Convolutional Networks Quiz
Answer the questions in the spaces provided.

Name and Grade: _____

1. (3 points) Calculate the convolution:

$$\begin{bmatrix} 3 & 2 & 4 & 2 \\ 5 & 8 & 4 & 4 \\ 6 & 5 & 5 & 2 \\ 1 & 1 & 7 & 2 \end{bmatrix} * \begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix}$$

   (a) Assuming stride length of 1

   (b) Assuming stride length of 2

   (c) With zero padding $P = 1$ around the input matrix and stride length of 1.

2. (2 points) The following represents the input of a pooling layer. Find the output for the following types of pooling layers.

$$\begin{bmatrix} 1 & 2 & 1 & 1 \\ 5 & 3 & 6 & 0 \\ 3 & 6 & 7 & 2 \\ 2 & 2 & 8 & 2 \end{bmatrix}$$

   (a) A 2×2 max-pooling layer

   (b) A 2×2 average-pooling layer

3. (6 points) A Convolutional layer has input volume $W_1 \times H_1 \times D_1$, number of filters K, filter size F, stride length S, and amount of zero padding P. The output is a volume of size $W_2 \times H_2 \times D_2$. Find expressions for the output volume dimensions in terms of W_1, H_1, D_1, K, F, S and P.
   (a) $W_2 =$
   (b) $H_2 =$
   (c) $D_2 =$

4. (6 points) A Pooling layer has input volume $W_1 \times H_1 \times D_1$, filter size F, and stride length S. The output is a volume of size $W_2 \times H_2 \times D_2$. Find expressions for the output volume dimensions in terms of W_1, H_1, D_1, F and S.
   (a) $W_2 =$
   (b) $H_2 =$
   (c) $D_2 =$

5. (7 points) Match the data format with correct the data type. Some data types may not be used, and some may be used more than once.

   A. 1-D Single channel B. 1-D Multichannel C. 2-D Single channel D. 2-D Multichannel
   E. 3-D Single channel F. 3-D Multichannel

   1. Audio preprocessed with Fourier transform
   2. Grayscale Image
   3. Audio Waveform
   4. Color image
   5. Color video
   6. Grayscale Video
   7. Volumetric Data (MRI, CT scan)

6. (3 points) What are the advantages of the ReLU activation function, $y = \max(0, x)$? Select all that apply.
   (a) ReLU is differentiable for all real numbers
   (b) ReLU has a computationally cheap derivative
   (c) ReLU tells you how far away you are from the correct value based on the magnitude of x
   (d) ReLU helps alleviate the vanishing gradient issue of Sigmoid functions
   (e) ReLU is linear/constant, so it is faster to compute derivatives than the step function