
   - Find X(n)
   - Find $X(e^{jw})$
2) X(n)= $(1/2)^{n-1}u(n-1)$
   - Find $X(e^{jw})$ and plot it.
3) X(n)= 2+cos($\frac{n*pi}{6}+\frac{pi}{8}$)
   - Find $X(e^{jw})$ and plot it.

4) Given below the system function: H1(z).

$$H_1(z) = \frac{b_1 + b_2 z^{-1} + b_3 z^{-2}}{1 + a_1 z^{-1} + a_2 z^{-2}}$$

where:

$[b_1\ b_2\ b_3]$ = [1 -0.4944 0.64]

$[1\ \ a_1\ \ a_2]$ = [1 -1.3315 0.49]

a. Plot $H_1(z)$'s zeros and poles in the same figure using the built- in **"roots"** command.

b. Learn the Matlab's **"zplane"** command and use it for part **a)**.

c. Write the difference equation corresponding to $H_1(z)$.

d. Plot its amplitude and phase responses.

e. Find $H_1(n)$.

5) Generate a Gaussian distributed random signal as input: x[n], using:

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x[n]  →  randn(1,32);
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Now, using x[n] as input and the difference equation you obtained in part **c)** above, calculate y[n];

- **a.** by writing your own function: **y = diff_eqn(b,a,x)**
- **b.** plot x[n] and y[n] in the same figure using "subplot".
- **c.** Generate a cosine signal whose frequency is 10 Hertz.
- **d.** Add the noise you generated above (with "randn" function) to this signal.
- **e.** Apply the filter to this noisy cosine signal. Obtain and examine the output.