

# ST 705 Linear models and variance components

## Homework problem set 7

February 17, 2020

1. (2 points) Exercise 3.20 from Monahan.
2. (2 points) Exercise 3.24 from Monahan.
3. (2 points) Exercise 3.36 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 scalars.

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