# report on project 2

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GitHub: `https://github.com/CPekaterina/project-no2`

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## Contents

questions a)
We look at the equation

$$|t| = \left|-\tau \pm \sqrt{1+\tau^2}\right| \tag{1}$$

and consider the three cases $\tau = 0$, $\tau > 0$ and $\tau < 0$.
For $\tau = 0$ we get

$$|t| = |\pm 1| = 1 \tag{2}$$

For $\tau > 0$ the absolute value of $t$ is smaller for the solution with plus.

$$|t| = \left|-\tau + \sqrt{1+\tau^2}\right| \tag{3}$$

Now we look at $\tau \to \infty$:

$$\lim_{\tau\to\infty} |t| = \lim_{\tau\to\infty} \left|-\tau + \sqrt{1+\tau^2}\right| = 0 \tag{4}$$

For $\tau < 0$ the absolute value of $t$ is smaller for the solution with minus.

$$|t| = \left|-\tau - \sqrt{1+\tau^2}\right| \tag{5}$$

So now we look at $\tau \to -\infty$:

$$\lim_{\tau\to-\infty} |t| = \lim_{\tau\to-\infty} \left|-\tau - \sqrt{1+\tau^2}\right| = 0 \tag{6}$$

We have seen that for $\tau = 0$ the absolute value of $t$ is one and if we increase or decrease $\tau$ it approachs zero.

$$|\tan\theta| \leq 1 \text{for } |\theta| \leq \frac{\pi}{4} \tag{7}$$

So if we choose $t$ to be the smaller of the roots $|\theta| \leq \frac{\pi}{4}$ what is minimizing the difference between the matrices A and B. This can be seen if we look at the given equation

$$||\mathbf{B} - \mathbf{A}||_F^2 = 4(1-c) \sum_{i=1, i\neq k,l}^{n} (a_{ik}^2 + a_{il}^2) + \frac{2a_{kl}^2}{c^2} \tag{8}$$

$(1-c)$ at the beginning of the equation becomes zero when $\cos\theta = 1$ and than the total first part of the equation is zero. Also the second part of the equation reaches its minimum value for $\cos\theta = 1$. For $|\theta| \leq \frac{\pi}{4}$ the value of $\cos\theta$ is between 1 and $\approx 0.7$ so the difference between the matrices A and B we get is near the minimum. This means that the non-diagonal matrix elements of A are nearly zero, what is what we want to achieve.