Exercise 1

You will learn some basic Matlab-functions in this exercise.

(1P) Subtask 1.1
Write a Matlab-function that can display two images at the same time.

(2P) Subtask 1.2
Reimplement the following Matlab-function:

```matlab
function [M] = randmat(n, m, p)
```

The function should generate a random matrix \( M \in \{1; 0\}^{n \times m} \) with \( n, m \in \mathbb{N} \). \( p \in [0; 1] \) is the probability how often a 1 occur in \( M \). If \( p = 1 \) then all the elements in \( M \) are 1 and vice versa all elements are 0 for \( p = 0 \).

(2P) Subtask 1.3
Implement a filter that manipulates the pixels of a gray-scale image in the following way:

\[
tmp(x, y) = \begin{cases} 
255 & S(x, y) == 1 \\
img(x, y) & \text{else} 
\end{cases} 
\]  
(1)

\[
out(x, y) = \begin{cases} 
0 & P(x, y) == 1 \\
tmp(x, y) & \text{else} 
\end{cases} 
\]  
(2)

\( S \) and \( P \) are random matrices with parameters \( s \) and \( p \) that you can produce with the function of subtask 1.2. Could you imagine where to use this filter?

\footnote{Have a look in the matlab-help: \texttt{imread(’filename’);}, \texttt{”imshow(image)”}, \texttt{”subplot”}.}

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(1P) subtask 1.4
Write a Matlab-script, that verifies your implementation. Make some experiments with different sets of parameters \( s, p \). You find two images on our webpage.

(6P) Exercise 2
A convolution can be computed in an efficient way due to the convolution theorem of the fourier transformation. Imagine you have a stereo signal \( y(n) := (l(n), r(n)) \) with length \( N_1 \) and impulse response of \( N_2 \). The convolution can be computed in a fast way by representing the two real sequences via a complex one \( z(n) = l(n) + ir(n) \). Describe the method for the fast convolution with the aid of equations, pseudo code or Matlab code.