Bayesian 4

2022-11-25

## Exercise 1

### Task a

Formula: $p(, \_1 … *n | y\_1 … y\_n) p()* {i=1}^n p(\_i | ) p(y\_i | \_i) $

Stan-model:

model\_a = "  
data {  
 int<lower=0> n;  
 real y[n];  
}  
  
parameters {  
 real alpha;  
 real theta[n];  
}  
  
model {  
 alpha ~ p()  
 for i in 1:n {  
 theta[i] ~ p(alpha)  
 y[i] ~ p(theta[i])  
 }  
}  
"

### Task b

Formula:

Stan-model:

model\_b = "  
data{  
 int<lower=0> n;  
 int<lower=0> m;  
 real y[n\*m];  
}  
  
parameters {  
 real alpha;  
 real mu[m];  
 real theta[m][n];  
}  
  
model {  
 alpha ~ p()  
 for i in 0:m-1 {  
 mu[i] ~ p(alpha)  
 for j in 0:n-1 {  
 theta[i][j] ~ p(mu[i])  
 y[m\*i+j] ~ p(theta[m\*i+j])  
 }  
 }  
}  
"

### Task c

Formula:

Stan-model:

model\_c = "  
data {  
 int<lower=0> n;  
 real x[n];  
 real y[n];  
}  
  
parameters {  
 real alpha;  
 real gamma;  
 real mu[n];  
 real sigma[n];  
}  
  
model {  
 alpha ~ p()  
 gamma ~ p()  
 for i in 1:n {  
 mu[i] ~ p(alpha)  
 sigma[i] ~ p(gamma)  
 y[i] ~ p(mu[i]\*x[i], sigma[i]\*x)  
 }  
}  
"

### Task d

Stan-model:

model\_d = "  
data {  
 int<lower=0> n;  
 int<lower=0> J;  
 real y[J][n]  
}  
  
parameters {  
 real v1;  
 real v2;  
 real s1;  
 real s2;  
 real fi;  
 real mu0;  
 real mu[J];  
 real sigma[J];  
}  
  
model {  
 v1 ~ p()  
 v2 ~ p()  
 s1 ~ p()  
 s2 ~ p()  
 mu0 ~ norm(0, 10^6)  
 fi ~ inv\_chi2(v1, s1)  
 for j in 1:J {  
 sigma[j] ~ inv\_chi2(v2, s2)  
 mu[j] ~ norm(mu0, fi)  
 for i in 1:n {  
 y[j][i] ~ norm(mu[j], sigma[j])  
 }  
 }  
}"