

ST 705 Linear models and variance components

Lab practice problem set 9

March 26, 2024

1. Show that if X is a p -dimensional random vector with mean μ and covariance Σ , A is a $p \times p$ matrix, and $Y = X'AX$, then $E(Y) = \text{tr}(A\Sigma) + \mu' A \mu$.
2. For a random vector Y , with finite second moment, verify the following properties.
 - (a) $E(a'Y) = a'E(Y)$, for a fixed vector a .
 - (b) $\text{Var}(a'Y) = a'\text{Var}(Y)a$, for a fixed vector a .
 - (c) $\text{Cov}(a'Y, c'Y) = a'\text{Var}(Y)c$, for fixed vectors a and c .
 - (d) $\text{Var}(A'Y) = A'\text{Var}(Y)A$, for a fixed matrix A .