

# CG - Assignment 1 Stefano Gonçalves Simas

## Exercise 1

$$x = (\sqrt{2}, 1, 0)^T, \quad y = (1, 1, 1)^T, \quad A = \begin{pmatrix} 1 & 1 & 1 \\ 2 & 2 & 1 \\ -1 & -3 & -3 \end{pmatrix}$$

Task 1:  $\cos \theta = \frac{\vec{x} \cdot \vec{y}}{\|x\| \cdot \|y\|}$

$$\left. \begin{aligned} \vec{x} \cdot \vec{y} &= \sqrt{2} + 1 + 0 = 1 + \sqrt{2} \\ \|x\| \cdot \|y\| &= \sqrt{2+1} \cdot \sqrt{3} = 3 \end{aligned} \right\} \frac{1+\sqrt{2}}{3}$$

$$\Rightarrow \theta = \arccos \left( \frac{1}{3} + \frac{\sqrt{2}}{3} \right) = \underline{0,6355}$$

$$\left. \begin{aligned} 0,6355 \cdot \frac{180^\circ}{\pi} &\simeq \underline{36,6} \end{aligned} \right.$$

Task 2:  $x \times y = (z_1, z_2, z_3)^T$

$$z_1 = \begin{vmatrix} 1 & 1 \\ 0 & 1 \end{vmatrix} = 1$$

$$z_2 = - \begin{vmatrix} \sqrt{2} & 1 \\ 0 & 1 \end{vmatrix} = -\sqrt{2} \quad \Rightarrow \underline{\vec{z} = (1, -\sqrt{2}, \sqrt{2}-1)}$$

$$z_3 = \begin{vmatrix} \sqrt{2} & 1 \\ 1 & 1 \end{vmatrix} = \sqrt{2}-1$$

Task 3:  $u = Az$

$$\begin{pmatrix} 1 & 1 & 1 \\ 2 & 2 & 1 \\ -1 & -3 & -3 \end{pmatrix} \begin{pmatrix} 1 \\ -\sqrt{2} \\ \sqrt{2}-1 \end{pmatrix} = \begin{pmatrix} 1-\sqrt{2}+\sqrt{2}-1 \\ 2-2\sqrt{2}+\sqrt{2}-1 \\ -1+3\sqrt{2}-3\sqrt{2}+3 \end{pmatrix} = \underline{\begin{pmatrix} 0 \\ 1-\sqrt{2} \\ 2 \end{pmatrix}}$$