# TEL 311E – Homework 3

Due 25.10.2010

1. Let $x(n) = (3)^n\, u(-n+2) - (1/2)^n\, u(n)$. Find the $z$-transform of $x(n)$. Sketch the pole-zero diagram and specify the ROC on the diagram.

2. Suppose that the $z$-transform of the step response (i.e. the response when a unit-step function, $u(n)$, is input to the system) of a stable LTI system is given by

$$X(z) = \frac{1}{1 + \frac{1}{2}z} + \frac{1}{1 - z^{-1}}.$$

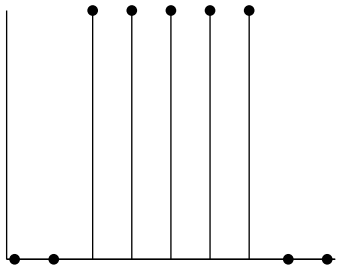
   What should be the ROC? Determine the impulse response, $h(n)$ of this system.

3. Suppose that the $z$-transform of the impulse response of a stable LTI system is given by

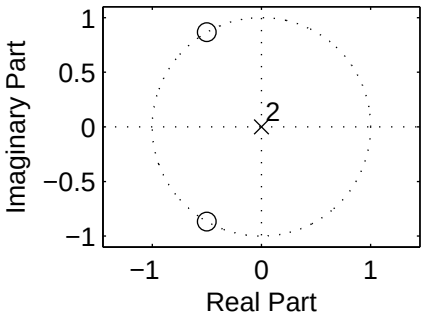
$$H(z) = \frac{1}{(1 - \frac{1}{2}z^{-1})\,(1 - \frac{3}{4}z^{-1})\,(1 - \frac{5}{6}z^{-1})} + \frac{2}{(1 - 2z^{-1})\,(1 - 3z^{-1})\,(1 + 4z^{-1})}.$$

   What is the ROC? Determine $h(1)$.

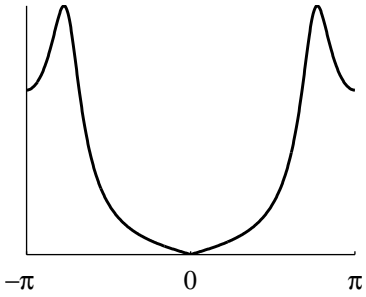
4. On the second page are shown four signals, their DTFT magnitudes, and the pole-zero diagrams. But they are not in the correct order. Put them in the correct order by matching each signal with its DTFT magnitude and pole-zero diagram.



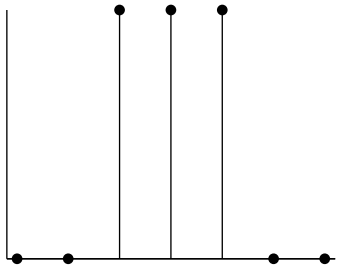
(I)



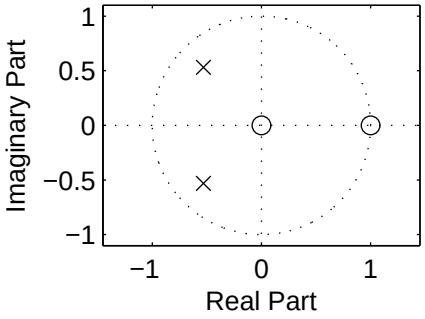

(a)



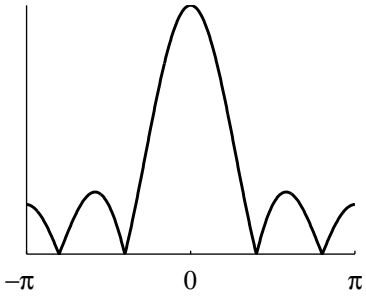

(1)



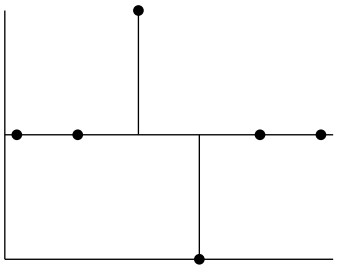
(II)



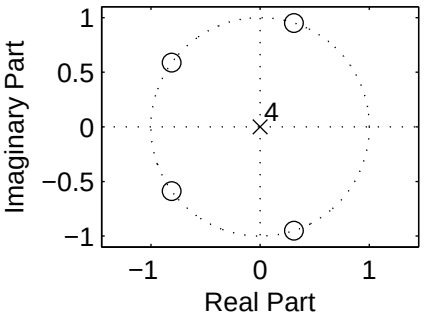

(b)



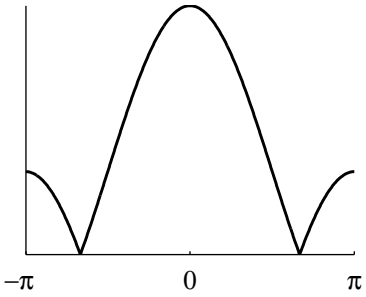

(2)



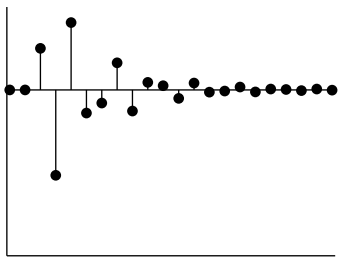
(III)



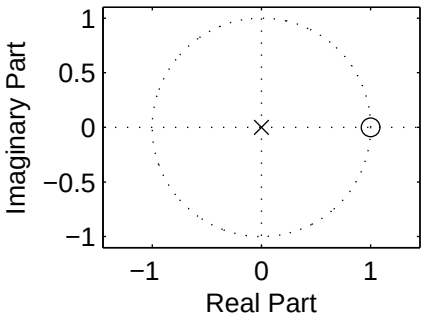

(c)



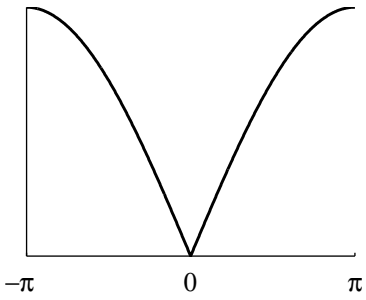

(3)



(IV)




(d)




(4)