ST 705 Linear models and variance components
Lab practice problem set 8

March 19, 2023

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) $\text{E}(a'Y) = a'\text{E}(Y)$, 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.