Data Analysis Project 1: Meta-Analysis of CABG and Stents for coronary artery disease

Each person must turn in a separate project.

Due: Tuesday, Nov 22, in class. Late assignments will be graded, but may be returned late.

You need to develop proper and informative prior information for all parameters.

Data gives results of 11 studies. Some people in each study received CABG (Coronary Artery Bypass Surgery), some received stents (also called Percutaneous coronary intervention or PCI), a small tube inserted into the heart to pop open the artery and allow blood to flow freely. CABG is the older treatment for heart disease, stents are a new treatment. The n columns give the number of people who received stents or CABG, and the failure column is the number of people who died within a one year span. The study is identified by the name of the first author.

	stents		CABG	
Paper	n	failure	n	failure
Brener	71	4	174	10
Buszman	52	1	53	4
Chieffo	107	3	142	9
Makikallio	49	2	238	25
Palmerini	86	12	103	11
Sanmartin	49	3	241	20
Serruys	357	15	348	15
Seung	516	19	512	17
Silvestri	186	18	218	25
White	36	5	41	4
Wu	70	11	80	5

The key question: (a) Is there higher mortality with CABG or with stents? Important secondary questions are (b) what is the typical death rate for people who (b1) receive CABG and who (b2) receive stents.

Studies are indexed by letter i, $i = 1, \ldots, 11$ in this case, with treatments $j = 0$ for stents and $j = 1$ for CABG, with n_{ij} is the number of people

treated in study i and treatment j, and y_{ij} is the number of people who died in study i on treatment j. The usual Bayesian random effects model for meta-analysis is

$$y_{ij}|\pi_{ij} \sim \text{Binomial}(n_{ij}, \pi_{ij}) \tag{1}$$

$$\text{logit}\pi_{ij} = \begin{cases} \mu_i - \frac{\delta_i}{2} & \text{if } j = 0 \\ \mu_i + \frac{\delta_i}{2} & \text{if } j = 1 \end{cases} \tag{2}$$

$$\mu_i|\mu_0, \sigma^2 \sim N(\mu_0, \sigma^2) \tag{3}$$

$$\delta_i|\delta_0, \tau^2 \sim N(\delta_0, \tau^2) \tag{4}$$

where π_{ij} is the probability of a death in study i for treatment j, δ_i is the treatment difference (log odds ratio) in study i, and μ_i is the average (on the log odds or logit scale) of the two treatment probabilities. The μ_i and δ_i are random effects, assumed independent of each other. The logit mortality rate μ_i is allowed to vary from study to study because each study draws people from very distinct populations, usually from different countries and cities. Similarly the logit treatment effect δ_i is allowed to vary from study to study.

You will need to construct and justify proper priors for μ_0, σ^2, δ_0 and τ^2.

Your report should be less than 3 typed double-spaced pages long, supplemented with graphs and tables as needed. Put all graphs and tables in the appendix. Any graph or table in the appendix must be discussed in the text. General guidelines should be as for the final project, but this is to be shorter in length. Include your model and prior in the text, and include your main JAGS (or other) program in the appendix.

See instructions for final projects for additional advice.