# ST 705 Linear models and variance components
# Lab practice problem set 3

January 24, 2023

1. Let $A$ be an $m \times n$ matrix and $B$ be an $n \times p$ matrix. Prove that $AB$ can be written as a sum of $n$ matrices of rank at most one. Hint: think about empirical covariance matrices.

2. If $P$ is a symmetric and idempotent matrix, show that the Pythagorean relationship holds:

$$\|y\|^2 = \|Py\|^2 + \|(I - P)y\|^2.$$