

TMA4267 Linear statistical models

Spring 2026

Thea Bjørnland

Part 1

- Mean and covariance of random vectors
- Multivariate normal distribution, $Y \sim \text{MVN}(\mu, \Sigma)$
- Linear and quadratic forms
 - Chi squared, F and t distributions
 - Idempotent matrices
 - Independence

Part 2

- Multiple linear regression (LM)
 - Model assumptions
 - Estimation (least squares, OLS) and properties of estimators
 - Hypothesis tests (F and t tests) and intervals
 - Model violations and model check
- General least squares (GLS)
- Linear mixed models (LMM)

Now: Part 3

Schedule

Week	Tuesday	Thursday
12	17.03.26	19.03.26
13	No lecture (excursion) 24.03.26	No lecture (excursion) 26.03.26
14	No lecture (easter) 31.03.26	No lecture (easter) 02.04.26
15	No lecture (easter) 07.04.26	09.04.26
16	14.04.26	16.04.26
17	21.04.26 (regular end of semester)	23.04.26 (excursion)
18	28.04.26 (excursion)	
19	05.05.26 EXAM	

Now: Part 3

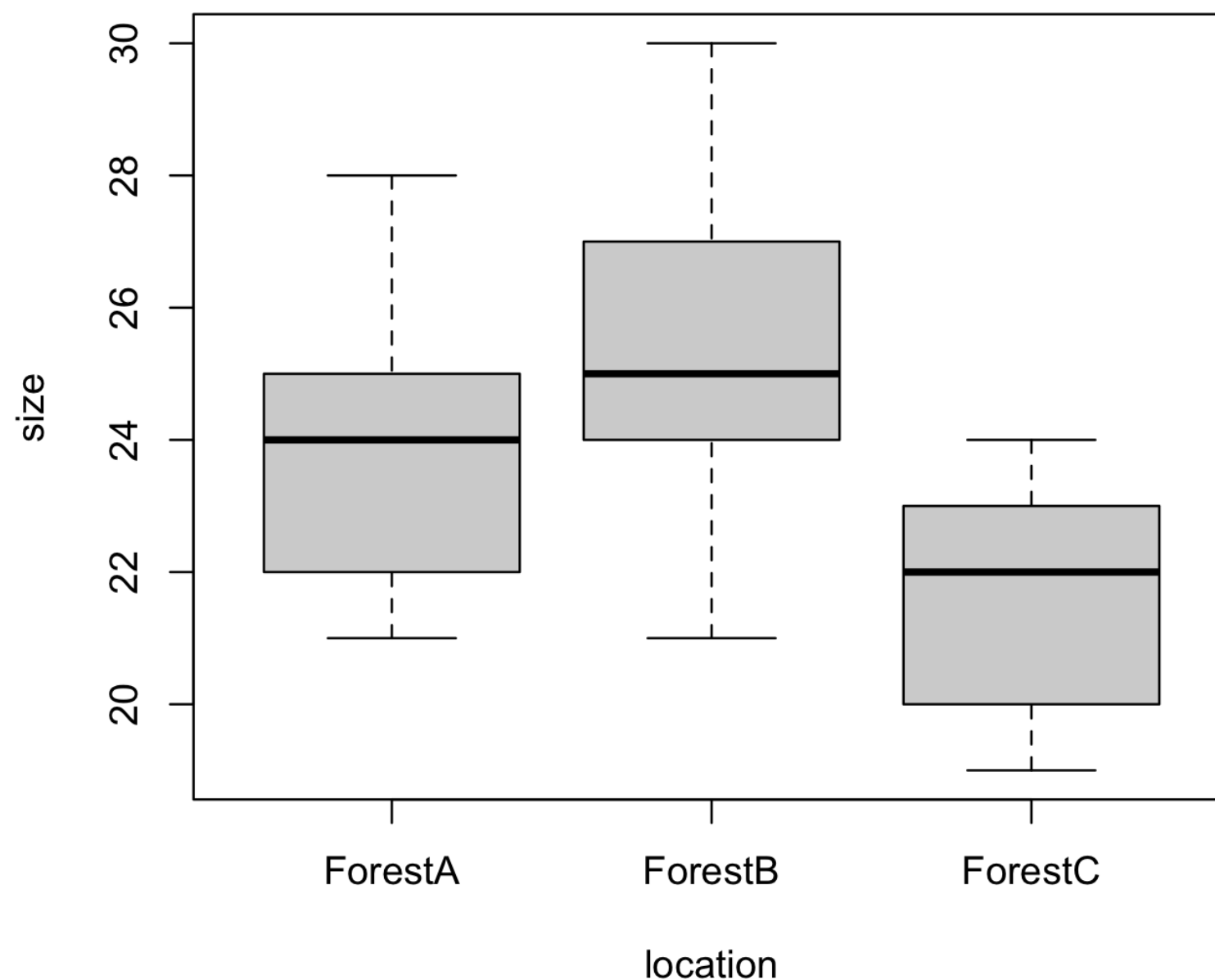
Tentative plan

Week	Tuesday	Thursday
12	ANOVA	ANOVA
13		
14		
15		Repetition + ANOVA / DOE
16	ANOVA / DOE	Assignment 7 (ANOVA / DOE)
17	"summary of everything" * deadline A7	Exam prep
18	Exam prep	
19	05.05.26 EXAM	

One-way (one-factor) anova



Example: We want to check whether the average size of blue ground beetles (*Carabus intricatus*) differs depending on their location. We consider 3 different locations, A, B and C, and we measure the size (in millimeters) of 10 individuals at each location.



Are the beetles different between locations, or is this something we can expect to occur "by chance"?

General linear hypothesis test

$$F = \frac{(\mathbf{C}\hat{\boldsymbol{\beta}})'[\mathbf{C}(\mathbf{X}'\mathbf{X})^{-1}\mathbf{C}']^{-1}\mathbf{C}\hat{\boldsymbol{\beta}}/q}{\text{SSE}/(n - k - 1)},$$

(i) If $H_0 : \mathbf{C}\boldsymbol{\beta} = \mathbf{0}$ is false, then

F is distributed as $F(q, n - k - 1, \lambda)$,

where $\lambda = (\mathbf{C}\boldsymbol{\beta})'[\mathbf{C}(\mathbf{X}'\mathbf{X})^{-1}\mathbf{C}']^{-1}\mathbf{C}\boldsymbol{\beta}/2\sigma^2$.

(ii) If $H_0 : \mathbf{C}\boldsymbol{\beta} = \mathbf{0}$ is true, then

F is distributed as $F(q, n - k - 1)$.