1. What is the difference between an interleaved image representation and a planar image representation in memory?

   Planar Representation stores color channels contiguously (e.g., all reds, then greens, then blues). Example: [R: 128, ...], [G: 128, ...], [B: 128, ...]

   Interleaved Representation stores pixel data consecutively by color channel (e.g., RGBRGB...) for more efficient individual pixel processing. E.g.: we use src[(i * cols + j) * 3 + k] to represent the row where k is 0,1,2.

2. Give a couple of subjective explanations of what a filter can do.

   Do image processing by modifying the variations in pixels, e.g. exposure, color balance and negatives to build up new color feature.
   Do edge detection by applying horizontal or vertical sobel filter.

3. What are a couple of ways of handling boundary issues (the edges of the image) when applying a filter?

   Pad the data with 0, or replicated the previous padding format of row or col. Ignore outside where filter cannot fully overlap with the input image.

4. If you have a 3x3 filter, how many operations per pixel are required for convolution? What about a 5x5 filter? What about a 7x7 filter? What about a 1x11 filter?

   3x3 filter: multiplication 3x3 = 9; additions = 9 – 1 = 8; total = 17 ops/ pixel
   5x5 filter: multiplication 5x5 = 25; additions = 25 – 1 = 24; total = 49 ops/ pixel
   7x7 filter: multiplication 7x7 = 49; additions = 49 – 1 = 48; total = 97 ops/ pixel
   1x11 filter: multiplication 1x11 = 11; additions = 11 – 1 = 10; total = 21 ops/ pixel

5. Full convolution is convolution where the result contains all possible ways the two filters could overlap. What happens if you do full convolution between the following two filters?

   $$[1 \quad 2 \quad 1] \quad \begin{vmatrix} -1 \\ 0 \\ 1 \end{vmatrix}$$

   3 * 3 matrix

   -1 -2 -1
   0 0 0
   1 2 1