

Building a matrix model for one-dimensional convolution

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Bayesian Inverse Problems Course

University of Helsinki, Finland

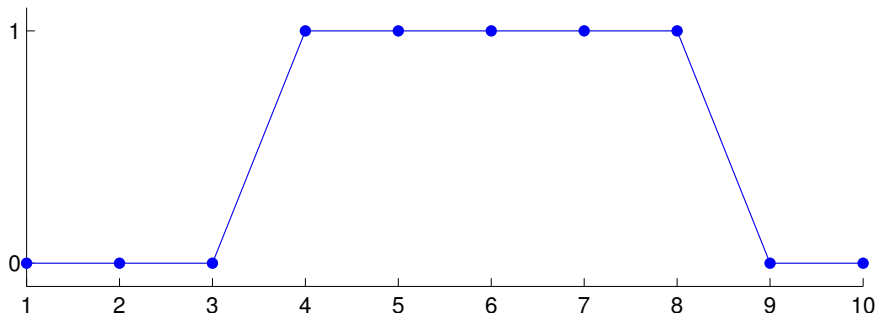
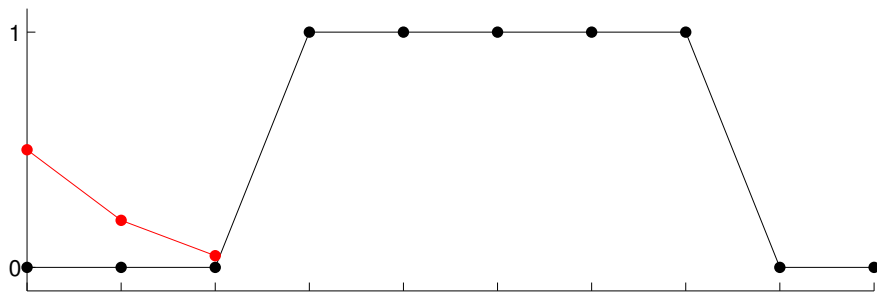
February 11, 2016

Outline

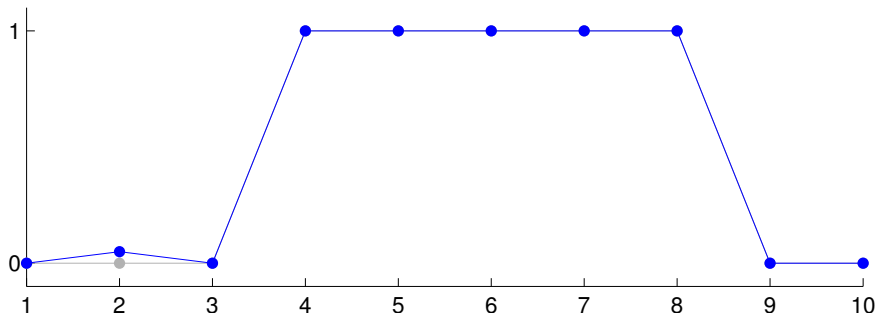
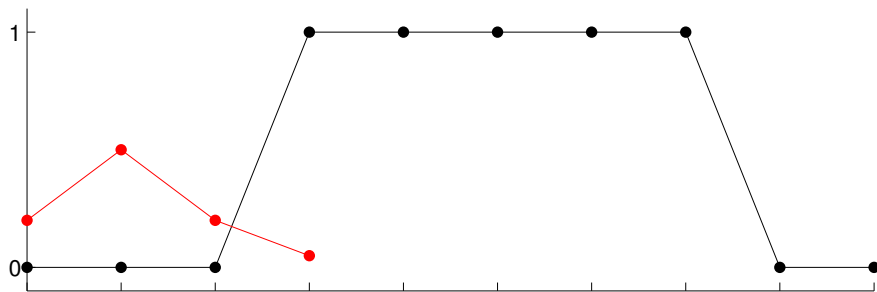
The convolution process

Constructing the matrix

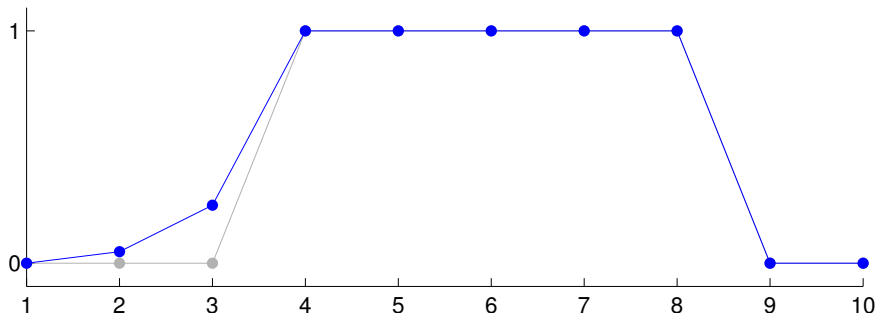
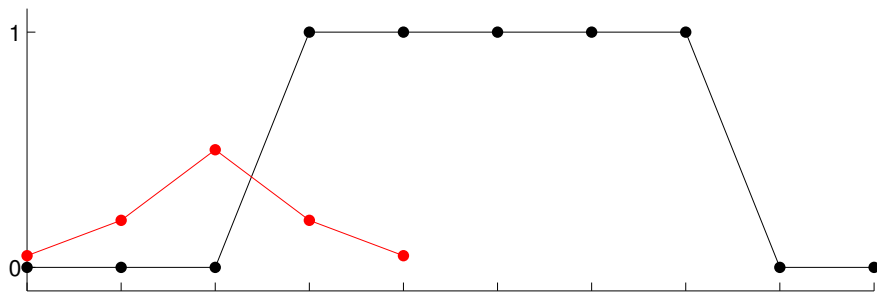
Convolution, position 1



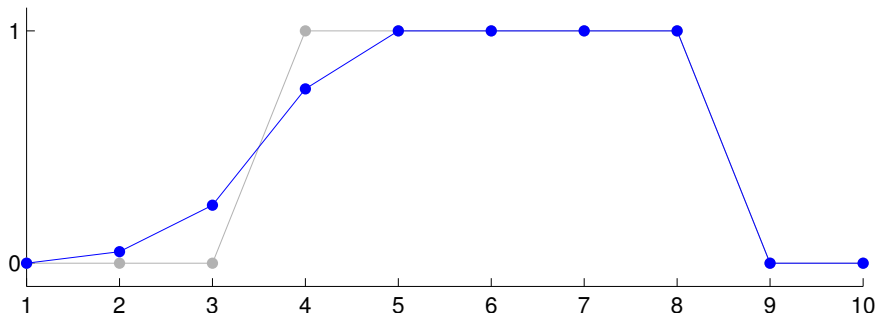
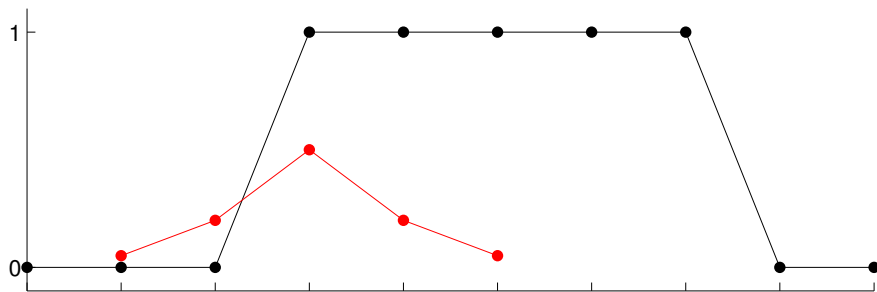
Convolution, position 2



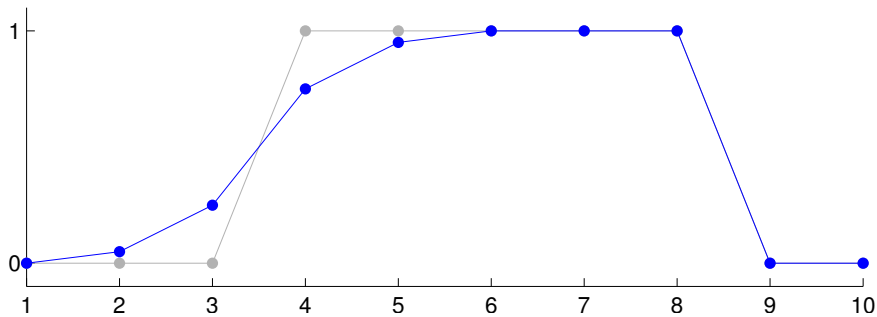
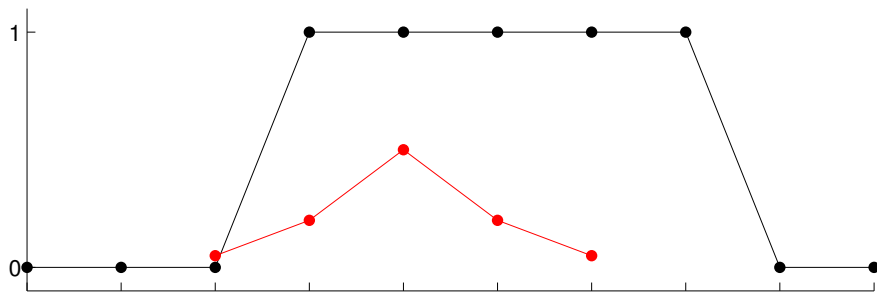
Convolution, position 3



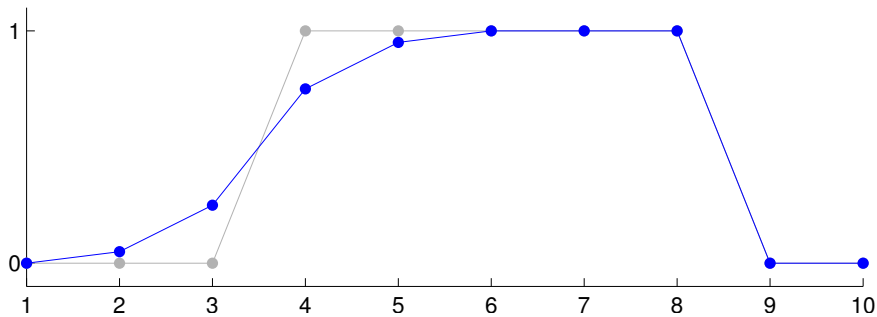
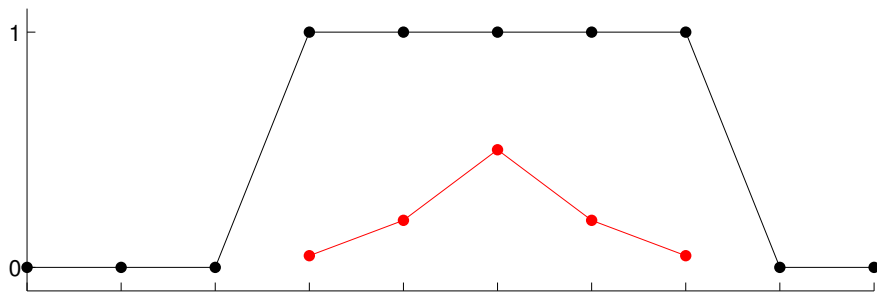
Convolution, position 4



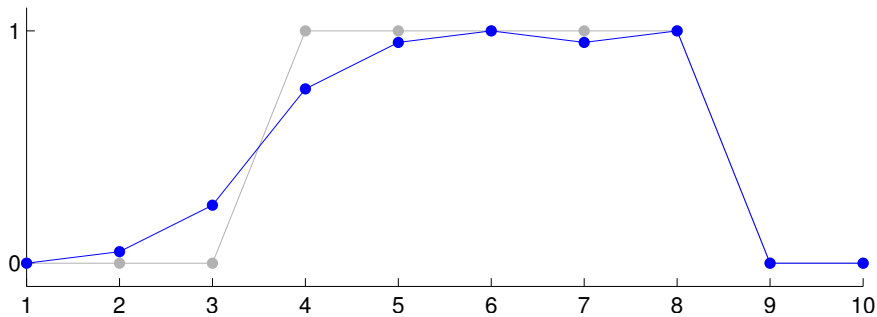
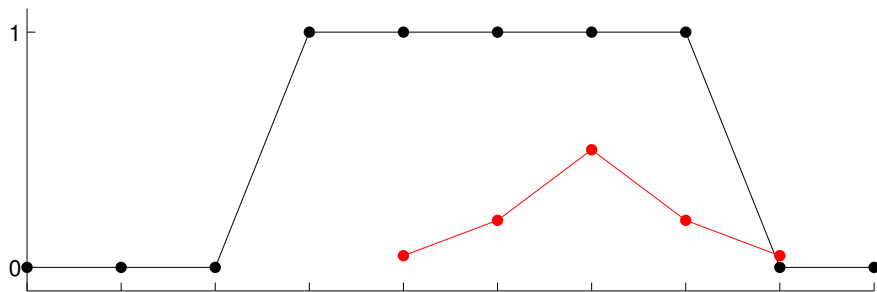
Convolution, position 5



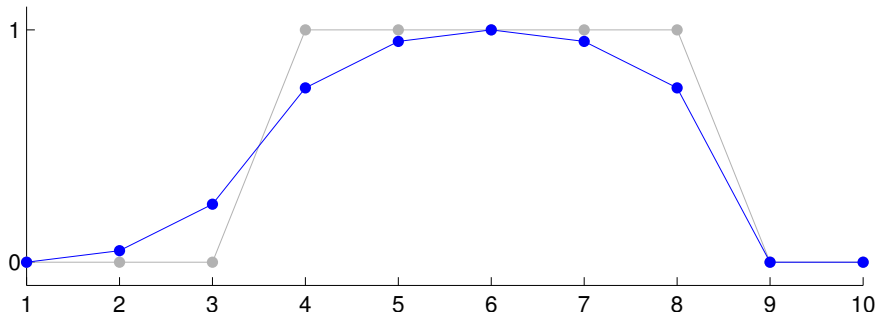
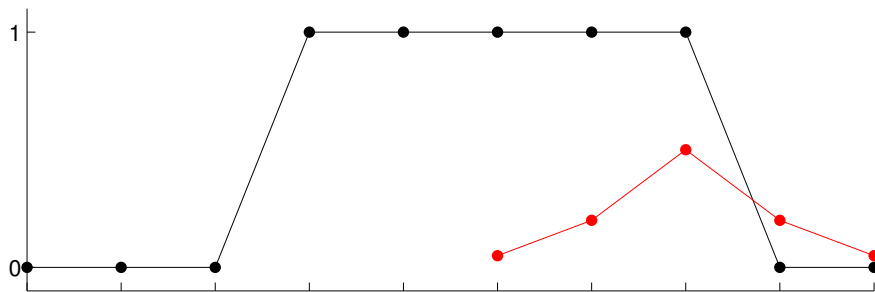
Convolution, position 6



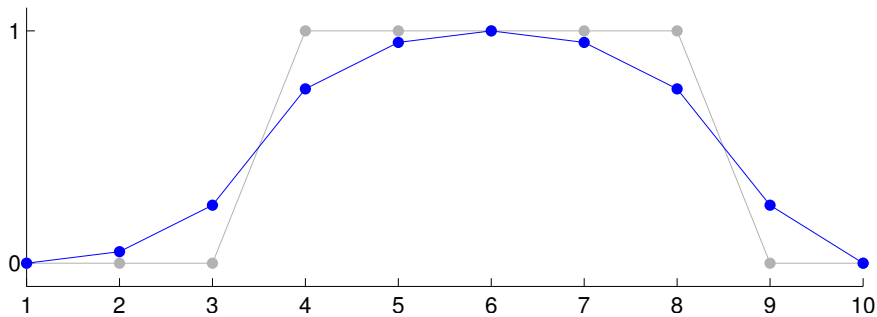
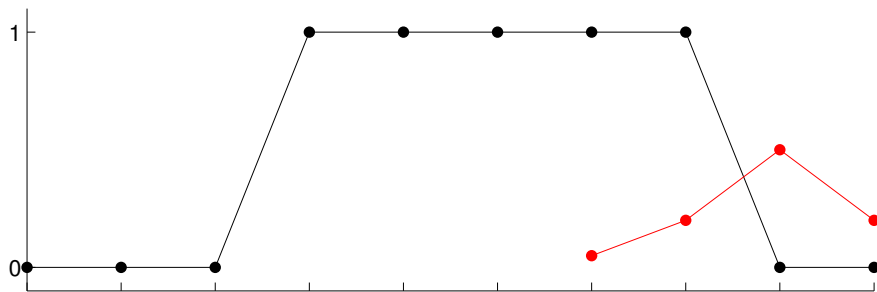
Convolution, position 7



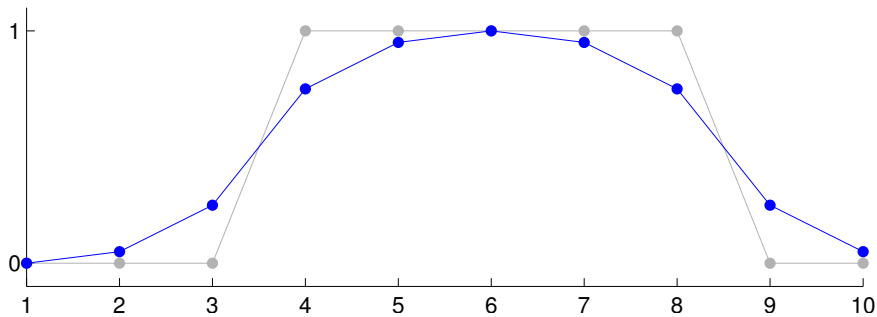
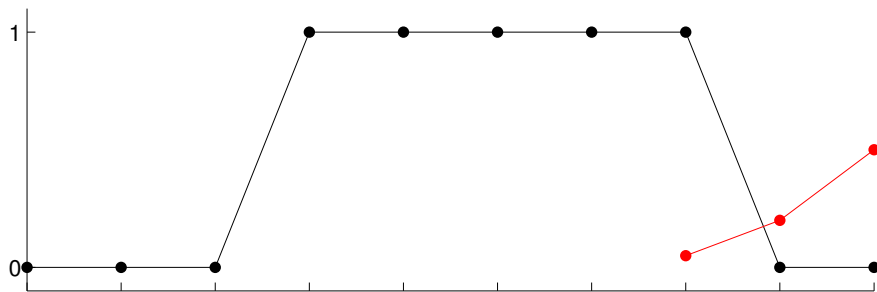
Convolution, position 8



Convolution, position 9



Convolution, position 10

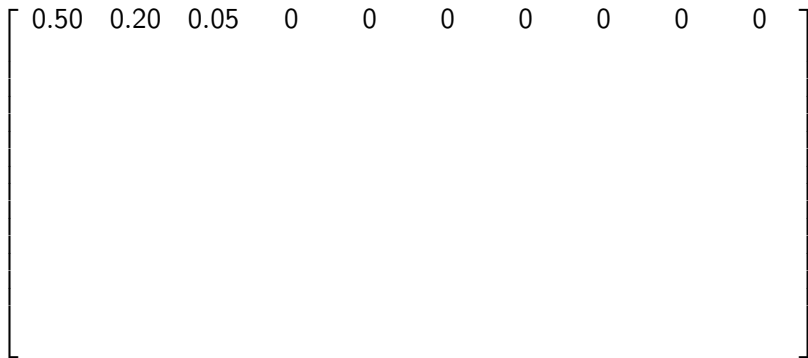
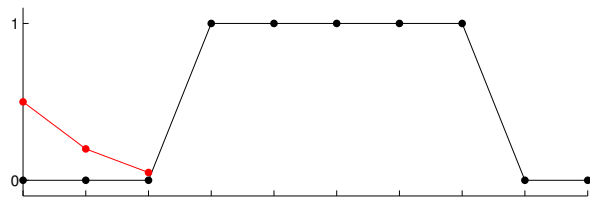


Outline

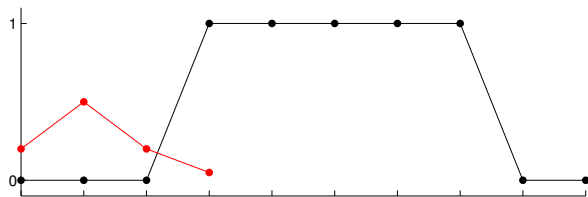
The convolution process

Constructing the matrix

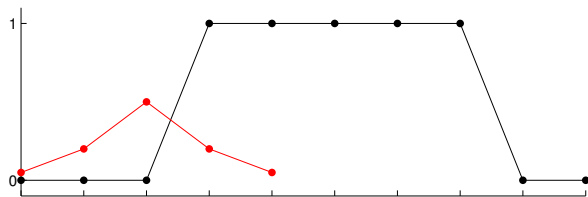
Convolution matrix, positions up to 1



Convolution matrix, positions up to 2

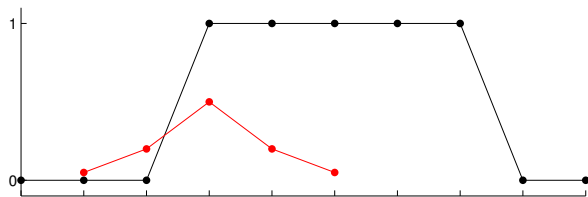

$$\begin{bmatrix} 0.50 & 0.20 & 0.05 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0.20 & 0.50 & 0.20 & 0.05 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Convolution matrix, positions up to 3



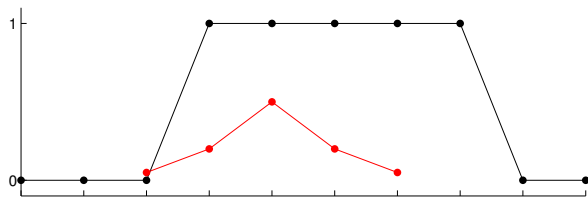
0.50	0.20	0.05	0	0	0	0	0	0	0
0.20	0.50	0.20	0.05	0	0	0	0	0	0
0.05	0.20	0.50	0.20	0.05	0	0	0	0	0

Convolution matrix, positions up to 4



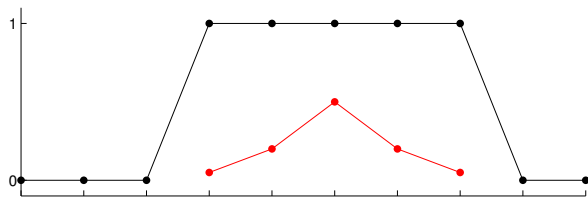
0.50	0.20	0.05	0	0	0	0	0	0	0
0.20	0.50	0.20	0.05	0	0	0	0	0	0
0.05	0.20	0.50	0.20	0.05	0	0	0	0	0
0	0.05	0.20	0.50	0.20	0.05	0	0	0	0

Convolution matrix, positions up to 5



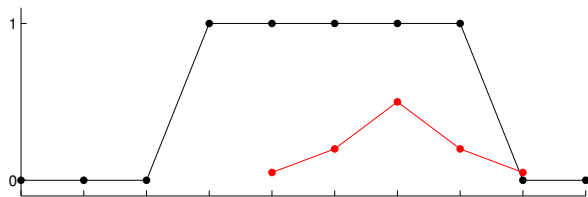
0.50	0.20	0.05	0	0	0	0	0	0	0
0.20	0.50	0.20	0.05	0	0	0	0	0	0
0.05	0.20	0.50	0.20	0.05	0	0	0	0	0
0	0.05	0.20	0.50	0.20	0.05	0	0	0	0
0	0	0.05	0.20	0.50	0.20	0.05	0	0	0

Convolution matrix, positions up to 6



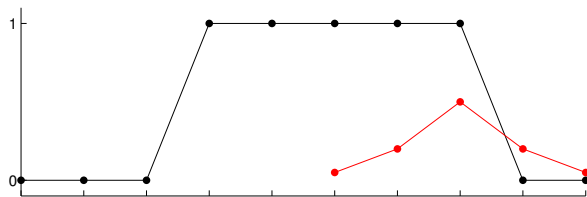
0.50	0.20	0.05	0	0	0	0	0	0	0
0.20	0.50	0.20	0.05	0	0	0	0	0	0
0.05	0.20	0.50	0.20	0.05	0	0	0	0	0
0	0.05	0.20	0.50	0.20	0.05	0	0	0	0
0	0	0.05	0.20	0.50	0.20	0.05	0	0	0
0	0	0	0.05	0.20	0.50	0.20	0.05	0	0

Convolution matrix, positions up to 7



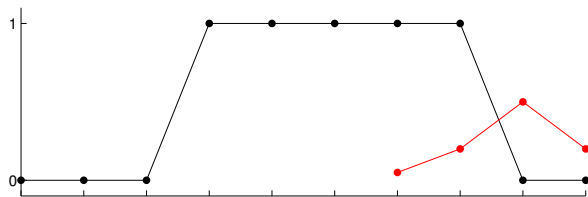
0.50	0.20	0.05	0	0	0	0	0	0	0
0.20	0.50	0.20	0.05	0	0	0	0	0	0
0.05	0.20	0.50	0.20	0.05	0	0	0	0	0
0	0.05	0.20	0.50	0.20	0.05	0	0	0	0
0	0	0.05	0.20	0.50	0.20	0.05	0	0	0
0	0	0	0.05	0.20	0.50	0.20	0.05	0	0
0	0	0	0	0.05	0.20	0.50	0.20	0.05	0

Convolution matrix, positions up to 8



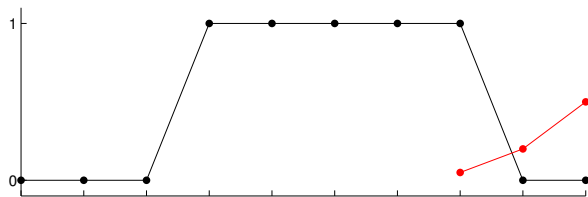
0.50	0.20	0.05	0	0	0	0	0	0	0
0.20	0.50	0.20	0.05	0	0	0	0	0	0
0.05	0.20	0.50	0.20	0.05	0	0	0	0	0
0	0.05	0.20	0.50	0.20	0.05	0	0	0	0
0	0	0.05	0.20	0.50	0.20	0.05	0	0	0
0	0	0	0.05	0.20	0.50	0.20	0.05	0	0
0	0	0	0	0.05	0.20	0.50	0.20	0.05	0
0	0	0	0	0	0.05	0.20	0.50	0.20	0.05

Convolution matrix, positions up to 9



0.50	0.20	0.05	0	0	0	0	0	0	0
0.20	0.50	0.20	0.05	0	0	0	0	0	0
0.05	0.20	0.50	0.20	0.05	0	0	0	0	0
0	0.05	0.20	0.50	0.20	0.05	0	0	0	0
0	0	0.05	0.20	0.50	0.20	0.05	0	0	0
0	0	0	0.05	0.20	0.50	0.20	0.05	0	0
0	0	0	0	0.05	0.20	0.50	0.20	0.05	0
0	0	0	0	0	0.05	0.20	0.50	0.20	0.05
0	0	0	0	0	0	0.05	0.20	0.50	0.20

Convolution matrix, positions up to 10



0.50	0.20	0.05	0	0	0	0	0	0	0
0.20	0.50	0.20	0.05	0	0	0	0	0	0
0.05	0.20	0.50	0.20	0.05	0	0	0	0	0
0	0.05	0.20	0.50	0.20	0.05	0	0	0	0
0	0	0.05	0.20	0.50	0.20	0.05	0	0	0
0	0	0	0.05	0.20	0.50	0.20	0.05	0	0
0	0	0	0	0.05	0.20	0.50	0.20	0.05	0
0	0	0	0	0	0.05	0.20	0.50	0.20	0.05
0	0	0	0	0	0	0.05	0.20	0.50	0.20
0	0	0	0	0	0	0	0.05	0.20	0.50