582412 Image Processing, Spring 2003
Exercise 4

1. Show that a high-pass filtered image can be achieved via the difference

$$f_{hp} = f_{id} - f_{lp}$$

where f_{hp}, f_{id}, and f_{lp} are high-pass-, identity-, and low-pass filters in spatial domain, respectively. For simplicity, use 3×3 filters.

2. Show that the result of a 3×3 average filter is achieved by replacing the filter by two filters of sizes 1×3 and 3×1. How many arithmetic operations (additions and multiplications) are needed in these two cases?

3. Show with one of the Sobel masks that the procedure of replacing a 3×3 mask by two masks of sizes 1×3 and 3×1 applies also with Sobel masks.

4. Calculate the response of an LTI system, when its impulse response is

$$h(n) = 2\delta(n+1) + 2\delta(n-1)$$

and input is

$$x(n) = \delta(n) + 2\delta(n-1) - \delta(n-3).$$

5. Calculate the DFT of a periodic sequence $x(n) = (1, 1, 1, 1, 0, 0, 0, 0)$.

6. Calculate the DFT of a sequence $x(n) = (4, -1, 2, 0)$ by simulating the FFT algorithm.