1D DCT:

$$F(u) = \sqrt{\frac{2}{N}} \cdot c(u) \sum_{i=0}^{N-1} \cos \frac{(2i+1) \cdot u\pi}{2N} \cdot f(i)$$

when $N = 4$,

$$F(u) = \sqrt{\frac{1}{2}} \cdot c(u) \sum_{i=0}^{3} \cos \frac{(2i+1) \cdot u\pi}{8} \cdot f(i)$$

$$c(u) = \begin{cases} \frac{\sqrt{2}}{2} & u = 0 \\ 1 & \text{otherwise} \end{cases}$$

If T is the DCT matrix

$$F(u,v) = T \cdot f(i,j) \cdot T^T$$

$$f(i,j) = T^T \cdot F(u,v) \cdot T$$

when $N = 4$,

$$T_4 = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\ \sqrt{\frac{1}{2}} \cos\frac{\pi}{8} & \sqrt{\frac{1}{2}} \cos\frac{3\pi}{8} & \sqrt{\frac{1}{2}} \cos\frac{5\pi}{8} & \sqrt{\frac{1}{2}} \cos\frac{7\pi}{8} \\ \sqrt{\frac{1}{2}} \cos\frac{\pi}{4} & \sqrt{\frac{1}{2}} \cos\frac{3\pi}{4} & \sqrt{\frac{1}{2}} \cos\frac{5\pi}{4} & \sqrt{\frac{1}{2}} \cos\frac{7\pi}{4} \\ \sqrt{\frac{1}{2}} \cos\frac{3\pi}{8} & \sqrt{\frac{1}{2}} \cos\frac{9\pi}{8} & \sqrt{\frac{1}{2}} \cos\frac{15\pi}{8} & \sqrt{\frac{1}{2}} \cos\frac{21\pi}{8} \end{bmatrix}$$

$$= \begin{bmatrix} a & a & a & a \\ b & c & -c & -b \\ a & -a & -a & a \\ c & -b & b & -c \end{bmatrix}$$

where $a = \frac{1}{2}$,

$b = \sqrt{\frac{1}{2}} \cos\frac{\pi}{8}$,

$c = \sqrt{\frac{1}{2}} \cos\frac{3\pi}{8}$.