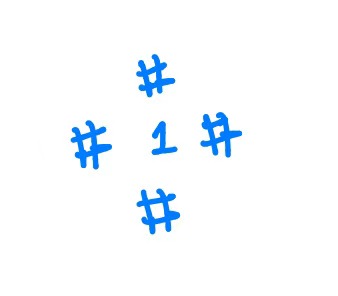
Problem 1: What is a connected component in a binary image?

Using pictures and words, explain what it means that two pixels are 4-connected.

Using pictures and words, explain what it means that two pixels are 8-connected.

A connected component in a binary image is a group of pixels with value of 1 that are connected to each other through a defined neighbourhood relationship. Each component corresponds to one object in the image.

* 4-connected pixels: two pixels are 4-connected if one is directly above, below, left or right of the center (see Figure 1.1).

  
Figure 1.1: 4-connected pixel. Here 1 is the current pixel, # represents its 4 neighbours

* 9-connected pixels: two pixels are 8-pixels if they are adjacent either horizontally, vertically or diagonally (see Figure 1.2).

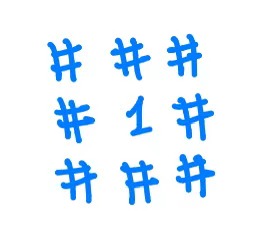


Figure 1.2: 8-connected pixel. Here 1 is the current pixel, # represents its 8 neighbours surrounding its all directions

Problem 2: How does depth-first search (DFS) work in the context of connected component labelling? You can provide a list to describe the operation of DFS.

DFS in connected component labelling works as follows:

1. Start at an unseen object pixel with value of 1.
2. Mark it as a seen pixel and assign it to the current connected component.
3. Explore one of its neighbours.
4. If the neighbour is also an object pixel and has not been visited, recursively continue from this neighbour.
5. If no new neighbours can be visited, backtrack to the previous pixels and continue checking other neighbour.
6. Repeat steps 2-5 until all pixels in this connected component have been visited.
7. Once DFS finishes, all pixels are labelled as belonging to the same object.
8. Move to the next unvisited object pixel and repeat the process for the next component.

Problem 3: Refer to the matlab file.

Problem 4: