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~~DD~~
DIP Assignment-3

Q2

Ans

We have

$$N=512, M=512$$

from image we have.

$$i(n, m) = \begin{cases} 1 & n=256, 0 \leq m \leq 511 \\ 0 & \text{otherwise.} \end{cases}$$

Doing DFT

$$I(k, l) = \sum_{n=0}^{N-1} \sum_{m=0}^{M-1} i(n, m) e^{-j2\pi kn \frac{N}{N}} e^{-j2\pi lm \frac{M}{M}}$$

$$I(k, l) = \sum_{m=0}^{M-1} e^{-j2\pi lm \frac{M}{M}} \cdot e^{-j\pi k}$$

$$I(k, l) = e^{-j\pi k} \left[\frac{1 - e^{-2\pi j l}}{1 - e^{-2\pi j l / M}} \right]$$

$$I(k, l) = (-1)^k \cdot \left[\frac{1 - e^{-2\pi j l}}{1 - e^{-2\pi j l / M}} \right]$$

we have two cases
 $l=0$ & $l \neq 0$

$$\underline{l=0}$$

we have $0/0$ form
L'Hôpital's rule.

$$\lim_{l \rightarrow 0} \frac{(-1)^k (1 - e^{-i2\pi l})}{(1 - e^{-2i\pi l/M})}$$

$$= (-1)^k M$$

$$l \neq 0$$

$$(1-1) = \underline{0}$$

So we can sum up.

$$I(k, l) = \begin{cases} (-1)^k M, & l=0 \\ 0 & \text{otherwise} \end{cases}$$