

Assignment 2

EE3900: Linear Systems and Signal Processing

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Discrete-time Signal Processing

Oppenheim and Schafer

Problem 2.17.(a) Determine the Fourier transform of the sequence

$$r[n] = \begin{cases} 1, & 0 \leq n \leq M \\ 0, & \text{otherwise} \end{cases} \quad (1)$$

Solution: Taking the fourier transform of the sequence

$$R(e^{j\omega}) = \sum_{n=0}^M e^{-j\omega n} \quad (2)$$

$$= \frac{1 - e^{-j\omega(M+1)}}{1 - e^{-j\omega}} \quad (3)$$

$$= e^{-j\frac{M}{2}\omega} \left(\frac{\sin \frac{M+1}{2}\omega}{\sin \frac{\omega}{2}} \right) \quad (4)$$