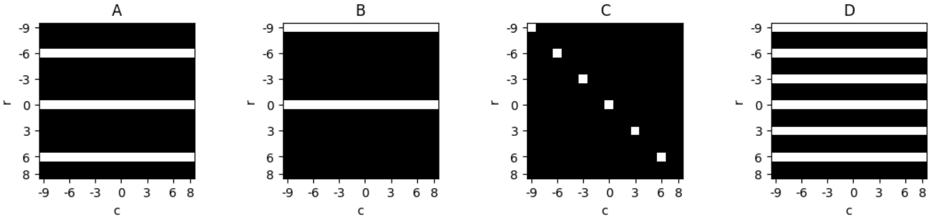
6.3000: Signal Processing

Filering Images

November 20, 2025

Filtering Images

Which of the following space-domain images can be constructed by filtering one of the other images by the DFT of another of them?



The brightnesses of the black pixels are zero. The brightnesses of the white pixels are greater than zero. The brightnesses of all white pixels in a given image are the same, but those of white pixels in one image may differ from those in a different image.

Filtering Images

Filter model:

input image → filter → output image

Space-domain interpretation:

$$x[r,c] \longrightarrow \boxed{h[r,c]} \longrightarrow y[r,c] = \frac{1}{RC}\,(x \circledast h)[r,c]$$

Frequency-domain interpretation:

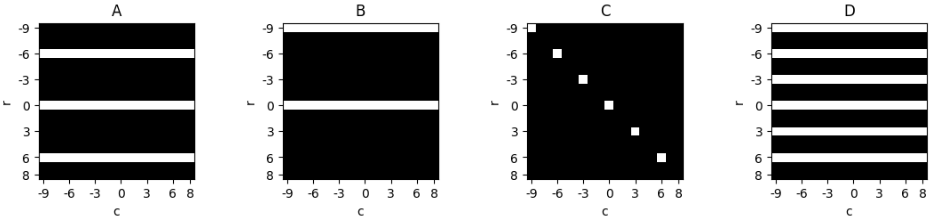
$$X[k_r,k_c] \longrightarrow \boxed{H[k_r,k_c]} \longrightarrow Y[k_r,k_c] = X[k_r,k_c]H[k_r,k_c]$$

We should be able to understand the previous problem both ways.

Filtering Images

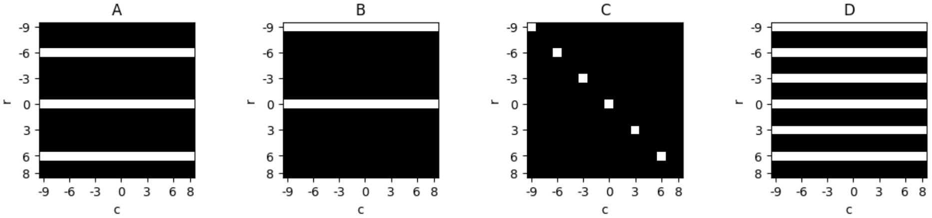
Which of the following images can be constructed by

- circularly convolving two of the other images
- inverse transforming the product of the DFTs of two images



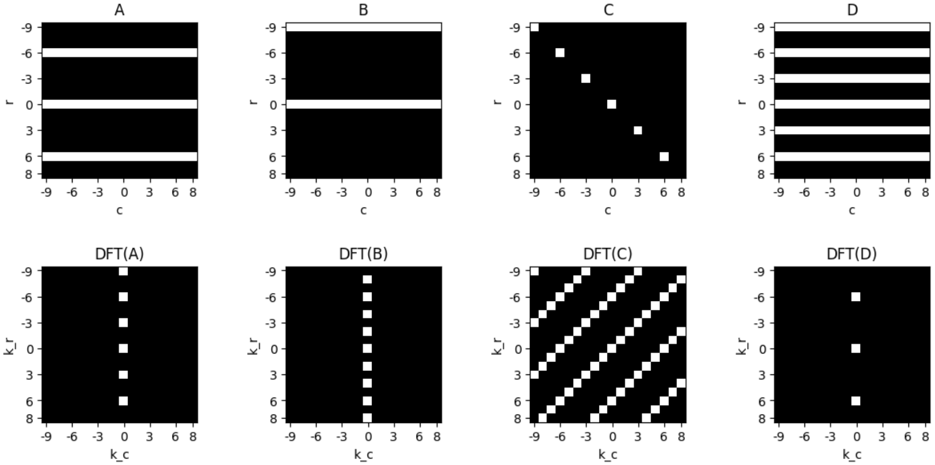
Filtering Images

Try the transform method.



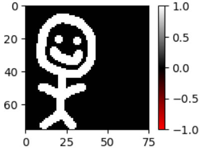
Filtering Images

Try the transform method.

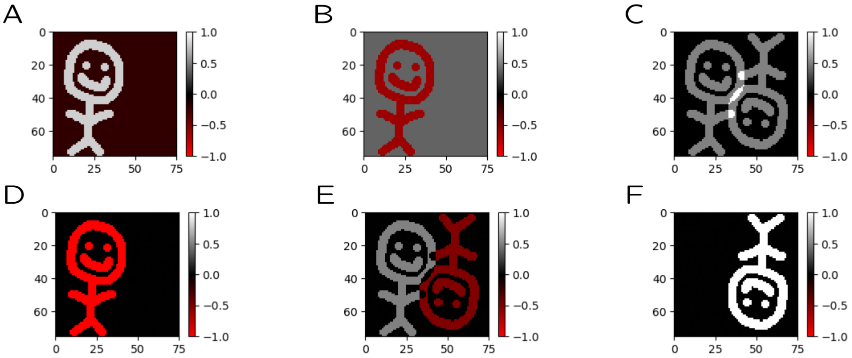


Stickmen

Let $X[k_r, k_c]$ represent the 2D DFT of the following image.



Which of A-F (if any) shows the iDFT of the real part of X?



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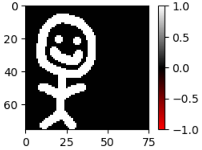
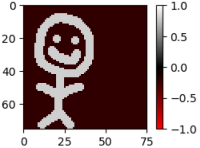
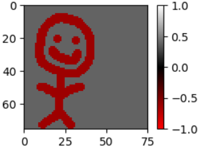


Which of A-F (if any) shows the iDFT of the real part of X? C

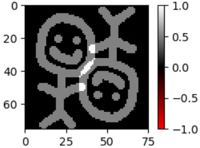
A



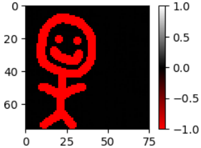
B



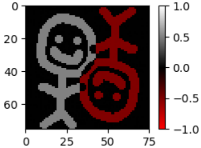
C



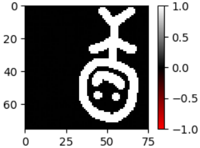
D



E



F



Stickmen

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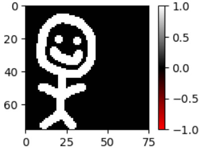
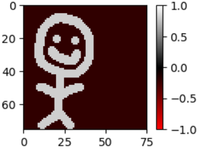
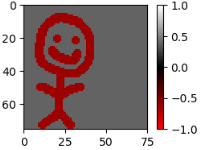


Which (if any) shows the iDFT of the imaginary part of X?

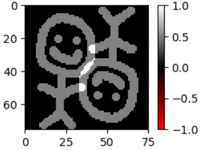
A



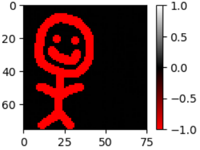
B



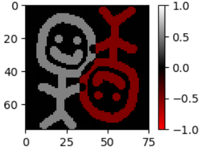
C



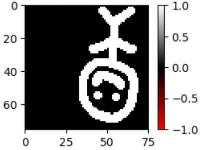
D



E



F



Stickmen

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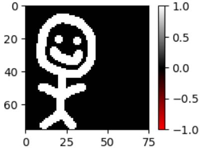
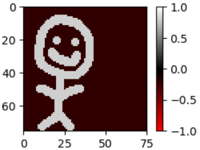
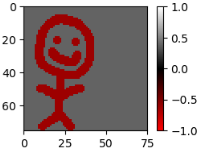


Which (if any) shows the iDFT of the imaginary part of X? None

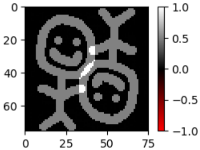
A



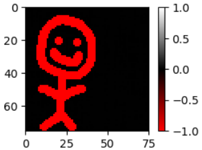
B



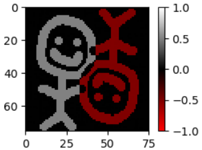
C



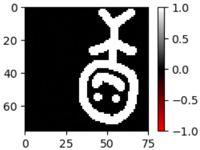
D



E

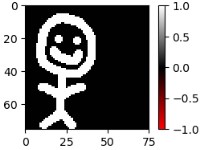


F



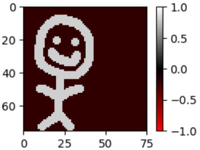
Stickmen

Let $X[k_r, k_c]$ represent the 2D DFT of the following image.

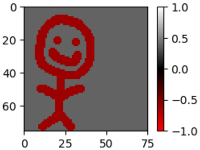


Which (if any) shows the iDFT of j times the imaginary part of X?

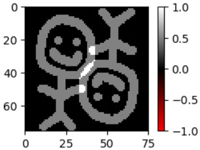
A



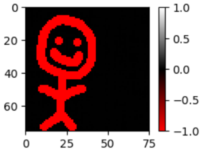
B



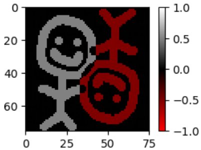
C



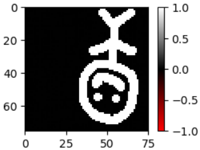
D



E

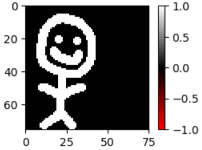


F



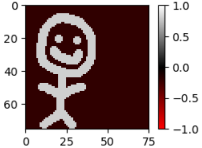
Stickmen

Let $X[k_r, k_c]$ represent the 2D DFT of the following image.

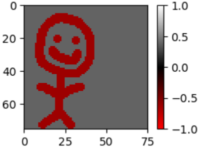


Which (if any) shows the iDFT of j times the imaginary part of X? E

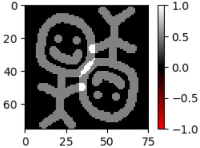
A



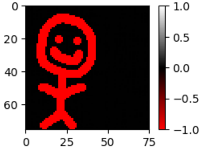
B



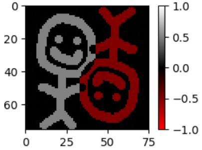
C



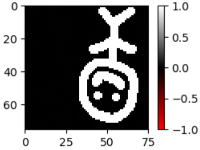
D



E



F



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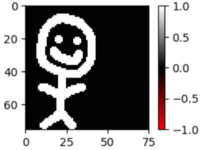
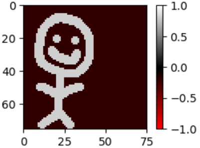
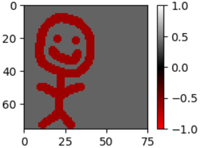


Which (if any) shows the iDFT of X after setting $X[0,0] = 0$.

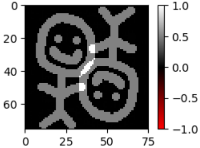
A



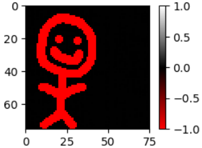
B



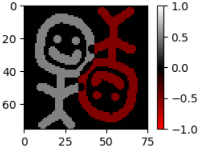
C



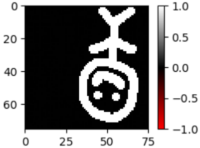
D



E



F



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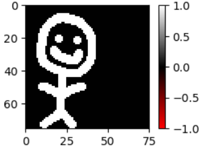
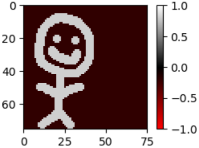
Let $X[k_r, k_c]$ represent the 2D DFT of the following image.

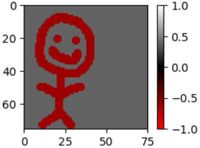


Which (if any) shows the iDFT of X after setting $X[0,0] = 0$. A

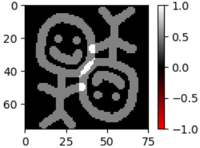
A



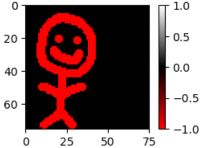
B



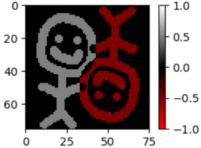
C



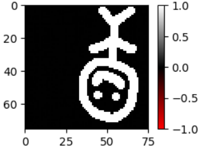
D



E



F



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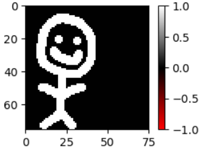
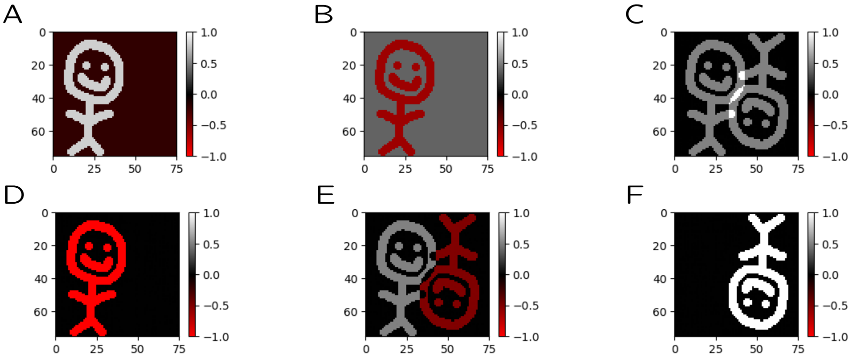
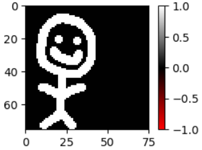


Which (if any) shows the iDFT of X after multiplying every value by $e^{j\pi}$.



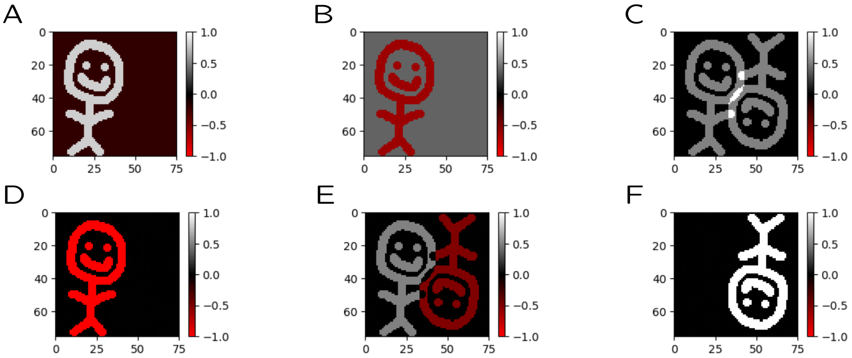
Stickmen

Let $X[k_r, k_c]$ represent the 2D DFT of the following image.



Which (if any) shows the iDFT of X after multiplying every value by $e^{j\pi}$.

D



Stickmen

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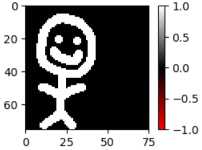
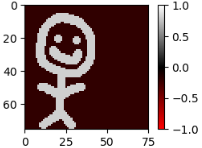
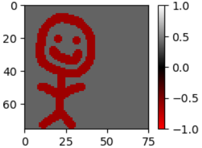


Which (if any) shows the iDFT of X after multiplying every value except $X[0,0]$ by $e^{j\pi}$.

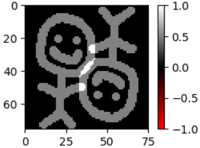
A



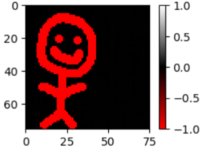
B



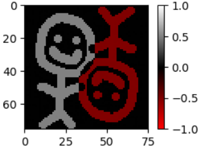
C



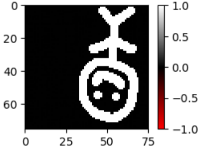
D



E



F



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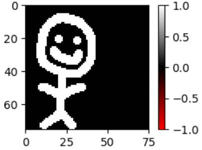
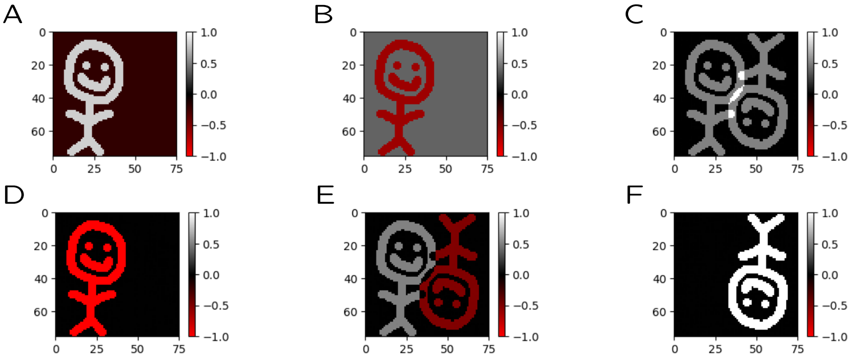
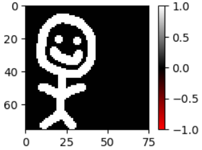


Which (if any) shows the iDFT of X after multiplying every value except $X[0,0]$ by $e^{j\pi}$. B



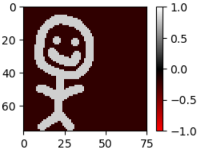
Stickmen

Let $X[k_r, k_c]$ represent the 2D DFT of the following image.

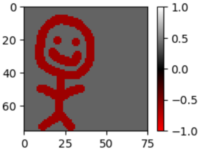


Which (if any) shows the iDFT of X after negating the phase of each point in X.

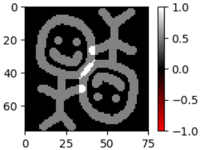
A



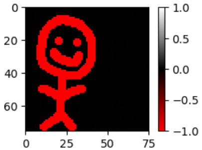
B



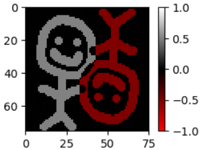
C



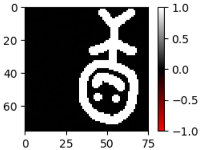
D



E

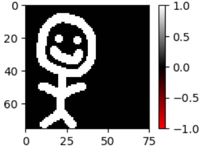


F



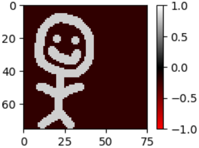
Stickmen

Let $X[k_r, k_c]$ represent the 2D DFT of the following image.

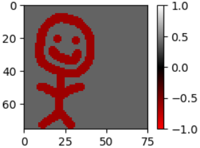


Which (if any) shows the iDFT of X after negating the phase of each point in X. F

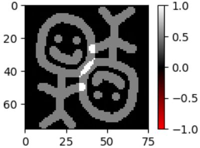
A



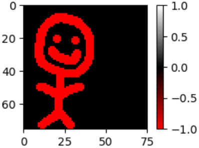
B



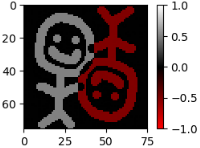
C



D



E



F