

ST 705 Linear models and variance components

Homework problem set 7

February 20, 2020

1. (2 points) Exercise 3.20 from Monahan.
2. (2 points) Exercise 3.24 from Monahan.
3. (2 points) Exercise 3.26 from Monahan.
4. (2 points) Let X be an $n \times p$ matrix with $\text{rank}(X) = r$, and let C be a $(p - r) \times p$ matrix with

(i) $\text{rank}(C) = p - r$ and

(ii) $\text{column}(X') \cap \text{column}(C') = \{0\}$.

Show that $C(X'X + C'C)^{-1}C' = I_{p-r}$.

5. (2 points) Maximize the function $f(x) := \sum_{i=1}^k n_i \log(x_i)$ subject to the constraints

$$\sum_{i=1}^k x_i = 1,$$

$$x_i \geq 0,$$

with $\{n_i\}$ a set of fixed positive scalars.

6. (2 points) Exercise 4.1 from Monahan.
7. (2 points) Exercise 4.2 from Monahan.