Exercise 1: Codec Framework

1. Make yourself familiar with the provided framework
2. Try to compile and run the software
3. Step through the code using a debugger (encoding & decoding)
4. Ask any questions in the next tutorial
5. Think about the following (do not implement anything)
   - What changes are required for implementing a JPEG-like codec?
   - Where and how could the transform be implemented?
   - Where and how could the quantization be implemented?
   - Where and how could the entropy coding be implemented?
(Optional) Color Matching Functions & Color Gamut

1. Download the CIE 1931 XYZ color matching functions (1nm steps) from:
   http://cvrl.ioo.ucl.ac.uk/cmfs.htm
2. Plot the CIE 1931 XYZ color matching functions
3. Plot the human gamut into an x-y chromaticity diagram
4. Plot the BT.709 color gamut into the same diagram
5. Plot the BT.2020 color gamut into the same diagram

Note: The chromaticity values for the primary colors of BT.709 and BT.2020 are given in the lecture slides
(Optional) Color Conversion for Linear Color Spaces

1. Determine the conversion matrix $M$ for converting XYZ tristimulus values into RGB tristimulus values for BT.2020

$$\begin{bmatrix}
R \\
G \\
B
\end{bmatrix} = M \cdot \begin{bmatrix}
X \\
Y \\
Z
\end{bmatrix}$$

2. Determine the RGB color matching functions for BT.2020 (reuse the XYZ color matching functions from previous exercise)

3. Assume you have to convert BT.2020 RGB values into BT.709 RGB values and vice versa. How do you do that?