◼ NTNU

Norwegian University of
Science and Technology

Department of Mathematical Sciences

Examination paper for **TMA4315 Generalised Linear Models**

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Examination date: 13th December 2016

Examination time (from–to): 09:00–13:00

Permitted examination support material: C. No written or handwritten examination support materials are permitted. A simple calculator is permitted.

Other information:
You may write your answers for this exam in English, *Norsk (bokmål og/eller nynorsk)*, or any mix of these.

Language: English

Number of pages: 1

Number of pages enclosed: 0

Checked by:

Informasjon om trykking av eksamensoppgave
Originalen er:
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Problem 1   We will consider (binomial or binary) logistic regression, where we have independent observations

$$y_i \sim \text{Binomial}(n_i, p_i), \qquad i = 1, \ldots, n,$$

so that

$$\text{Prob}(y_i) = \binom{n_i}{y_i} p_i^{y_i}(1 - p_i)^{n_i - y_i}, \quad y_i = 0, 1, \ldots, n_i.$$

The linear predictor is

$$\eta_i = x_i^T \beta,$$

and

$$p_i = \frac{\exp(\eta_i)}{1 + \exp(\eta_i)}$$

or

$$\text{logit}(p_i) = \eta_i.$$

Here, x_i is the vector of the p covariates for the i'th observation y_i with size (number of trials) n_i, and β is the vector of p unknown regression coefficients.

Write an introduction to logistic regression and its practical usage, for a student with a good background in statistics but no knowledge about Generalized Linear Models (GLM). Topics you may want to consider, are

- When to use it? Underlying assumptions.

- Parameter estimation, asymptotic results for the MLE, Fisher information and observed Fisher information, confidence intervals and hypothesis testing.

- Output analysis, residual plots (when its possible) and interpretation of the β-coefficients.

- Deviance and its usage.