Two-Dimensional Patterns

Which of A-H corresponds to $f_0$?

\[ f_0[r, c] \]
\[ f_1[r, c] \]
\[ f_2[r, c] \]
\[ f_3[r, c] \]
\[ f_4[r, c] \]
\[ f_5[r, c] \]
\[ f_6[r, c] \]
\[ f_7[r, c] \]

A B C D
E F G H
Which of A-H corresponds to $f_0$?
Two-Dimensional Patterns

Which of A-H corresponds to $f_1$?
Two-Dimensional Patterns

Which of A-H corresponds to $f_1$?
Two-Dimensional Patterns

Which of A-H corresponds to $f_2$?

- $f_0[r,c]$:
- $f_1[r,c]$:
- $f_2[r,c]$:
- $f_3[r,c]$:
- $f_4[r,c]$:
- $f_5[r,c]$:
- $f_6[r,c]$:
- $f_7[r,c]$:

A:0 B:1 C D:0 E F:1 G H
Two-Dimensional Patterns

Which of A-H corresponds to $f_2$?

- $f_0[r, c]$
- $f_1[r, c]$
- $f_2[r, c]$
- $f_3[r, c]$
- $f_4[r, c]$
- $f_5[r, c]$
- $f_6[r, c]$
- $f_7[r, c]$

A: B: C:2 D:0
E: F:1 G: H
Two-Dimensional Patterns

Which of A-H corresponds to $f_3$?
Two-Dimensional Patterns

Which of A-H corresponds to $f_3$?

\[ f_0[r, c] \]
\[ f_1[r, c] \]
\[ f_2[r, c] \]
\[ f_3[r, c] \]
\[ f_4[r, c] \]
\[ f_5[r, c] \]
\[ f_6[r, c] \]
\[ f_7[r, c] \]
Which of A-H corresponds to $f_4$?

- $f_0[r,c]$
- $f_1[r,c]$
- $f_2[r,c]$
- $f_3[r,c]$
- $f_4[r,c]$
- $f_5[r,c]$
- $f_6[r,c]$
- $f_7[r,c]$

A B C:2 D:0
E:3 F:1
Two-Dimensional Patterns

Which of A-H corresponds to $f_4$?

- $f_0[r, c]$
- $f_1[r, c]$
- $f_2[r, c]$
- $f_3[r, c]$
- $f_4[r, c]$
- $f_5[r, c]$
- $f_6[r, c]$
- $f_7[r, c]$

A: 4
B
C: 2
D: 0
E: 3
F: 1
G
H
Which of A-H corresponds to $f_5$?
Two-Dimensional Patterns

Which of A-H corresponds to $f_5$?

A:4  B  C:2  D:0  E:3  F:1  G:5  H
Which of A-H corresponds to $f_6$?
Two-Dimensional Patterns

Which of A-H corresponds to $f_6$?

$$f_0[r,c]$$

$$f_1[r,c]$$

$$f_2[r,c]$$

$$f_3[r,c]$$

$$f_4[r,c]$$

$$f_5[r,c]$$

$$f_6[r,c]$$

$$f_7[r,c]$$

A: 4  B: 6  C: 2  D: 0

E: 3  F: 1  G: 5  H
Two-Dimensional Patterns

Which of A-H corresponds to $f_7$?
Two-Dimensional Patterns

Which of A-H corresponds to $f_7$?

A:4  B:6  C:2  D:0  E:3  F:1  G:5  H:7
Circular Convolution

Which of the following images shows the circular convolution of the images above?

In each image, black represents the most negative value (not necessarily 0) and white represents the most positive value (not necessarily 1).
Circular Convolution

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Circular Convolution

\[ \text{Circular Convolution} \]

\[ = 0 \]
\[ = +1 \]
\[ x_0 \]
\[ -6 \rightarrow 0 \rightarrow 6 \]
\[ -4 \rightarrow 4 \]

\[ = -1.7 \]
\[ = 0 \]
\[ = +2 \]
\[ x_1 \]
\[ -6 \rightarrow 0 \rightarrow 6 \]
\[ -4 \rightarrow 4 \]

Which of the following images shows the circular convolution of the images above?

- Graph A
- Graph B
- Graph C
- Graph D
- Graph E
- Graph F
- Graph G
- Graph H
- Graph I
- Graph J
- Graph K
- Graph L
- Graph M
- Graph N
- Graph O

In each image, black represents the most negative value (not necessarily 0) and white represents the most positive value (not necessarily 1).
Circular Convolution

\[ x_0 \ast C = C \]

Which of the following images shows the circular convolution of the images above?

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Circular Convolution

\[ \begin{array}{ccc}
-6 & 0 & 6 \\
0 & * & 0 \\
-4 & 0 & 4 \\
-2 & 0 & 2 \\
-4 & 0 & 4 \\
-6 & 0 & 6 \\
\end{array} \]

Which of the following images shows the circular convolution of the images above?

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Circular Convolution

\[
\begin{align*}
\text{Graph A} & \quad \text{Graph B} \\
\text{Graph C} & \quad \text{Graph D} \\
\text{Graph E} & \quad \text{Graph F} \\
\text{Graph G} & \quad \text{Graph H} \\
\text{Graph I} & \quad \text{Graph J} \\
\text{Graph K} & \quad \text{Graph L} \\
\text{Graph M} & \quad \text{Graph N} \\
\text{Graph O} & \\
\end{align*}
\]

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