

Introduction to Modern Cryptography, Fall 2020

Homework 9 - due January 19

December 29, 2020

In this assignment you will implement visual secret sharing for images as demonstrated in lecture 11. Select 3 black and white images A , B and C of the same dimensions. You will generate two encoded images \tilde{A} and \tilde{B} whose dimensions are twice those of the original images. Let \tilde{C} be the encoded image that results from placing \tilde{A} and \tilde{B} on top of each other when white pixels are transparent. That is, each pixel in \tilde{C} is white if and only if the pixels of \tilde{A} and \tilde{B} in the same location are both white. Each encoded image should resemble the original image, but contain no information about the two other images. That is, for any $X \in \{A, B, C\}$, the encoded image \tilde{X} should look similar to X , but \tilde{X} should contain no information about the two images in $\{A, B, C\} \setminus \{X\}$.

Hint: Encode each pixel of $X \in \{A, B, C\}$ as a 2-by-2 square of pixels in \tilde{X} as follows:

- In the images A and B :
 - If the original pixel is white, exactly 2 of the the 4 encoding pixels are white.
 - If the original pixel is black, exactly 3 of the the 4 encoding pixels are black.
- In image C :
 - If the original pixel is white, exactly 1 of the the 4 encoding pixels are white.
 - If the original pixel is black, exactly 4 of the the 4 encoding pixels are black.

Make sure that the distribution of the encoding pixels in the encoded image \tilde{X} depends only on the original pixel in X and not on any of the pixels of the other two images.

What to submit. Submit a single zip file named “solution.zip” that contains:

- The two encoded images \tilde{A} and \tilde{B} in monochromatic BMP format.
- A folder named “code” containing all the source code you used to get to your solution.