VIR 2018 **Name:** _____

Test 2

Time Limit: Teaching Assistant _____

In all questions, assume stride = 1 and pad = 0 (zero padding) are the defaults for both convolutional (conv) and max-pooling (max) layers.

1. You are given input feature map (image) $\mathbf{x}$ and kernel $\mathbf{w}$:

$$\mathbf{x} = \begin{array}{|c|c|c|}\hline 1 & 0 & 2 \\ \hline 2 & 1 & -1 \\ \hline 0 & 0 & 2 \\ \hline \end{array} \qquad \mathbf{w} = \begin{array}{|c|c|}\hline 1 & -1 \\ \hline 0 & 2 \\ \hline \end{array}$$

Compute outputs of the following layers:

- $\text{conv}(\mathbf{x},\ \mathbf{w}) =$

- $\text{conv}(\mathbf{x},\ \mathbf{w},\ \text{stride} = 3,\ \text{pad} = 1) =$

- $\max(\mathbf{x},\ 2 \times 2) =$

2. You are given network (without loss layer) which consists of the convolutional layer and the max-pooling layer. The structure is defined as follows:

$$f(\mathbf{x}, \mathbf{w}) = \max\Big(\text{conv}(\mathbf{x},\ \mathbf{w}),\ 1 \times 2\Big)$$

- Draw computational graph and compute the feed-forward pass for input feature map (image) $\mathbf{x} = [2, 1, 2]$ and convolutional kernel $\mathbf{w} = [1, 0]$.

- Estimate gradient wrt kernel $\mathbf{w}$ (i.e. compute local gradients for the max-pooling layer and the convolutional layer and substitute edge-values computed in the feed-forward pass).

$$\frac{\partial f(\mathbf{x}, \mathbf{w})}{\partial \mathbf{w}} =$$