MMAT 5390: Mathematical Image Processing

Assignment 3

Due: March 15, 2024

Please give reasons in your solutions.

1. Suppose $g = (g(k,l))_{0\le k,l\le N-1}$ is an $N \times N$ image, define $\tilde{g} = (\tilde{g}(k,l))_{-2\le k\le N-3,-4-N\le l\le -5}$ as
$$\tilde{g}(k,l) = g(k+2,-5-l) \text{ for } -2 \le k \le N-3 \text{ and } -4-N \le l \le -5.$$
Prove that
$$DFT(\tilde{g})(m,n) = e^{2\pi j \frac{5n+2m}{N}} DFT(g)(m,-n).$$

2. Let $f, g \in \mathbb{R}^{M\times N}$ be $M \times N$ images. Prove that $DFT(f \odot g) = DFT(f) * DFT(g)$, where $f \odot g(k,l) = f(k,l)g(k,l)$.