

## Grading document

The exam questions are available at

<https://www.math.ntnu.no/emner/TMA4267/2025v/eksamen/2025e.pdf>

and the solutions at

<https://www.math.ntnu.no/emner/TMA4267/2025v/eksamen/2025l.pdf>

There was an error in question 3 with  $H = X(X^T X)^{-1}X$  instead of  $H = X(X^T X)^{-1}X^T$ . Some students spotted this, but it had otherwise no impact on any student's answers. No student achieved full marks.

The grading scale was: F [0, 39), E [39, 51), D [51, 63), C [63, 75), B [75,87), A [87, 100].

Each question (1a, 1b, etc) were given at most 10 points. A further *guide* for distribution of points per question is given below. An overall assessment was also done.

### 1. Multivariate normal

- (a) Normal dist 3p, expectation 3p, variance 4p
- (b) Normal dist 2p, expectation 4p, variance 4p
- (c) Covariance zero implies independence 5p,  $c = -1$  5p

### 2. Multiple linear regression

- (a) Questionsmarks 1p each (at most 3p)
  - Derivation of CI 4p (2p for an attempt)
  - Calculation of CI 1p
  - Choosing model B based on  $R_{\text{adj}}^2$  2p
- (b) Distribution of  $\hat{Y}_0$  3p
  - Distribution of the prediction error  $\hat{\varepsilon}_0 = Y_0 - \hat{Y}_0$  3p
  - Calculate prediction 1p
  - Calculate prediction interval 3p

### 3. Partial F-test

- (a) Proof of  $\chi^2$ -dist which includes  $(H - H_0)(Y - X_0\beta_0) = (H - H_0)Y$  5p, otherwise at most 2p

Proof of F-dist which includes  $(H - H_0)(I - H) = 0$  (for independence) 5p, otherwise at most 3p

- (b) 10p for correct calculations, 8p if calculations are correct but C not specified. Some points given for decent attempts.

### 4. 2-level fractional factorial designs

- (a) Aliasing 5p, resolution 5p

- (b) 10p correct regression model with explanation of all components. At most 5p for something that looks somewhat like the correct answer.

- (c) 3p for correct Bonferroni

4p interaction plot with calculations

3p proportion of SST