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Exercise 04a. Implement a program 'exercise\_04a\_opening' that performs a morphological opening of size 'i' using a square of size  $(2*i+1) \times (2*i+1)$ :

exercise\_04a\_opening i exercise\_04a\_input\_01.pgm exercise\_04a\_output\_01.pgm

Note: 8-connectivity is assumed.

Some test images:

immed\_gray\_inv.pgm (input image)  
immed\_gray\_inv\_20051123\_ope1.pgm (opening of size 1, 8-connectivity)  
immed\_gray\_inv\_20051123\_ope2.pgm (opening of size 2, 8-connectivity)

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Exercise 04b. Implement a program 'exercise\_04b\_closing' that performs a morphological closing of size 'i' using a square of size  $(2*i+1) \times (2*i+1)$ :

exercise\_04b\_closing i exercise\_04b\_input\_01.pgm exercise\_04b\_output\_01.pgm

Note: 8-connectivity is assumed.

Some test images:

immed\_gray\_inv.pgm (input image)  
immed\_gray\_inv\_20051123\_clo1.pgm (closing of size 1, 8-connectivity)  
immed\_gray\_inv\_20051123\_clo2.pgm (closing of size 2, 8-connectivity)

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