3.5 Ordered categorical responses

Model description In the standard logistic regression there are $S = 2$ possible outcomes (success and failure). A generalization of this model is to allow outcomes to come from the ordered set $y^{(1)} < y^{(2)} < \cdots < y^{(S)}$. The probability associated with $y^{(s)}$ is denoted by π_s, and is de ned through:

$$\sum_{j=1}^{s} \pi_j = \frac{\exp(\kappa_s - \eta)}{1 + \exp(\kappa_s - \eta)}, \qquad s = 1, \ldots, S-1,$$

where $\kappa_1 < \cdots < \kappa_{S-1}$ are parameters and η is a linear predictor depending on covariates.

The SOCATT data set is used in a software review conducted by the Centre for Multilevel Modelling (http://multilevel.ioe.ac.uk/softrev/index.html). The SOCATT data consist of responses to a set of dichotomous items on a woman's right to have an abortion under di erent circumstances. The outcome variable y is a score constructed from these items ranging from 1 to 7, with a higher score corresponding to stronger support for abortion. Each of $q = 264$ respondents was asked the same set of questions on four occasions (hence $n = 1056$) in the period $1983 - 1986$, and y_{ij} denotes the response for individual i at year j. We consider three indicator variables (x_1, x_2, x_3) and the following linear predictor

$$\eta_i = \beta_1 x_{ij1} + \beta_2 x_{ij2} + \beta_3 x_{ij3} + u_i,$$

with $u_i \sim N(0, \sigma^2)$.

Results Estimates of hyper-parameters are shown in the following table:

	β_1	β_2	β_3	σ	κ_1	κ_2	κ_3	κ_4	κ_5	κ_6
ADMB-RE	1.953	0.684	2.775	2.229	-4.127	-2.390	0.402	1.337	2.225	3.265
aML	2.064	0.688	2.841	2.283	-4.056	-2.300	0.510	1.449	2.341	3.384

The computation time (ADMB-RE) for this model was 30 seconds on a 1,400 MHz PC running linux, while for the packages participating in the software review the computation times ranged from 5 to 60 seconds.