6.300: Signal Processing

Final Exam Practice Problems #3

- Final Exam: Johnson Track on Friday, 12/19 at 1:30 p.m.
- Bring three 8.5″ × 11.0″ pages (six sides) of handwritten notes.

Fill out the survey on the course website.
https://sigproc.mit.edu/fall25/survey

Fill out a subject evaluation for this class.
https://registrar.mit.edu/classes-grades-evaluations/subject-evaluation

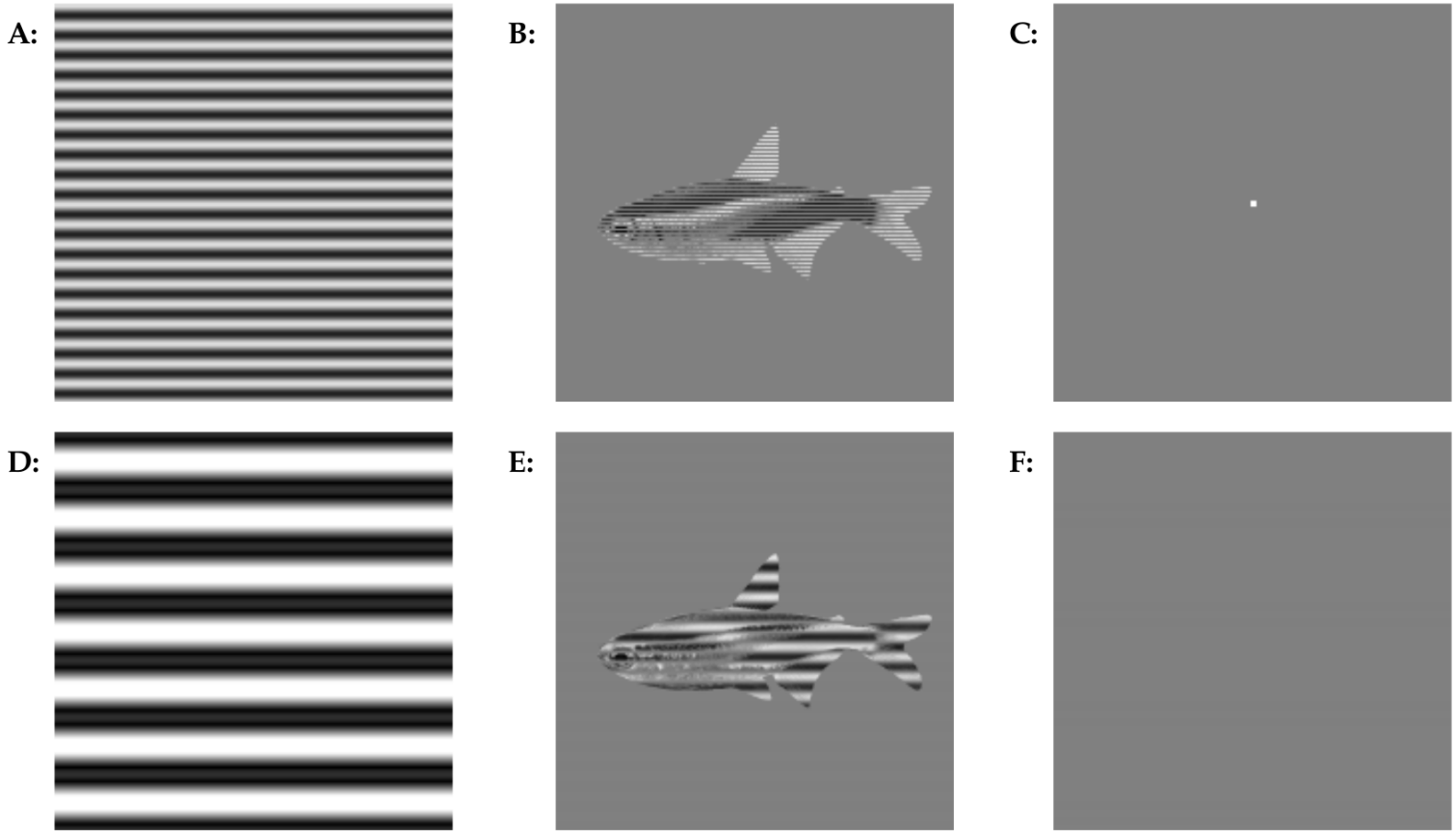
December 9, 2025

Tetra

Let $f[r, c]$ represent the image above. Black (-0.5) and white (0.5) pixels are indexed by row number r and column number c. Here, $-100 \leq r, c < 100$ and $R = C = 200$. Define four additional images:

$$h_1[r, c] = \sin(40\pi r/R) \qquad h_2[r, c] = \begin{cases} 1 & r \text{ even} \\ 0 & \text{otherwise} \end{cases}$$

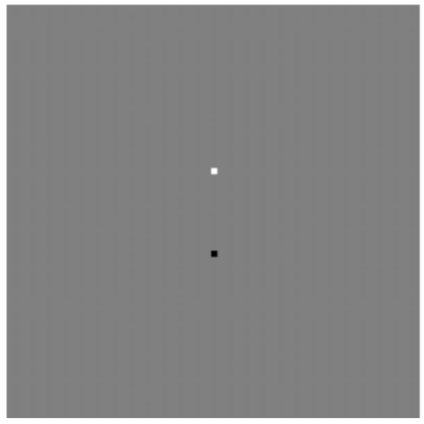
$$H_3[k_r, k_c] = j \sin(40\pi k_r/R) \qquad H_4[k_r, k_c] = \begin{cases} 1 & k_r \text{ even} \\ 0 & \text{otherwise} \end{cases}$$



Match each transformation to the corresponding image. (Images **A/B/C/D/E/F** are shown; **G/H/I/J/K/L** are on the next slide.)

$(f \times h_1)[r, c]$	$(f \times h_2)[r, c]$	$(f \times h_3)[r, c]$	$(f \times h_4)[r, c]$
$(f \circledast h_1)[r, c]$	$(f \circledast h_2)[r, c]$	$(f \circledast h_3)[r, c]$	$(f \circledast h_4)[r, c]$

G:



H:

I:

J:

K:

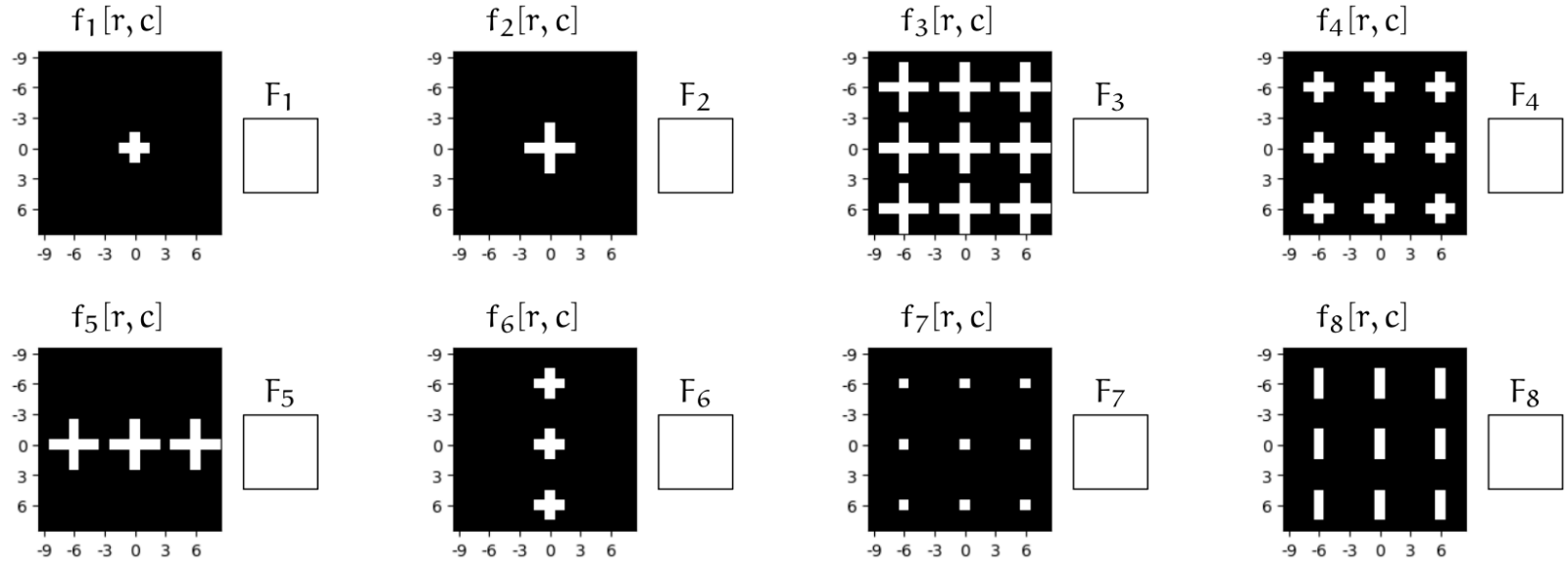
L:

Match each transformation to the corresponding image. (Images **G/H/I/J/K/L** are shown; **A/B/C/D/E/F** are on the last slide.)

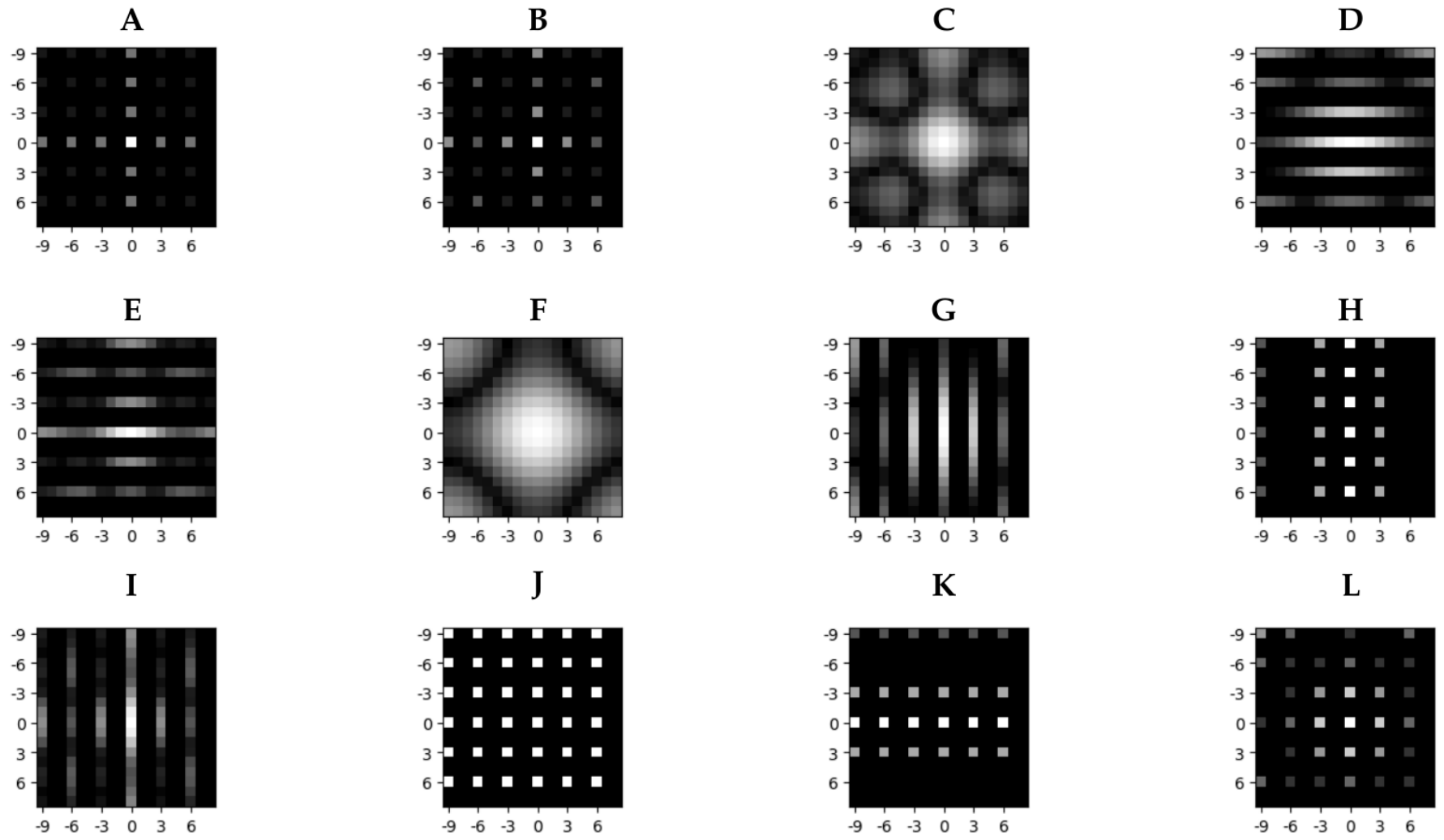
$(f \times h_1)[r, c]$	$(f \times h_2)[r, c]$	$(f \times h_3)[r, c]$	$(f \times h_4)[r, c]$
$(f \circledast h_1)[r, c]$	$(f \circledast h_2)[r, c]$	$(f \circledast h_3)[r, c]$	$(f \circledast h_4)[r, c]$

Pluses and Minuses

The images below show eight images: $f_1[r, c], \ldots, f_8[r, c]$. Black (0) and white (1) pixels are indexed by row number r and column number c, where $-9 \leq r, c < 9$.



Match $f_i[r, c]$ to the image on the next page that shows $|F_i[k_r, k_c]|$, the magnitude of its 2D DFT. Black represents the minimum magnitude and white represents the maximum magnitude.



Match $f_i[r, c]$ to the image above that shows $|F_i[k_r, k_c]|$, the magnitude of its 2D DFT. Black represents the minimum magnitude and white represents the maximum magnitude.