Digital Signal Processing

http://kom.aau.dk/~zt/cources/DSP/

Exercises of Lecture 3 (MM3)

Exercise 3.1. Find the Z-transform and ROC of the following sequences

a) $(½)^n u[n]$

b) $-(½)^n u[-n-1]$

c) $(½)^n u[-n]$

d) $\delta[n-1]$

e) $\delta[n+1]$

f) $(½)^n \left[u[n]-u[n-10]\right]$

g) $x[n]=\alpha^{|n|}$

Exercise 3.2. The input to a LTI-system is $u[n]$ and the output $y[n]$ is $y[n]=\left(\frac{1}{2}\right)^{n-1}u[n+1]$.

Find the transfer function, H(z).

Exercise 3.3. Find the Z-transform of the sequence

$$x[n]=\begin{cases} n, & 0 \le n \le \text{N-1}, \\ N, & N \le n. \end{cases}$$

Hint: Express $x[n]$ using $u[n]$.

Exercise 3.4. Given the Z-transform $X(z)=\dfrac{1}{(1+\frac{1}{2}z^{-1})}, |z|>\frac{1}{2}$. Use power series expansion (long division) to find x[n].

Exercise 3.5. Given the Z-transform $X(z)=\dfrac{1-\frac{1}{2}z^{-1}}{(1+\frac{3}{4}z^{-1}+\frac{1}{8}z^{-2})}, |z|>\frac{1}{2}$. Try both using partial fraction expansion and power series expansion (long division) to find x[n].

Exercise 3.6. Given the transfer function $H(z)=\dfrac{1+z^{-1}}{(1-\frac{1}{2}z^{-1})(1+\frac{1}{4}z^{-1})}$ of a causal LTI system. Is the system stable ? (First find the ROC)