Q1-1: If the size of Input matrix I is NxN and kernel size is KxK, what is the size of the output matrix after performing Convolution? Assume N>K, no padding (VALID), and stride = 1.

1. \((N - K + 1) \times (N - K + 1)\)
2. \((N - K) \times (N - K)\)
3. \((N - K - 1) \times (N - K - 1)\)
4. None of the above
Q1-1: If the size of Input matrix I is NxN and kernel size is KxK, what is the size of the output matrix after performing Convolution? Assume N>K, no padding (VALID), and stride = 1.

1. \((N - K + 1) \times (N - K + 1)\)
2. \((N - K) \times (N - K)\)
3. \((N - K - 1) \times (N - K - 1)\)
4. None of the above

- When sliding to the right, we have N-K+1 so many positions
- Similar when sliding downwards
Q1-2: Given the input I (left) and CNN kernel K (right) with stride=1 and no padding, compute the output matrix (O). Which of the following statements are true?

\[
\begin{array}{ccc}
 a & b & a \\
b & a & b \\
a & b & a \\
\end{array}
\]

\[
\begin{array}{cc}
 1 & -1 \\
-1 & 1 \\
\end{array}
\]

A. The size of output matrix \( O \) = 2x2
B. Sum of all the values in output matrix is 0.
C. Output matrix \( O \) is a symmetric matrix.
D. Output matrix \( O \) is a positive definite matrix.

1. A, B
2. A, B, C
3. A, C, D
4. A, B, C, D
Given the input $I$ (left) and CNN kernel $K$ (right) with stride=1 and no padding, compute the output matrix $O$. Which of the following statements are true?

$$
\begin{array}{ccc}
1 & -1 \\
-1 & 1 \\
\end{array}
\quad
\begin{array}{cc}
2a - 2b & 2b - 2a \\
2b - 2a & 2a - 2b \\
\end{array}
$$

A. The size of output matrix $O = 2 \times 2$

B. Sum of all the values in output matrix is 0.

C. Output matrix $O$ is a symmetric matrix.

D. Output matrix $O$ is a positive definite matrix.

1. A, B
2. A, B, C
3. A, C, D
4. A, B, C, D

- A, B, C are trivial.
- D: Determinant of $O = 0$, hence it’s not positive definite.
Q2-1: Which of the following statements are TRUE?

A. CNN successfully capture the Spatial dependencies.
B. Pooling helps in extracting dominant features.
C. In general, Average Pooling performs better denoising than Max Pooling.

1. A
2. A, B
3. B, C
4. A, B, C
Q2-1: Which of the following statements are TRUE?

A. CNN successfully capture the Spatial dependencies.
B. Pooling helps in extracting dominant features.
C. In general, Average Pooling performs better denoising than Max Pooling.

1. A
2. A, B
3. B, C
4. A, B, C

Max Pooling discards the noisy activations and performs denoising along with dimensionality reduction. Average Pooling simply performs dimensionality reduction as a noise suppressing mechanism. In general, Max Pooling performs better than Average Pooling.
Q2-2: Given the input, perform Max Pooling and Average Pooling with 2x2 kernel. Assume no padding (VALID), and stride=1. Let the output matrix be M1 and M2. Select the correct option.

\[
\begin{array}{ccc}
1 & 2 & 3 \\
4 & 5 & 6 \\
7 & 8 & 9 \\
\end{array}
\]

A. \( M1 - M2 = 2*I \) where \( I \) is a 2x2 identity matrix.

B. \( \det(M1) > \det(M2) \) where \( \det(.) \) refers to determinant of a matrix.

1. Both the statements are TRUE.
2. Statement A is TRUE, but statement B is FALSE.
3. Statement A is FALSE, but statement B is TRUE.
4. Both the statements are FALSE.
Q2-2: Given the input, perform Max Pooling and Average Pooling with 2x2 kernel. Assume no padding (VALID), and stride=1. Let the output matrix be M1 and M2. Select the correct option.

A. $M1 - M2 = 2*I$ where $I$ is a 2x2 identity matrix.

B. $\text{det}(M1) > \text{det}(M2)$ where $\text{det}(.)$ refers to determinant of a matrix.

1. Both the statements are TRUE.
2. Statement A is TRUE, but statement B is FALSE.
3. Statement A is FALSE, but statement B is TRUE.
4. Both the statements are FALSE.

\[ \begin{array}{ccc}
1 & 2 & 3 \\
4 & 5 & 6 \\
7 & 8 & 9 \\
\end{array} \]

\[ \begin{array}{cc}
5 & 6 \\
8 & 9 \\
\end{array} \]

\[ \begin{array}{cc}
3 & 4 \\
6 & 7 \\
\end{array} \]

- $\text{det}(M1) = 45 - 48 = -3$
- $\text{det}(M2) = 21 - 24 = -3$
Q3-1: Select the correct option about LeNet-5.

A. LeNet-5 architecture has subsampling layers which essentially does pooling operation.

B. Fully Connected Network is used in the end to obtain softmax scores.

1. Both statements are true.
2. Both statements are false.
3. Statement A is true, Statement B is false.
4. Statement B is true, Statement A is false.
Q3-1: Select the correct option about LeNet-5.

A. LeNet-5 architecture has subsampling layers which essentially does pooling operation.
B. Fully Connected Network is used in the end to obtain softmax scores.

1. Both statements are true.
2. Both statements are false.
3. Statement A is true, Statement B is false.
4. Statement B is true, Statement A is false.
Q3-2: If the size of Input matrix I is NxN and kernel size is KxK, what is the size of the output matrix after performing Convolution? Assume no padding, and stride = S. For simplicity, also assume N, K, and S are such that the division involved gives integer outputs.

1. \((N - K + 1)/S \times (N - K + 1)/S\)
2. \([N - K]/S + 1] \times [(N - K)/S + 1]\]
3. \((N - K - 1)/S \times (N - K - 1)/S\)
4. \([N - K]/S - 1] \times [(N - K)/S - 1]\]
Q3-2: If the size of Input matrix is NxN and kernel size is KxK, what is the size of the output matrix after performing Convolution? Assume no padding, and stride = S. For simplicity, also assume N, K, and S are such that the division involved gives integer outputs.

1. \( \frac{N - K + 1}{S} \times \frac{N - K + 1}{S} \)
2. \( \left[\frac{N - K}{S} + 1\right] \times \left[\frac{N - K}{S} + 1\right] \)
3. \( \frac{N - K - 1}{S} \times \frac{N - K - 1}{S} \)
4. \( \left[\frac{N - K}{S} - 1\right] \times \left[\frac{N - K}{S} - 1\right] \)