

Week 9 Homework

Problem 1

Let g be a “derivative” mask defined by $g(-1) = 1$, $g(0) = -1$ and $g(i) = 0$ everywhere else. Compute $f \otimes g$ for the following cases:

- (a) $f(i) = i$.
- (b) $f(i) = i^2$.

Problem 2

We saw in class that every linear shift-invariant system can be seen as a convolution. Now you will show a converse to that statement. Let S be a system that convolves its input with a fixed signal (or mask) g ,

$$S(f) = f \otimes g.$$

Show that S is linear and shift-invariant.

Problem 3

- (a) Show that convolution is commutative $f \otimes g = g \otimes f$.
- (b) Show that convolution is associative $f \otimes (g \otimes h) = (f \otimes g) \otimes h$.