Homework 4 Solutions

Tuesday, May 4, 2021 7:07 PM

1. (a) $G(u,v) =$

$$\frac{1}{4}\left[e^{-j2\pi v/N} + e^{j2\pi v/N} + e^{-j2\pi u/M} + e^{j2\pi u/M}\right] F(u,v)$$

(b) $H(u,v) = G(u,v) / F(u,v)$

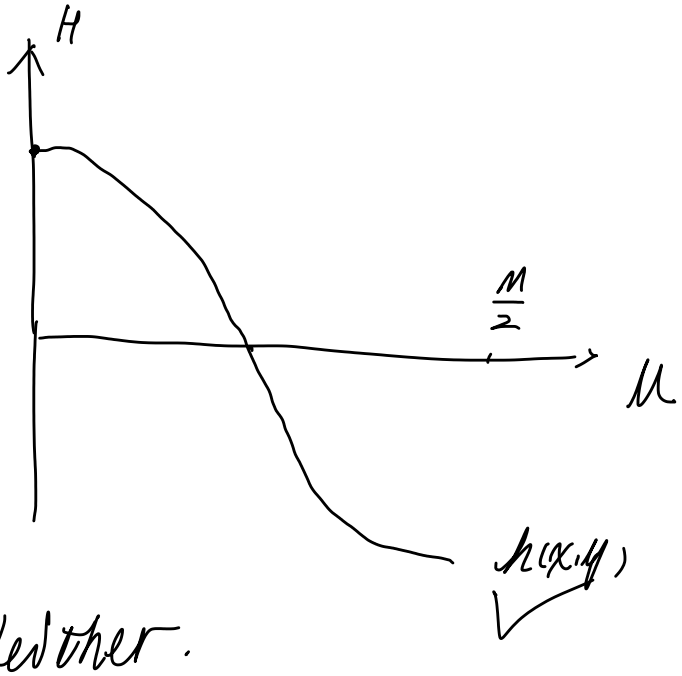
$$= \frac{1}{4}\left(e^{-j2\pi v/N} + e^{j2\pi v/N} + e^{-j2\pi u/M} + e^{j2\pi u/M}\right)$$

$$= \frac{1}{4}\left(2\cos\left(\frac{2\pi v}{N}\right) + 2\cos\left(\frac{2\pi u}{M}\right)\right)$$

$$= \frac{1}{2}\left(\cos\frac{2\pi v}{N} + \cos\frac{2\pi u}{M}\right)$$

(c) $\frac{1}{2}\left|\cos\frac{2\pi u}{M} + \cos\frac{2\pi v}{N}\right|$

(a)



Neither.

2. (a) $\begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix} = h(x,y)$

Use [illegible]

we know:

$$f(x-x_0, y-y_0) \rightarrow F(u,v)e^{-j2\pi\left(\frac{ux_0}{M}+\frac{vy_0}{N}\right)}$$

So. $H(u,v) = e^{-j2\pi\frac{u}{M}} + e^{-j2\pi\frac{v}{N}} + 0 - 4e^{\cdot}$

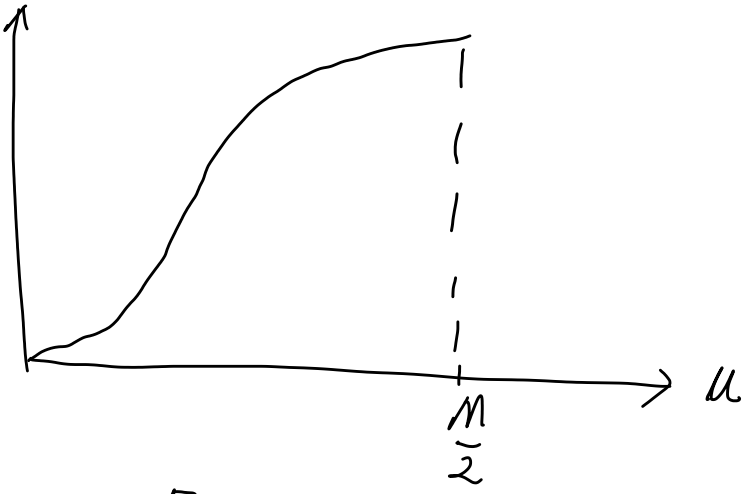
$$+e^{j2\pi\frac{u}{M}} + e^{j2\pi\frac{v}{N}}$$

$$= -4 + \left(e^{-j2\pi\frac{u}{M}} + e^{j2\pi\frac{u}{M}}\right) + \left(e^{-j2\pi\frac{v}{N}} + e^{j2\pi\frac{v}{N}}\right)$$

$$= -4 + 2\cos\frac{2\pi u}{M} + 2\cos\frac{2\pi v}{N}$$

(b) 见此码

(c)



Highpass Filter