hw5 for stat341

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Q: 4E4-4E5 4M3-4M6

4E4. In the model definition below, which line is the linear model?
$y_i \sim Normal(\mu, \sigma)$
$\mu_i = \alpha + \beta x_i$
$\alpha \sim Normal(0, 10)$
$\beta \sim Normal(0, 1)$
$\sigma \sim Uniform(0, 10)$

Solution:

$\mu_i = \alpha + \beta x_i$ is the linear model.

4E5. In the model definition just above, how many parameters are in the posterior distribution?

Solution:

There are three parameters, and they are α, β *and* σ

4M3. Translate the map model formula below into a mathematical model definition. flist <- alist(y ~ dnorm(mu , sigma), mu <- a + b*x, a ~ dnorm(0 , 50), b ~ dunif(0 , 10), sigma ~ dunif(0 , 50))

Solution:

a mathematical model will be $y_i \sim Normal(\mu, \sigma)$
$\mu_i = \alpha + \beta x_i$
$\alpha \sim Normal(0, 50)$
$\beta \sim Normal(0, 10)$
$\sigma \sim Uniform(0, 50)$

4M4. A sample of students is measured for height each year for 3 years. After the third year, you want to fit a linear regression predicting height using year as a predictor. Write down the mathematical model definition for this regression, using any variable names and priors you choose. Be prepared to defend your choice of priors.

Solution: #choose my height as a average

$Height_i \sim Normal(\mu, \sigma)$
$\mu_i = \alpha + \beta \cdot year$
$\alpha \sim Normal(173, 100)$
$\beta \sim Normal(0, 10)$
$\sigma \sim Uniform(0, 50)$

4M5. Now suppose I tell you that the average height in the first year was 120 cm and that every student got taller each year. Does this information lead you to change your choice of priors? How?

Solution: Yes, it can. With given information, I can have a smaller standard deviation.

$Height_i \sim Normal(\mu, \sigma)$
$\mu_i = \alpha + \beta \cdot year$
$\alpha \sim Normal(120, 500)$
$\beta \sim Normal(0, 10)$
$\sigma \sim Uniform(0, 50)$

4M6. Now suppose I tell you that the variance among heights for students of the same age is never more than 64cm. How does this lead you to revise your priors?

Solution:

The model will becomes

$Height_i \sim Normal(\mu, \sigma)$
$\mu_i = \alpha + \beta \cdot year$
$\alpha \sim Normal(120, 50)$
$\beta \sim Normal(0, 10)$
$\sigma \sim Uniform(0, 64)$