

MATH 523 - ASSIGNMENT 1

To be handed in not later than 5pm, 7th February 2012.

Please hand in during lectures, to Burnside 1225, or to the Mathematics Office Burnside 1005

Consider the following data, which record the number y_i of turbines out of m_i that develop fissures after a given number of hours x_i of operation.

x_i	m_i	y_i
400	39	2
1000	53	4
1400	33	3
1800	73	7
2200	30	5
2600	39	9
3000	42	9
3400	13	6
3800	34	22
4200	40	21
4600	36	21

- (a) Using a Binomial GLM with canonical link, derive the estimators of the parameters when x_i is treated as a factor predictor with 11 levels, and the linear predictor for data point i is written

$$\eta_i = \beta_0 + \beta_i \quad i = 1, \dots, 11$$

with the identifiability constraint $\beta_1 = 0$.

4 MARKS

- (b) Using statistical software, and the same distributional and link assumptions as in (a), fit the model where the linear predictor

$$\eta_i = \beta_0 + \beta_1 x_i \quad i = 1, \dots, 11$$

and report the estimates and their standard errors.

4 MARKS

- (c) Fit the model in (b) instead using a **probit** link function, and report the estimates and their standard errors.

3 MARKS

- (d) Fit the model in (b) instead using a **complementary log-log** link function, and report the estimates and their standard errors.

3 MARKS

- (e) Compare predictions (with associated measures of uncertainty) under the three fitted models from (b), (c) and (d) for a turbine that has been in operation for 2000 hours.

3 MARKS

- (f) Construct a plot to demonstrate how well or poorly the models from (b), (c) and (d) fit the data, and comment on the fits of the models.

3 MARKS