# GEO4-1415 Data processing and inverse theory

## Tentamen - 2 Feb 2012 - 13h30-16h00

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The numbers in () indicate the percentage for evaluation. No documents are allowed during the examination. Please write clearly and feel free to write your answers in Dutch.

1. (10) Suppose that the output of a filter in the Z-domain is given by $Y(Z) = F(Z).X(Z)$, where X(Z) is the input, Y(Z) is the output and $F(Z) = \frac{a_0+a_1z+a_2z^2}{1+b_1z}$ is the filter. Write the corresponding expression for $y_t$ in the time domain.

2. (20) State the convolution theorem for a Fourier transfrom pair of continuous time series. Using the wavelets $a_t = (1, 2, -3, 4)$ and $b_t = (3, 5, 1, 6)$ show that the convolution theorem holds for their Z-tranforms as well.

3. (30) We give the wavelet $a_t = (4, -2, 1)$. Calculate the corresponding inverse wavelet of length 2 by polynomial division in the Z-domain. Calculate the energy of the error. Now solve the same deconvolution problem using a Wiener filter. Calculate again the energy of the error. Which one has the smallest error and why?

4. (40) Consider the problem of solving the following simultaneous equations:

$$m_1 = 1 \quad (1)$$
$$m_2 = 2 \quad (2)$$
$$m_1 + m_2 = 2 \quad (3)$$

There are several ways of solving this system. Which ones do you know? Simply enumerate. Solve the system by singular value decomposition and interpret the data and model resolution. Could you have found the same solution using another inverse operator? Why?

Good luck.