# DSP2 SS2020 – Exercise 7: DCT

Notes:

- The program accepts arguments for the block size N and the quantization parameter Q when you start it from the terminal. An example with N = 8 and Q = 1 would look like this:

    ./dct 8 1

- This program uses a lot of images which cannot be displayed without prior conversion to another data type. To keep the code readable, these images are stored inside the class instance.

Tasks:

1. Implement the discrete cosine transformation (DCT) and its inverse (IDTC) in the two functions `void Dct::calcDct(…)` and `void Dct::calcIdct(…)`. First, cut a block of size N x N from the input image, then perform the transformation on this single block (sub-image). Repeat this for all blocks of the input.
   Use the given helper variables of common factors for cleaner code: `piFactor` and `oneDivSqrtTwo`.
2. Try different block sizes (N) and quantization values (Q).

Appendix:

- Block size: N x N pixels
- x,y – local range with x,y = [0, N-1]
- u,v – frequency range with u,v = [0, N-1]

$$c_u(u) = \begin{cases} \dfrac{1}{\sqrt{2}}, & u = 0 \\ 1, & u \neq 0 \end{cases} \qquad c_v(v) = \begin{cases} \dfrac{1}{\sqrt{2}}, & v = 0 \\ 1, & v \neq 0 \end{cases} \qquad \alpha = \dfrac{\pi}{2N}$$

DCT:

$$S[u,v] = \frac{1}{4} * c_u(u) * c_v(v) * \sum_{x=0}^{N-1}\sum_{y=0}^{N-1} s[x,y] * \cos[\alpha\,(2x+1)\,u] * \cos[\alpha\,(2y+1)\,v]$$

IDCT:

$$s[x,y] = \frac{1}{4} \sum_{u=0}^{N-1}\sum_{v=0}^{N-1} S[u,v] * \cos[\alpha\,(2u+1)x] * \cos[\alpha\,(2v+1)\,y] * c_u(u) * c_v(v)$$