ECE 482/582 Digital Image Processing Project #1
Connected Component Labeling Function

For this project you will create a MATLAB function that implements a connected component labeling algorithm. The function is to be capable of operating on a square 8-bit grayscale image. The size of the image is not predetermined, but can be assumed to be at most 1024×1024 pixels. The function is to have the following form:

\[ [X] = \text{cclabel}(f, 'type', V_{\text{min}}, V_{\text{max}}); \]

where \( f \) is the input image, \( \text{type} \) is the connectivity type (4 or 8), and \( V_{\text{min}} \) and \( V_{\text{max}} \) determine the range of the set \( V \) used to connect components. \( X \) is the returned array. The size of \( X \) should be the size of \( f \). Values of \( X \) should be:

\[ X(x, y) = \begin{cases} 0 & \text{if } f(x, y) \notin V \\ \text{Component number, } L \ (L \geq 1) & \text{otherwise} \end{cases} \]

Obtain (or construct) at least three suitable test images for your algorithm.

**ECE582 students only:** The set \( V \) is not given by a \( V_{\text{min}} \) and \( V_{\text{max}} \) quantity. Rather, the set \( V \) is to be constructed using one of two methods. First, a set \( V \) may be passed to the function. In this case, \( V \) may be an arbitrary set of valid values. For the second method, \( V \) should be constructed using pixel values from \( f \). Devise a suitable set of criteria for creating reasonable \( V \). There may be multiple sets for \( V \).