Week 9: Hierarchical GLM

18/03/23

Lip cancer

Here is the lip cancer data given to you in terribly unreproducible and error-prone format.

- `aff.i` is proportion of male population working outside in each region
- `observe.i` is observed deaths in each region
- `expect.i` is expected deaths, based on region-specific age distribution and national-level age-specific mortality rates.

```
observe.i <- c(
  5,13,18,5,10,18,29,10,15,22,4,11,10,22,13,14,17,21,25,6,11,21,13,5,19,18,14,17,3,10,
  7,3,12,11,6,16,13,6,9,10,4,9,11,12,23,18,12,7,13,12,12,13,6,14,7,18,13,9,6,8,7,6,16,4,6,
  17,5,7,2,9,7,6,12,13,17,5,5,6,12,10,16,10,16,15,18,6,12,6,8,33,15,14,18,25,14,2,73,13,14
  12,10,3,11,3,11,13,11,13,10,5,18,10,23,5,9,2,11,9,11,6,11,5,19,15,4,8,9,6,4,4,2,12,12,11
  8,12,11,23,7,16,46,9,18,12,13,14,14,3,9,15,6,13,13,12,8,11,5,9,8,22,9,2,10,6,10,12,9,11,
  9,11,11,0,9,3,11,11,11,5,4,8,9,30,110)
expect.i <- c(
    6.17,8.44,7.23,5.62,4.18,29.35,11.79,12.35,7.28,9.40,3.77,3.41,8.70,9.57,8.18,4.35,
    4.91,10.66,16.99,2.94,3.07,5.50,6.47,4.85,9.85,6.95,5.74,5.70,2.22,3.46,4.40,4.05,5.74
    16.99,6.19,5.56,11.69,4.69,6.25,10.84,8.40,13.19,9.25,16.98,8.39,2.86,9.70,12.12,12.94
    10.34,5.09,3.29,17.19,5.42,11.39,8.33,4.97,7.14,6.74,17.01,5.80,4.84,12.00,4.50,4.39,1
    6.42,5.26,4.59,11.86,4.05,5.48,13.13,8.72,2.87,2.13,4.48,5.85,6.67,6.11,5.78,12.31,10.
    2.52,6.22,14.29,5.71,37.93,7.81,9.86,11.61,18.52,12.28,5.41,61.96,8.55,12.07,4.29,19.4
    12.90,4.76,5.56,11.11,4.76,10.48,13.13,12.94,14.61,9.26,6.94,16.82,33.49,20.91,5.32,6.
    12.94,16.07,8.87,7.79,14.60,5.10,24.42,17.78,4.04,7.84,9.89,8.45,5.06,4.49,6.25,9.16,1
    9.57,5.83,9.21,9.64,9.09,12.94,17.42,10.29,7.14,92.50,14.29,15.61,6.00,8.55,15.22,18.4
    18.37,13.16,7.69,14.61,15.85,12.77,7.41,14.86,6.94,5.66,9.88,102.16,7.63,5.13,7.58,8.0
    18.75,12.33,5.88,64.64,8.62,12.09,11.11,14.10,10.48,7.00,10.23,6.82,15.71,9.65,8.59,8.
    12.31,8.91,50.10,288.00)
aff.i <- c(0.2415,0.2309,0.3999,0.2977,0.3264,0.3346,0.4150,0.4202,0.1023,0.1752,
```

```
0.2548,0.3248,0.2287,0.2520,0.2058,0.2785,0.2528,0.1847,0.3736,0.2411,
0.3700,0.2997,0.2883,0.2427,0.3782,0.1865,0.2633,0.2978,0.3541,0.4176,
0.2910,0.3431,0.1168,0.2195,0.2911,0.4297,0.2119,0.2698,0.0874,0.3204,
0.1839,0.1796,0.2471,0.2016,0.1560,0.3162,0.0732,0.1490,0.2283,0.1187,
0.3500,0.2915,0.1339,0.0995,0.2355,0.2392,0.0877,0.3571,0.1014,0.0363,
0.1665,0.1226,0.2186,0.1279,0.0842,0.0733,0.0377,0.2216,0.3062,0.0310,
0.0755,0.0583,0.2546,0.2933,0.1682,0.2518,0.1971,0.1473,0.2311,0.2471,
0.3063,0.1526,0.1487,0.3537,0.2753,0.0849,0.1013,0.1622,0.1267,0.2376,
0.0737,0.2755,0.0152,0.1415,0.1344,0.1058,0.0545,0.1047,0.1335,0.3134,
0.1326,0.1222,0.1992,0.0620,0.1313,0.0848,0.2687,0.1396,0.1234,0.0997,
0.0694,0.1022,0.0779,0.0253,0.1012,0.0999,0.0828,0.2950,0.0778,0.1388,
0.2449,0.0978,0.1144,0.1038,0.1613,0.1921,0.2714,0.1467,0.1783,0.1790,
0.1482,0.1383,0.0805,0.0619,0.1934,0.1315,0.1050,0.0702,0.1002,0.1445,
0.0353,0.0400,0.1385,0.0491,0.0520,0.0640,0.1017,0.0837,0.1462,0.0958,
0.0745,0.2942,0.2278,0.1347,0.0907,0.1238,0.1773,0.0623,0.0742,0.1003,
0.0590,0.0719,0.0652,0.1687,0.1199,0.1768,0.1638,0.1360,0.0832,0.2174,
0.1662,0.2023,0.1319,0.0526,0.0287,0.0405,0.1616,0.0730,0.1005,0.0743,
0.0577,0.0481,0.1002,0.0433,0.0838,0.1124,0.2265,0.0436,0.1402,0.0313,
0.0359,0.0696,0.0618,0.0932,0.0097)
```

Question 1

Explain a bit more what the `expect.i` variable is. For example, if a particular area has an expected deaths of 6, what does this mean?

Expected death is the implied number of lip cancer deaths for a particular region given that region's age structure and national-level age-specific mortality rates for lip cancer. For example, an expected number of deaths of 6 would mean for that particular region, we would expect 6 lip cancer deaths if this region were to experience the same age specific mortality rate at the national level.

Question 2

Run three different models in Stan with three different set-up's for estimating θ_i, that is the relative risk of lip cancer in each region:

1. Intercept α_i is same in each region $= \alpha$
2. α_i is different in each region and modeled separately (with covariate)
3. α_i is different in each region and the intercept is modeled hierarchically (with covariate)

$$y_i|\theta_i \sim \text{Poisson}(\theta_i \cdot e_i)$$

Look at three models for $\log \theta_i$:

$$\log \theta_i = \alpha + \beta x_i$$

and

$$\log \theta_i = \alpha_i + \beta x_i$$

with

$$\alpha_i \sim N(\mu, \sigma^2)$$

Model 1

```
library(tidyverse)
library(rstan)
library(tidybayes)

stan_data <- list(y=observe.i,
                  log_e=log(expect.i),
                  N=length(observe.i),
                  x=aff.i-mean(aff.i))

mod1 <- stan(data=stan_data, file="lab9_1.stan", seed = 1)
```

```
Running /Library/Frameworks/R.framework/Resources/bin/R CMD SHLIB foo.c
clang -mmacosx-version-min=10.13 -I"/Library/Frameworks/R.framework/Resources/include" -DNDEI
In file included from <built-in>:1:
In file included from /Library/Frameworks/R.framework/Versions/4.1/Resources/library/StanHeac
In file included from /Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEige
In file included from /Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEige
/Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEigen/include/Eigen/src/Co
namespace Eigen {
^
/Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEigen/include/Eigen/src/Co
namespace Eigen {
               ^
               ;
In file included from <built-in>:1:
In file included from /Library/Frameworks/R.framework/Versions/4.1/Resources/library/StanHeac
In file included from /Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEige
/Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEigen/include/Eigen/Core:9
```

```
#include <complex>
         ^~~~~~~~~
3 errors generated.
make: *** [foo.o] Error 1

SAMPLING FOR MODEL 'lab9_1' NOW (CHAIN 1).
Chain 1:
Chain 1: Gradient evaluation took 5.6e-05 seconds
Chain 1: 1000 transitions using 10 leapfrog steps per transition would take 0.56 seconds.
Chain 1: Adjust your expectations accordingly!
Chain 1:
Chain 1:
Chain 1: Iteration:    1 / 2000 [  0%]  (Warmup)
Chain 1: Iteration:  200 / 2000 [ 10%]  (Warmup)
Chain 1: Iteration:  400 / 2000 [ 20%]  (Warmup)
Chain 1: Iteration:  600 / 2000 [ 30%]  (Warmup)
Chain 1: Iteration:  800 / 2000 [ 40%]  (Warmup)
Chain 1: Iteration: 1000 / 2000 [ 50%]  (Warmup)
Chain 1: Iteration: 1001 / 2000 [ 50%]  (Sampling)
Chain 1: Iteration: 1200 / 2000 [ 60%]  (Sampling)
Chain 1: Iteration: 1400 / 2000 [ 70%]  (Sampling)
Chain 1: Iteration: 1600 / 2000 [ 80%]  (Sampling)
Chain 1: Iteration: 1800 / 2000 [ 90%]  (Sampling)
Chain 1: Iteration: 2000 / 2000 [100%]  (Sampling)
Chain 1:
Chain 1:  Elapsed Time: 0.075 seconds (Warm-up)
Chain 1:                0.074988 seconds (Sampling)
Chain 1:                0.149988 seconds (Total)
Chain 1:

SAMPLING FOR MODEL 'lab9_1' NOW (CHAIN 2).
Chain 2:
Chain 2: Gradient evaluation took 2e-05 seconds
Chain 2: 1000 transitions using 10 leapfrog steps per transition would take 0.2 seconds.
Chain 2: Adjust your expectations accordingly!
Chain 2:
Chain 2:
Chain 2: Iteration:    1 / 2000 [  0%]  (Warmup)
Chain 2: Iteration:  200 / 2000 [ 10%]  (Warmup)
Chain 2: Iteration:  400 / 2000 [ 20%]  (Warmup)
Chain 2: Iteration:  600 / 2000 [ 30%]  (Warmup)
Chain 2: Iteration:  800 / 2000 [ 40%]  (Warmup)
Chain 2: Iteration: 1000 / 2000 [ 50%]  (Warmup)
```

```
Chain 2: Iteration: 1001 / 2000 [ 50%]  (Sampling)
Chain 2: Iteration: 1200 / 2000 [ 60%]  (Sampling)
Chain 2: Iteration: 1400 / 2000 [ 70%]  (Sampling)
Chain 2: Iteration: 1600 / 2000 [ 80%]  (Sampling)
Chain 2: Iteration: 1800 / 2000 [ 90%]  (Sampling)
Chain 2: Iteration: 2000 / 2000 [100%]  (Sampling)
Chain 2:
Chain 2:  Elapsed Time: 0.079844 seconds (Warm-up)
Chain 2:                0.076569 seconds (Sampling)
Chain 2:                0.156413 seconds (Total)
Chain 2:

SAMPLING FOR MODEL 'lab9_1' NOW (CHAIN 3).
Chain 3:
Chain 3: Gradient evaluation took 2e-05 seconds
Chain 3: 1000 transitions using 10 leapfrog steps per transition would take 0.2 seconds.
Chain 3: Adjust your expectations accordingly!
Chain 3:
Chain 3:
Chain 3: Iteration:    1 / 2000 [  0%]  (Warmup)
Chain 3: Iteration:  200 / 2000 [ 10%]  (Warmup)
Chain 3: Iteration:  400 / 2000 [ 20%]  (Warmup)
Chain 3: Iteration:  600 / 2000 [ 30%]  (Warmup)
Chain 3: Iteration:  800 / 2000 [ 40%]  (Warmup)
Chain 3: Iteration: 1000 / 2000 [ 50%]  (Warmup)
Chain 3: Iteration: 1001 / 2000 [ 50%]  (Sampling)
Chain 3: Iteration: 1200 / 2000 [ 60%]  (Sampling)
Chain 3: Iteration: 1400 / 2000 [ 70%]  (Sampling)
Chain 3: Iteration: 1600 / 2000 [ 80%]  (Sampling)
Chain 3: Iteration: 1800 / 2000 [ 90%]  (Sampling)
Chain 3: Iteration: 2000 / 2000 [100%]  (Sampling)
Chain 3:
Chain 3:  Elapsed Time: 0.073887 seconds (Warm-up)
Chain 3:                0.069941 seconds (Sampling)
Chain 3:                0.143828 seconds (Total)
Chain 3:

SAMPLING FOR MODEL 'lab9_1' NOW (CHAIN 4).
Chain 4:
Chain 4: Gradient evaluation took 3.5e-05 seconds
Chain 4: 1000 transitions using 10 leapfrog steps per transition would take 0.35 seconds.
Chain 4: Adjust your expectations accordingly!
Chain 4:
```

```
Chain 4:
Chain 4: Iteration:    1 / 2000 [  0%]  (Warmup)
Chain 4: Iteration:  200 / 2000 [ 10%]  (Warmup)
Chain 4: Iteration:  400 / 2000 [ 20%]  (Warmup)
Chain 4: Iteration:  600 / 2000 [ 30%]  (Warmup)
Chain 4: Iteration:  800 / 2000 [ 40%]  (Warmup)
Chain 4: Iteration: 1000 / 2000 [ 50%]  (Warmup)
Chain 4: Iteration: 1001 / 2000 [ 50%]  (Sampling)
Chain 4: Iteration: 1200 / 2000 [ 60%]  (Sampling)
Chain 4: Iteration: 1400 / 2000 [ 70%]  (Sampling)
Chain 4: Iteration: 1600 / 2000 [ 80%]  (Sampling)
Chain 4: Iteration: 1800 / 2000 [ 90%]  (Sampling)
Chain 4: Iteration: 2000 / 2000 [100%]  (Sampling)
Chain 4:
Chain 4:  Elapsed Time: 0.078628 seconds (Warm-up)
Chain 4:                0.065253 seconds (Sampling)
Chain 4:                0.143881 seconds (Total)
Chain 4:
```

```
mod1
```

```
Inference for Stan model: lab9_1.
4 chains, each with iter=2000; warmup=1000; thin=1;
post-warmup draws per chain=1000, total post-warmup draws=4000.

                mean se_mean   sd    2.5%     25%     50%     75%   97.5%
alpha          -0.01    0.00 0.02   -0.05   -0.02   -0.01    0.00    0.03
beta            2.43    0.00 0.18    2.08    2.30    2.43    2.55    2.78
log_theta[1]    0.17    0.00 0.02    0.12    0.15    0.17    0.19    0.22
log_theta[2]    0.15    0.00 0.02    0.10    0.13    0.15    0.16    0.19
log_theta[3]    0.56    0.00 0.05    0.47    0.52    0.56    0.59    0.65
log_theta[4]    0.31    0.00 0.03    0.25    0.29    0.31    0.33    0.37
log_theta[5]    0.38    0.00 0.04    0.31    0.35    0.38    0.40    0.45
log_theta[6]    0.40    0.00 0.04    0.33    0.37    0.40    0.42    0.47
log_theta[7]    0.59    0.00 0.05    0.50    0.56    0.59    0.63    0.69
log_theta[8]    0.61    0.00 0.05    0.51    0.57    0.61    0.64    0.70
log_theta[9]   -0.17    0.00 0.02   -0.21   -0.18   -0.17   -0.15   -0.12
log_theta[10]   0.01    0.00 0.02   -0.03    0.00    0.01    0.02    0.05
log_theta[11]   0.20    0.00 0.03    0.15    0.19    0.20    0.22    0.25
log_theta[12]   0.37    0.00 0.03    0.30    0.35    0.37    0.40    0.44
log_theta[13]   0.14    0.00 0.02    0.09    0.12    0.14    0.16    0.19
log_theta[14]   0.20    0.00 0.03    0.15    0.18    0.20    0.21    0.25
```

log_theta[15]	0.09	0.00	0.02	0.04	0.07	0.09	0.10	0.13
log_theta[16]	0.26	0.00	0.03	0.20	0.24	0.26	0.28	0.32
log_theta[17]	0.20	0.00	0.03	0.15	0.18	0.20	0.22	0.25
log_theta[18]	0.03	0.00	0.02	-0.01	0.02	0.03	0.05	0.07
log_theta[19]	0.49	0.00	0.04	0.41	0.46	0.49	0.52	0.58
log_theta[20]	0.17	0.00	0.02	0.12	0.15	0.17	0.19	0.22
log_theta[21]	0.48	0.00	0.04	0.40	0.45	0.48	0.51	0.57
log_theta[22]	0.31	0.00	0.03	0.25	0.29	0.31	0.33	0.37
log_theta[23]	0.29	0.00	0.03	0.23	0.26	0.29	0.31	0.34
log_theta[24]	0.17	0.00	0.02	0.13	0.16	0.17	0.19	0.22
log_theta[25]	0.50	0.00	0.04	0.42	0.47	0.50	0.53	0.59
log_theta[26]	0.04	0.00	0.02	0.00	0.02	0.04	0.05	0.08
log_theta[27]	0.22	0.00	0.03	0.17	0.21	0.22	0.24	0.28
log_theta[28]	0.31	0.00	0.03	0.25	0.29	0.31	0.33	0.37
log_theta[29]	0.44	0.00	0.04	0.37	0.42	0.45	0.47	0.52
log_theta[30]	0.60	0.00	0.05	0.50	0.57	0.60	0.63	0.70
log_theta[31]	0.29	0.00	0.03	0.23	0.27	0.29	0.31	0.35
log_theta[32]	0.42	0.00	0.04	0.34	0.39	0.42	0.44	0.49
log_theta[33]	-0.13	0.00	0.02	-0.18	-0.15	-0.13	-0.12	-0.09
log_theta[34]	0.12	0.00	0.02	0.07	0.10	0.12	0.13	0.16
log_theta[35]	0.29	0.00	0.03	0.23	0.27	0.29	0.31	0.35
log_theta[36]	0.63	0.00	0.05	0.53	0.59	0.63	0.66	0.73
log_theta[37]	0.10	0.00	0.02	0.06	0.08	0.10	0.11	0.14
log_theta[38]	0.24	0.00	0.03	0.19	0.22	0.24	0.26	0.29
log_theta[39]	-0.20	0.00	0.02	-0.25	-0.22	-0.20	-0.19	-0.15
log_theta[40]	0.36	0.00	0.03	0.30	0.34	0.36	0.39	0.43
log_theta[41]	0.03	0.00	0.02	-0.01	0.02	0.03	0.05	0.07
log_theta[42]	0.02	0.00	0.02	-0.02	0.01	0.02	0.04	0.06
log_theta[43]	0.19	0.00	0.02	0.14	0.17	0.19	0.20	0.23
log_theta[44]	0.07	0.00	0.02	0.03	0.06	0.08	0.09	0.12
log_theta[45]	-0.04	0.00	0.02	-0.08	-0.05	-0.04	-0.02	0.00
log_theta[46]	0.35	0.00	0.03	0.29	0.33	0.35	0.38	0.42
log_theta[47]	-0.24	0.00	0.03	-0.29	-0.25	-0.24	-0.22	-0.19
log_theta[48]	-0.05	0.00	0.02	-0.09	-0.07	-0.05	-0.04	-0.01
log_theta[49]	0.14	0.00	0.02	0.09	0.12	0.14	0.16	0.18
log_theta[50]	-0.13	0.00	0.02	-0.17	-0.14	-0.13	-0.11	-0.08
log_theta[51]	0.44	0.00	0.04	0.36	0.41	0.44	0.46	0.51
log_theta[52]	0.29	0.00	0.03	0.23	0.27	0.29	0.31	0.35
log_theta[53]	-0.09	0.00	0.02	-0.13	-0.10	-0.09	-0.08	-0.05
log_theta[54]	-0.17	0.00	0.02	-0.22	-0.19	-0.17	-0.16	-0.13
log_theta[55]	0.16	0.00	0.02	0.11	0.14	0.16	0.17	0.20
log_theta[56]	0.17	0.00	0.02	0.12	0.15	0.17	0.18	0.21
log_theta[57]	-0.20	0.00	0.02	-0.25	-0.22	-0.20	-0.19	-0.15

log_theta[58]	0.45	0.00	0.04	0.37	0.42	0.45	0.48	0.53
log_theta[59]	-0.17	0.00	0.02	-0.22	-0.18	-0.17	-0.15	-0.12
log_theta[60]	-0.33	0.00	0.03	-0.39	-0.35	-0.33	-0.31	-0.26
log_theta[61]	-0.01	0.00	0.02	-0.05	-0.02	-0.01	0.00	0.03
log_theta[62]	-0.12	0.00	0.02	-0.16	-0.13	-0.12	-0.10	-0.08
log_theta[63]	0.12	0.00	0.02	0.07	0.10	0.12	0.13	0.16
log_theta[64]	-0.10	0.00	0.02	-0.15	-0.12	-0.10	-0.09	-0.06
log_theta[65]	-0.21	0.00	0.03	-0.26	-0.23	-0.21	-0.19	-0.16
log_theta[66]	-0.24	0.00	0.03	-0.29	-0.25	-0.24	-0.22	-0.19
log_theta[67]	-0.32	0.00	0.03	-0.38	-0.34	-0.32	-0.30	-0.26
log_theta[68]	0.12	0.00	0.02	0.08	0.11	0.12	0.14	0.17
log_theta[69]	0.33	0.00	0.03	0.26	0.31	0.33	0.35	0.39
log_theta[70]	-0.34	0.00	0.03	-0.40	-0.36	-0.34	-0.32	-0.28
log_theta[71]	-0.23	0.00	0.03	-0.28	-0.25	-0.23	-0.21	-0.18
log_theta[72]	-0.27	0.00	0.03	-0.33	-0.29	-0.27	-0.25	-0.22
log_theta[73]	0.20	0.00	0.03	0.15	0.19	0.20	0.22	0.25
log_theta[74]	0.30	0.00	0.03	0.24	0.28	0.30	0.32	0.36
log_theta[75]	-0.01	0.00	0.02	-0.05	-0.02	-0.01	0.01	0.03
log_theta[76]	0.20	0.00	0.03	0.15	0.18	0.20	0.21	0.25
log_theta[77]	0.06	0.00	0.02	0.02	0.05	0.06	0.08	0.10
log_theta[78]	-0.06	0.00	0.02	-0.10	-0.07	-0.06	-0.04	-0.02
log_theta[79]	0.15	0.00	0.02	0.10	0.13	0.15	0.16	0.19
log_theta[80]	0.19	0.00	0.02	0.14	0.17	0.19	0.20	0.23
log_theta[81]	0.33	0.00	0.03	0.26	0.31	0.33	0.35	0.39
log_theta[82]	-0.04	0.00	0.02	-0.09	-0.06	-0.04	-0.03	0.00
log_theta[83]	-0.05	0.00	0.02	-0.09	-0.07	-0.05	-0.04	-0.01
log_theta[84]	0.44	0.00	0.04	0.37	0.42	0.44	0.47	0.52
log_theta[85]	0.25	0.00	0.03	0.20	0.23	0.25	0.27	0.31
log_theta[86]	-0.21	0.00	0.02	-0.26	-0.23	-0.21	-0.19	-0.16
log_theta[87]	-0.17	0.00	0.02	-0.22	-0.18	-0.17	-0.15	-0.12
log_theta[88]	-0.02	0.00	0.02	-0.06	-0.03	-0.02	-0.01	0.02
log_theta[89]	-0.11	0.00	0.02	-0.15	-0.12	-0.11	-0.09	-0.07
log_theta[90]	0.16	0.00	0.02	0.11	0.15	0.16	0.18	0.21
log_theta[91]	-0.24	0.00	0.03	-0.29	-0.25	-0.24	-0.22	-0.18
log_theta[92]	0.25	0.00	0.03	0.20	0.24	0.25	0.27	0.31
log_theta[93]	-0.38	0.00	0.03	-0.44	-0.40	-0.38	-0.36	-0.31
log_theta[94]	-0.07	0.00	0.02	-0.11	-0.08	-0.07	-0.06	-0.03
log_theta[95]	-0.09	0.00	0.02	-0.13	-0.10	-0.09	-0.07	-0.05
log_theta[96]	-0.16	0.00	0.02	-0.20	-0.17	-0.16	-0.14	-0.11
log_theta[97]	-0.28	0.00	0.03	-0.34	-0.30	-0.28	-0.26	-0.23
log_theta[98]	-0.16	0.00	0.02	-0.21	-0.18	-0.16	-0.15	-0.12
log_theta[99]	-0.09	0.00	0.02	-0.13	-0.10	-0.09	-0.08	-0.05
log_theta[100]	0.35	0.00	0.03	0.28	0.32	0.35	0.37	0.41

log_theta[101]	-0.09	0.00	0.02	-0.14	-0.11	-0.09	-0.08	-0.05
log_theta[102]	-0.12	0.00	0.02	-0.16	-0.13	-0.12	-0.10	-0.08
log_theta[103]	0.07	0.00	0.02	0.03	0.05	0.07	0.08	0.11
log_theta[104]	-0.26	0.00	0.03	-0.32	-0.28	-0.26	-0.25	-0.21
log_theta[105]	-0.10	0.00	0.02	-0.14	-0.11	-0.10	-0.08	-0.06
log_theta[106]	-0.21	0.00	0.02	-0.26	-0.23	-0.21	-0.19	-0.16
log_theta[107]	0.24	0.00	0.03	0.18	0.22	0.24	0.26	0.29
log_theta[108]	-0.08	0.00	0.02	-0.12	-0.09	-0.08	-0.06	-0.04
log_theta[109]	-0.11	0.00	0.02	-0.16	-0.13	-0.11	-0.10	-0.07
log_theta[110]	-0.17	0.00	0.02	-0.22	-0.19	-0.17	-0.16	-0.13
log_theta[111]	-0.25	0.00	0.03	-0.30	-0.26	-0.25	-0.23	-0.19
log_theta[112]	-0.17	0.00	0.02	-0.21	-0.18	-0.17	-0.15	-0.12
log_theta[113]	-0.23	0.00	0.03	-0.28	-0.24	-0.22	-0.21	-0.17
log_theta[114]	-0.35	0.00	0.03	-0.42	-0.37	-0.35	-0.33	-0.29
log_theta[115]	-0.17	0.00	0.02	-0.22	-0.18	-0.17	-0.15	-0.12
log_theta[116]	-0.17	0.00	0.02	-0.22	-0.19	-0.17	-0.16	-0.13
log_theta[117]	-0.21	0.00	0.03	-0.26	-0.23	-0.21	-0.20	-0.16
log_theta[118]	0.30	0.00	0.03	0.24	0.28	0.30	0.32	0.36
log_theta[119]	-0.23	0.00	0.03	-0.28	-0.24	-0.23	-0.21	-0.18
log_theta[120]	-0.08	0.00	0.02	-0.12	-0.09	-0.08	-0.06	-0.04
log_theta[121]	0.18	0.00	0.02	0.13	0.16	0.18	0.20	0.23
log_theta[122]	-0.18	0.00	0.02	-0.22	-0.19	-0.18	-0.16	-0.13
log_theta[123]	-0.14	0.00	0.02	-0.18	-0.15	-0.14	-0.12	-0.09
log_theta[124]	-0.16	0.00	0.02	-0.21	-0.18	-0.16	-0.15	-0.12
log_theta[125]	-0.02	0.00	0.02	-0.06	-0.04	-0.02	-0.01	0.02
log_theta[126]	0.05	0.00	0.02	0.01	0.04	0.05	0.07	0.09
log_theta[127]	0.24	0.00	0.03	0.19	0.23	0.24	0.26	0.30
log_theta[128]	-0.06	0.00	0.02	-0.10	-0.07	-0.06	-0.04	-0.02
log_theta[129]	0.02	0.00	0.02	-0.02	0.00	0.02	0.03	0.06
log_theta[130]	0.02	0.00	0.02	-0.02	0.01	0.02	0.03	0.06
log_theta[131]	-0.05	0.00	0.02	-0.10	-0.07	-0.05	-0.04	-0.02
log_theta[132]	-0.08	0.00	0.02	-0.12	-0.09	-0.08	-0.06	-0.04
log_theta[133]	-0.22	0.00	0.03	-0.27	-0.24	-0.22	-0.20	-0.17
log_theta[134]	-0.26	0.00	0.03	-0.32	-0.28	-0.26	-0.25	-0.21
log_theta[135]	0.05	0.00	0.02	0.01	0.04	0.06	0.07	0.10
log_theta[136]	-0.10	0.00	0.02	-0.14	-0.11	-0.10	-0.08	-0.05
log_theta[137]	-0.16	0.00	0.02	-0.21	-0.17	-0.16	-0.14	-0.12
log_theta[138]	-0.24	0.00	0.03	-0.30	-0.26	-0.24	-0.23	-0.19
log_theta[139]	-0.17	0.00	0.02	-0.22	-0.19	-0.17	-0.16	-0.13
log_theta[140]	-0.06	0.00	0.02	-0.11	-0.08	-0.06	-0.05	-0.02
log_theta[141]	-0.33	0.00	0.03	-0.39	-0.35	-0.33	-0.31	-0.27
log_theta[142]	-0.32	0.00	0.03	-0.38	-0.34	-0.32	-0.30	-0.26
log_theta[143]	-0.08	0.00	0.02	-0.12	-0.09	-0.08	-0.06	-0.04

log_theta[144]	-0.30	0.00	0.03	-0.35	-0.31	-0.30	-0.28	-0.24
log_theta[145]	-0.29	0.00	0.03	-0.34	-0.31	-0.29	-0.27	-0.23
log_theta[146]	-0.26	0.00	0.03	-0.31	-0.28	-0.26	-0.24	-0.20
log_theta[147]	-0.17	0.00	0.02	-0.21	-0.18	-0.17	-0.15	-0.12
log_theta[148]	-0.21	0.00	0.03	-0.26	-0.23	-0.21	-0.19	-0.16
log_theta[149]	-0.06	0.00	0.02	-0.10	-0.07	-0.06	-0.05	-0.02
log_theta[150]	-0.18	0.00	0.02	-0.23	-0.20	-0.18	-0.17	-0.14
log_theta[151]	-0.23	0.00	0.03	-0.28	-0.25	-0.23	-0.22	-0.18
log_theta[152]	0.30	0.00	0.03	0.24	0.28	0.30	0.32	0.36
log_theta[153]	0.14	0.00	0.02	0.09	0.12	0.14	0.15	0.18
log_theta[154]	-0.09	0.00	0.02	-0.13	-0.10	-0.09	-0.07	-0.05
log_theta[155]	-0.19	0.00	0.02	-0.24	-0.21	-0.19	-0.18	-0.15
log_theta[156]	-0.11	0.00	0.02	-0.16	-0.13	-0.11	-0.10	-0.07
log_theta[157]	0.02	0.00	0.02	-0.02	0.00	0.02	0.03	0.05
log_theta[158]	-0.26	0.00	0.03	-0.32	-0.28	-0.26	-0.25	-0.21
log_theta[159]	-0.23	0.00	0.03	-0.29	-0.25	-0.23	-0.22	-0.18
log_theta[160]	-0.17	0.00	0.02	-0.22	-0.19	-0.17	-0.16	-0.13
log_theta[161]	-0.27	0.00	0.03	-0.33	-0.29	-0.27	-0.25	-0.22
log_theta[162]	-0.24	0.00	0.03	-0.29	-0.26	-0.24	-0.22	-0.19
log_theta[163]	-0.26	0.00	0.03	-0.31	-0.27	-0.26	-0.24	-0.20
log_theta[164]	-0.01	0.00	0.02	-0.05	-0.02	0.00	0.01	0.03
log_theta[165]	-0.12	0.00	0.02	-0.17	-0.14	-0.12	-0.11	-0.08
log_theta[166]	0.01	0.00	0.02	-0.03	0.00	0.02	0.03	0.05
log_theta[167]	-0.02	0.00	0.02	-0.06	-0.03	-0.02	0.00	0.02
log_theta[168]	-0.08	0.00	0.02	-0.13	-0.10	-0.08	-0.07	-0.04
log_theta[169]	-0.21	0.00	0.03	-0.26	-0.23	-0.21	-0.20	-0.16
log_theta[170]	0.11	0.00	0.02	0.07	0.10	0.11	0.13	0.16
log_theta[171]	-0.01	0.00	0.02	-0.05	-0.02	-0.01	0.00	0.03
log_theta[172]	0.08	0.00	0.02	0.03	0.06	0.08	0.09	0.12
log_theta[173]	-0.09	0.00	0.02	-0.14	-0.11	-0.09	-0.08	-0.05
log_theta[174]	-0.29	0.00	0.03	-0.34	-0.31	-0.29	-0.27	-0.23
log_theta[175]	-0.34	0.00	0.03	-0.41	-0.37	-0.34	-0.32	-0.28
log_theta[176]	-0.32	0.00	0.03	-0.38	-0.34	-0.32	-0.30	-0.26
log_theta[177]	-0.02	0.00	0.02	-0.06	-0.04	-0.02	-0.01	0.02
log_theta[178]	-0.24	0.00	0.03	-0.29	-0.26	-0.24	-0.22	-0.19
log_theta[179]	-0.17	0.00	0.02	-0.22	-0.19	-0.17	-0.16	-0.13
log_theta[180]	-0.23	0.00	0.03	-0.29	-0.25	-0.23	-0.22	-0.18
log_theta[181]	-0.27	0.00	0.03	-0.33	-0.29	-0.27	-0.26	-0.22
log_theta[182]	-0.30	0.00	0.03	-0.36	-0.32	-0.30	-0.28	-0.24
log_theta[183]	-0.17	0.00	0.02	-0.22	-0.19	-0.17	-0.16	-0.13
log_theta[184]	-0.31	0.00	0.03	-0.37	-0.33	-0.31	-0.29	-0.25
log_theta[185]	-0.21	0.00	0.03	-0.26	-0.23	-0.21	-0.19	-0.16
log_theta[186]	-0.14	0.00	0.02	-0.19	-0.16	-0.14	-0.13	-0.10

log_theta[187]	0.14	0.00	0.02	0.09	0.12	0.14	0.15	0.18
log_theta[188]	-0.31	0.00	0.03	-0.37	-0.33	-0.31	-0.29	-0.25
log_theta[189]	-0.07	0.00	0.02	-0.12	-0.09	-0.07	-0.06	-0.03
log_theta[190]	-0.34	0.00	0.03	-0.40	-0.36	-0.34	-0.32	-0.28
log_theta[191]	-0.33	0.00	0.03	-0.39	-0.35	-0.33	-0.31	-0.27
log_theta[192]	-0.25	0.00	0.03	-0.30	-0.26	-0.24	-0.23	-0.19
log_theta[193]	-0.26	0.00	0.03	-0.32	-0.28	-0.26	-0.25	-0.21
log_theta[194]	-0.19	0.00	0.02	-0.24	-0.20	-0.19	-0.17	-0.14
log_theta[195]	-0.39	0.00	0.03	-0.46	-0.41	-0.39	-0.37	-0.32
lp__	3710.77	0.02	0.99	3708.16	3710.40	3711.08	3711.49	3711.75

	n_eff	Rhat
alpha	3149	1
beta	2847	1
log_theta[1]	3081	1
log_theta[2]	3117	1
log_theta[3]	2830	1
log_theta[4]	2902	1
log_theta[5]	2865	1
log_theta[6]	2856	1
log_theta[7]	2825	1
log_theta[8]	2823	1
log_theta[9]	3303	1
log_theta[10]	3173	1
log_theta[11]	3033	1
log_theta[12]	2867	1
log_theta[13]	3124	1
log_theta[14]	3043	1
log_theta[15]	3182	1
log_theta[16]	2952	1
log_theta[17]	3040	1
log_theta[18]	3189	1
log_theta[19]	2840	1
log_theta[20]	3082	1
log_theta[21]	2842	1
log_theta[22]	2899	1
log_theta[23]	2922	1
log_theta[24]	3076	1
log_theta[25]	2838	1
log_theta[26]	3191	1
log_theta[27]	3003	1
log_theta[28]	2902	1
log_theta[29]	2851	1
log_theta[30]	2824	1

```
log_theta[31]   2914    1
log_theta[32]   2854    1
log_theta[33]   3299    1
log_theta[34]   3152    1
log_theta[35]   2914    1
log_theta[36]   2821    1
log_theta[37]   3170    1
log_theta[38]   2981    1
log_theta[39]   3293    1
log_theta[40]   2872    1
log_theta[41]   3189    1
log_theta[42]   3182    1
log_theta[43]   3061    1
log_theta[44]   3188    1
log_theta[45]   3119    1
log_theta[46]   2877    1
log_theta[47]   3279    1
log_theta[48]   3160    1
log_theta[49]   3125    1
log_theta[50]   3297    1
log_theta[51]   2853    1
log_theta[52]   2913    1
log_theta[53]   3242    1
log_theta[54]   3301    1
log_theta[55]   3102    1
log_theta[56]   3089    1
log_theta[57]   3293    1
log_theta[58]   2849    1
log_theta[59]   3302    1
log_theta[60]   3209    1
log_theta[61]   3148    1
log_theta[62]   3289    1
log_theta[63]   3154    1
log_theta[64]   3269    1
log_theta[65]   3290    1
log_theta[66]   3279    1
log_theta[67]   3212    1
log_theta[68]   3146    1
log_theta[69]   2890    1
log_theta[70]   3199    1
log_theta[71]   3282    1
log_theta[72]   3251    1
log_theta[73]   3034    1
```

```
log_theta[74]   2909    1
log_theta[75]   3154    1
log_theta[76]   3044    1
log_theta[77]   3192    1
log_theta[78]   3170    1
log_theta[79]   3116    1
log_theta[80]   3061    1
log_theta[81]   2890    1
log_theta[82]   3138    1
log_theta[83]   3162    1
log_theta[84]   2851    1
log_theta[85]   2963    1
log_theta[86]   3291    1
log_theta[87]   3302    1
log_theta[88]   3132    1
log_theta[89]   3274    1
log_theta[90]   3094    1
log_theta[91]   3280    1
log_theta[92]   2962    1
log_theta[93]   3172    1
log_theta[94]   3203    1
log_theta[95]   3240    1
log_theta[96]   3304    1
log_theta[97]   3243    1
log_theta[98]   3303    1
log_theta[99]   3244    1
log_theta[100]  2881    1
log_theta[101]  3248    1
log_theta[102]  3291    1
log_theta[103]  3190    1
log_theta[104]  3258    1
log_theta[105]  3254    1
log_theta[106]  3291    1
log_theta[107]  2985    1
log_theta[108]  3213    1
log_theta[109]  3286    1
log_theta[110]  3301    1
log_theta[111]  3272    1
log_theta[112]  3303    1
log_theta[113]  3285    1
log_theta[114]  3189    1
log_theta[115]  3302    1
log_theta[116]  3302    1
```

```
log_theta[117]  3289    1
log_theta[118]  2906    1
log_theta[119]  3285    1
log_theta[120]  3218    1
log_theta[121]  3069    1
log_theta[122]  3300    1
log_theta[123]  3301    1
log_theta[124]  3303    1
log_theta[125]  3128    1
log_theta[126]  3193    1
log_theta[127]  2976    1
log_theta[128]  3174    1
log_theta[129]  3180    1
log_theta[130]  3181    1
log_theta[131]  3165    1
log_theta[132]  3220    1
log_theta[133]  3287    1
log_theta[134]  3258    1
log_theta[135]  3193    1
log_theta[136]  3253    1
log_theta[137]  3303    1
log_theta[138]  3273    1
log_theta[139]  3302    1
log_theta[140]  3186    1
log_theta[141]  3207    1
log_theta[142]  3216    1
log_theta[143]  3219    1
log_theta[144]  3233    1
log_theta[145]  3239    1
log_theta[146]  3262    1
log_theta[147]  3302    1
log_theta[148]  3290    1
log_theta[149]  3177    1
log_theta[150]  3299    1
log_theta[151]  3281    1
log_theta[152]  2908    1
log_theta[153]  3127    1
log_theta[154]  3238    1
log_theta[155]  3294    1
log_theta[156]  3285    1
log_theta[157]  3178    1
log_theta[158]  3258    1
log_theta[159]  3280    1
```

```
log_theta[160]  3302    1
log_theta[161]  3252    1
log_theta[162]  3276    1
log_theta[163]  3264    1
log_theta[164]  3155    1
log_theta[165]  3296    1
log_theta[166]  3177    1
log_theta[167]  3138    1
log_theta[168]  3232    1
log_theta[169]  3290    1
log_theta[170]  3157    1
log_theta[171]  3147    1
log_theta[172]  3187    1
log_theta[173]  3251    1
log_theta[174]  3240    1
log_theta[175]  3195    1
log_theta[176]  3217    1
log_theta[177]  3129    1
log_theta[178]  3278    1
log_theta[179]  3302    1
log_theta[180]  3281    1
log_theta[181]  3250    1
log_theta[182]  3231    1
log_theta[183]  3302    1
log_theta[184]  3222    1
log_theta[185]  3290    1
log_theta[186]  3302    1
log_theta[187]  3131    1
log_theta[188]  3223    1
log_theta[189]  3210    1
log_theta[190]  3200    1
log_theta[191]  3208    1
log_theta[192]  3272    1
log_theta[193]  3257    1
log_theta[194]  3296    1
log_theta[195]  3163    1
lp__            1685    1

Samples were drawn using NUTS(diag_e) at Sat Mar 18 20:45:30 2023.
For each parameter, n_eff is a crude measure of effective sample size,
and Rhat is the potential scale reduction factor on split chains (at
convergence, Rhat=1).
```

Model 2

```
mod2 <- stan(data=stan_data, file="lab9_2.stan", seed = 1)
```

```
Running /Library/Frameworks/R.framework/Resources/bin/R CMD SHLIB foo.c
clang -mmacosx-version-min=10.13 -I"/Library/Frameworks/R.framework/Resources/include" -DNDEI
In file included from <built-in>:1:
In file included from /Library/Frameworks/R.framework/Versions/4.1/Resources/library/StanHea
In file included from /Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEig
In file included from /Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEig
/Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEigen/include/Eigen/src/Co
namespace Eigen {
^
/Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEigen/include/Eigen/src/Co
namespace Eigen {
              ^
              ;
In file included from <built-in>:1:
In file included from /Library/Frameworks/R.framework/Versions/4.1/Resources/library/StanHea
In file included from /Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEig
/Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEigen/include/Eigen/Core:9
#include <complex>
         ^~~~~~~~~
3 errors generated.
make: *** [foo.o] Error 1

SAMPLING FOR MODEL 'lab9_2' NOW (CHAIN 1).
Chain 1:
Chain 1: Gradient evaluation took 0.0001 seconds
Chain 1: 1000 transitions using 10 leapfrog steps per transition would take 1 seconds.
Chain 1: Adjust your expectations accordingly!
Chain 1:
Chain 1:
Chain 1: Iteration:    1 / 2000 [  0%]  (Warmup)
Chain 1: Iteration:  200 / 2000 [ 10%]  (Warmup)
Chain 1: Iteration:  400 / 2000 [ 20%]  (Warmup)
Chain 1: Iteration:  600 / 2000 [ 30%]  (Warmup)
Chain 1: Iteration:  800 / 2000 [ 40%]  (Warmup)
Chain 1: Iteration: 1000 / 2000 [ 50%]  (Warmup)
Chain 1: Iteration: 1001 / 2000 [ 50%]  (Sampling)
Chain 1: Iteration: 1200 / 2000 [ 60%]  (Sampling)
Chain 1: Iteration: 1400 / 2000 [ 70%]  (Sampling)
```

```
Chain 1: Iteration: 1600 / 2000 [ 80%]  (Sampling)
Chain 1: Iteration: 1800 / 2000 [ 90%]  (Sampling)
Chain 1: Iteration: 2000 / 2000 [100%]  (Sampling)
Chain 1:
Chain 1:  Elapsed Time: 0.349724 seconds (Warm-up)
Chain 1:                0.327867 seconds (Sampling)
Chain 1:                0.677591 seconds (Total)
Chain 1:

SAMPLING FOR MODEL 'lab9_2' NOW (CHAIN 2).
Chain 2:
Chain 2: Gradient evaluation took 2.2e-05 seconds
Chain 2: 1000 transitions using 10 leapfrog steps per transition would take 0.22 seconds.
Chain 2: Adjust your expectations accordingly!
Chain 2:
Chain 2:
Chain 2: Iteration:    1 / 2000 [  0%]  (Warmup)
Chain 2: Iteration:  200 / 2000 [ 10%]  (Warmup)
Chain 2: Iteration:  400 / 2000 [ 20%]  (Warmup)
Chain 2: Iteration:  600 / 2000 [ 30%]  (Warmup)
Chain 2: Iteration:  800 / 2000 [ 40%]  (Warmup)
Chain 2: Iteration: 1000 / 2000 [ 50%]  (Warmup)
Chain 2: Iteration: 1001 / 2000 [ 50%]  (Sampling)
Chain 2: Iteration: 1200 / 2000 [ 60%]  (Sampling)
Chain 2: Iteration: 1400 / 2000 [ 70%]  (Sampling)
Chain 2: Iteration: 1600 / 2000 [ 80%]  (Sampling)
Chain 2: Iteration: 1800 / 2000 [ 90%]  (Sampling)
Chain 2: Iteration: 2000 / 2000 [100%]  (Sampling)
Chain 2:
Chain 2:  Elapsed Time: 0.344971 seconds (Warm-up)
Chain 2:                0.328579 seconds (Sampling)
Chain 2:                0.67355 seconds (Total)
Chain 2:

SAMPLING FOR MODEL 'lab9_2' NOW (CHAIN 3).
Chain 3:
Chain 3: Gradient evaluation took 2.2e-05 seconds
Chain 3: 1000 transitions using 10 leapfrog steps per transition would take 0.22 seconds.
Chain 3: Adjust your expectations accordingly!
Chain 3:
Chain 3:
Chain 3: Iteration:    1 / 2000 [  0%]  (Warmup)
Chain 3: Iteration:  200 / 2000 [ 10%]  (Warmup)
```

```
Chain 3: Iteration:  400 / 2000 [ 20%]  (Warmup)
Chain 3: Iteration:  600 / 2000 [ 30%]  (Warmup)
Chain 3: Iteration:  800 / 2000 [ 40%]  (Warmup)
Chain 3: Iteration: 1000 / 2000 [ 50%]  (Warmup)
Chain 3: Iteration: 1001 / 2000 [ 50%]  (Sampling)
Chain 3: Iteration: 1200 / 2000 [ 60%]  (Sampling)
Chain 3: Iteration: 1400 / 2000 [ 70%]  (Sampling)
Chain 3: Iteration: 1600 / 2000 [ 80%]  (Sampling)
Chain 3: Iteration: 1800 / 2000 [ 90%]  (Sampling)
Chain 3: Iteration: 2000 / 2000 [100%]  (Sampling)
Chain 3:
Chain 3:  Elapsed Time: 0.349756 seconds (Warm-up)
Chain 3:                0.329939 seconds (Sampling)
Chain 3:                0.679695 seconds (Total)
Chain 3:

SAMPLING FOR MODEL 'lab9_2' NOW (CHAIN 4).
Chain 4:
Chain 4: Gradient evaluation took 2.2e-05 seconds
Chain 4: 1000 transitions using 10 leapfrog steps per transition would take 0.22 seconds.
Chain 4: Adjust your expectations accordingly!
Chain 4:
Chain 4:
Chain 4: Iteration:    1 / 2000 [  0%]  (Warmup)
Chain 4: Iteration:  200 / 2000 [ 10%]  (Warmup)
Chain 4: Iteration:  400 / 2000 [ 20%]  (Warmup)
Chain 4: Iteration:  600 / 2000 [ 30%]  (Warmup)
Chain 4: Iteration:  800 / 2000 [ 40%]  (Warmup)
Chain 4: Iteration: 1000 / 2000 [ 50%]  (Warmup)
Chain 4: Iteration: 1001 / 2000 [ 50%]  (Sampling)
Chain 4: Iteration: 1200 / 2000 [ 60%]  (Sampling)
Chain 4: Iteration: 1400 / 2000 [ 70%]  (Sampling)
Chain 4: Iteration: 1600 / 2000 [ 80%]  (Sampling)
Chain 4: Iteration: 1800 / 2000 [ 90%]  (Sampling)
Chain 4: Iteration: 2000 / 2000 [100%]  (Sampling)
Chain 4:
Chain 4:  Elapsed Time: 0.354055 seconds (Warm-up)
Chain 4:                0.327652 seconds (Sampling)
Chain 4:                0.681707 seconds (Total)
Chain 4:
```

```
mod2
```

```
Inference for Stan model: lab9_2.
4 chains, each with iter=2000; warmup=1000; thin=1;
post-warmup draws per chain=1000, total post-warmup draws=4000.
```

	mean	se_mean	sd	2.5%	25%	50%	75%	97.5%
alpha[1]	-0.33	0.01	0.40	-1.16	-0.59	-0.31	-0.06	0.40
alpha[2]	0.28	0.00	0.27	-0.30	0.11	0.29	0.47	0.78
alpha[3]	0.51	0.01	0.27	-0.03	0.34	0.52	0.69	1.02
alpha[4]	-0.32	0.01	0.40	-1.17	-0.58	-0.31	-0.05	0.43
alpha[5]	0.53	0.01	0.32	-0.12	0.32	0.55	0.75	1.12
alpha[6]	-0.72	0.00	0.24	-1.23	-0.88	-0.72	-0.56	-0.26
alpha[7]	0.50	0.01	0.24	0.03	0.34	0.50	0.66	0.94
alpha[8]	-0.57	0.01	0.33	-1.28	-0.79	-0.56	-0.34	0.04
alpha[9]	0.74	0.00	0.26	0.19	0.57	0.75	0.92	1.21
alpha[10]	0.78	0.00	0.22	0.33	0.63	0.78	0.93	1.19
alpha[11]	-0.14	0.01	0.47	-1.16	-0.44	-0.12	0.20	0.70
alpha[12]	0.81	0.01	0.31	0.18	0.61	0.83	1.03	1.38
alpha[13]	0.01	0.00	0.30	-0.62	-0.19	0.02	0.22	0.57
alpha[14]	0.65	0.00	0.22	0.19	0.50	0.65	0.80	1.07
alpha[15]	0.34	0.00	0.27	-0.22	0.17	0.35	0.53	0.85
alpha[16]	0.90	0.00	0.28	0.34	0.71	0.91	1.09	1.42
alpha[17]	1.02	0.00	0.25	0.51	0.87	1.03	1.19	1.49
alpha[18]	0.60	0.00	0.22	0.14	0.46	0.61	0.75	1.00
alpha[19]	0.06	0.01	0.23	-0.40	-0.09	0.06	0.21	0.51
alpha[20]	0.44	0.00	0.40	-0.38	0.18	0.46	0.71	1.18
alpha[21]	0.85	0.01	0.32	0.19	0.65	0.86	1.06	1.43
alpha[22]	1.06	0.00	0.24	0.59	0.91	1.07	1.23	1.50
alpha[23]	0.44	0.00	0.28	-0.14	0.26	0.45	0.64	0.95
alpha[24]	-0.14	0.01	0.41	-0.97	-0.41	-0.12	0.15	0.61
alpha[25]	0.30	0.01	0.26	-0.23	0.13	0.31	0.48	0.79
alpha[26]	0.85	0.00	0.23	0.36	0.69	0.86	1.01	1.27
alpha[27]	0.66	0.00	0.28	0.09	0.48	0.67	0.85	1.16
alpha[28]	0.82	0.00	0.26	0.30	0.65	0.83	1.00	1.31
alpha[29]	-0.08	0.01	0.52	-1.20	-0.42	-0.05	0.29	0.87
alpha[30]	0.58	0.01	0.34	-0.11	0.35	0.60	0.82	1.21
alpha[31]	0.20	0.01	0.37	-0.57	-0.04	0.21	0.45	0.87
alpha[32]	-0.52	0.01	0.50	-1.56	-0.85	-0.49	-0.17	0.38
alpha[33]	0.71	0.00	0.29	0.10	0.52	0.72	0.91	1.24
alpha[34]	0.38	0.00	0.30	-0.24	0.19	0.40	0.59	0.93
alpha[35]	-0.08	0.01	0.39	-0.91	-0.33	-0.06	0.19	0.62
alpha[36]	-0.45	0.01	0.29	-1.03	-0.64	-0.45	-0.26	0.09
alpha[37]	0.59	0.00	0.28	0.00	0.42	0.61	0.78	1.10
alpha[38]	-0.13	0.01	0.39	-0.95	-0.38	-0.11	0.14	0.56

alpha[39]	-0.17	0.00	0.32	-0.83	-0.39	-0.16	0.05	0.42
alpha[40]	0.44	0.01	0.33	-0.24	0.22	0.45	0.67	1.05
alpha[41]	-0.46	0.01	0.45	-1.37	-0.75	-0.44	-0.14	0.33
alpha[42]	-0.23	0.00	0.32	-0.92	-0.43	-0.22	-0.02	0.35
alpha[43]	0.09	0.00	0.30	-0.52	-0.10	0.11	0.30	0.64
alpha[44]	-0.16	0.00	0.27	-0.72	-0.35	-0.16	0.02	0.33
alpha[45]	0.87	0.00	0.21	0.45	0.73	0.87	1.01	1.25
alpha[46]	-0.18	0.00	0.24	-0.66	-0.33	-0.17	-0.01	0.27
alpha[47]	0.42	0.00	0.29	-0.18	0.23	0.43	0.62	0.96
alpha[48]	0.74	0.00	0.39	-0.11	0.49	0.76	1.02	1.46
alpha[49]	0.15	0.00	0.27	-0.40	-0.02	0.16	0.34	0.65
alpha[50]	0.02	0.00	0.28	-0.57	-0.16	0.03	0.22	0.53
alpha[51]	-0.36	0.01	0.30	-0.98	-0.56	-0.35	-0.15	0.19
alpha[52]	0.06	0.00	0.27	-0.49	-0.12	0.07	0.25	0.57
alpha[53]	-0.49	0.00	0.38	-1.29	-0.74	-0.48	-0.23	0.20
alpha[54]	1.01	0.00	0.27	0.45	0.83	1.01	1.20	1.53
alpha[55]	0.50	0.01	0.39	-0.32	0.26	0.52	0.77	1.21
alpha[56]	-0.09	0.00	0.23	-0.56	-0.24	-0.08	0.08	0.33
alpha[57]	0.88	0.00	0.28	0.29	0.70	0.90	1.08	1.41
alpha[58]	-0.51	0.01	0.33	-1.22	-0.72	-0.50	-0.28	0.09
alpha[59]	-0.25	0.00	0.37	-1.02	-0.49	-0.23	0.00	0.43
alpha[60]	0.54	0.00	0.36	-0.21	0.31	0.56	0.78	1.20
alpha[61]	-0.07	0.00	0.35	-0.81	-0.29	-0.06	0.17	0.57
alpha[62]	-0.10	0.00	0.39	-0.93	-0.35	-0.09	0.16	0.61
alpha[63]	-0.16	0.00	0.25	-0.70	-0.33	-0.16	0.02	0.30
alpha[64]	-0.32	0.01	0.44	-1.27	-0.60	-0.29	-0.01	0.46
alpha[65]	0.22	0.01	0.40	-0.64	-0.03	0.24	0.50	0.96
alpha[66]	0.09	0.00	0.29	-0.52	-0.10	0.10	0.29	0.62
alpha[67]	0.18	0.01	0.42	-0.68	-0.10	0.20	0.48	0.94
alpha[68]	-0.03	0.01	0.42	-0.92	-0.29	0.00	0.26	0.73
alpha[69]	-0.18	0.00	0.24	-0.68	-0.35	-0.18	-0.01	0.26
alpha[70]	-0.06	0.01	0.43	-0.96	-0.34	-0.04	0.25	0.69
alpha[71]	0.14	0.00	0.37	-0.62	-0.10	0.16	0.39	0.79
alpha[72]	-0.65	0.01	0.52	-1.79	-0.99	-0.63	-0.27	0.28
alpha[73]	0.43	0.00	0.34	-0.28	0.23	0.45	0.67	1.06
alpha[74]	-0.67	0.01	0.35	-1.39	-0.89	-0.65	-0.43	-0.01
alpha[75]	0.27	0.01	0.40	-0.58	0.02	0.30	0.54	0.99
alpha[76]	0.56	0.00	0.29	-0.04	0.38	0.58	0.76	1.09
alpha[77]	-0.08	0.00	0.27	-0.63	-0.25	-0.07	0.10	0.40
alpha[78]	0.63	0.00	0.25	0.12	0.47	0.64	0.80	1.09
alpha[79]	0.31	0.00	0.42	-0.55	0.05	0.34	0.60	1.06
alpha[80]	0.54	0.01	0.44	-0.38	0.25	0.56	0.85	1.33
alpha[81]	0.01	0.01	0.39	-0.83	-0.24	0.03	0.28	0.71

alpha[82]	0.65	0.00	0.29	0.06	0.45	0.66	0.85	1.17
alpha[83]	0.35	0.00	0.31	-0.29	0.15	0.37	0.57	0.91
alpha[84]	0.61	0.01	0.27	0.08	0.44	0.62	0.80	1.11
alpha[85]	0.31	0.00	0.33	-0.38	0.10	0.32	0.54	0.90
alpha[86]	0.33	0.00	0.25	-0.19	0.17	0.34	0.50	0.81
alpha[87]	0.39	0.00	0.26	-0.15	0.22	0.40	0.57	0.87
alpha[88]	0.52	0.00	0.23	0.02	0.37	0.52	0.67	0.93
alpha[89]	0.71	0.01	0.41	-0.13	0.46	0.73	0.99	1.47
alpha[90]	0.48	0.00	0.29	-0.13	0.29	0.49	0.68	0.99
alpha[91]	-0.69	0.00	0.36	-1.45	-0.93	-0.67	-0.43	-0.02
alpha[92]	0.10	0.00	0.34	-0.61	-0.12	0.12	0.34	0.73
alpha[93]	0.07	0.00	0.19	-0.31	-0.05	0.08	0.20	0.45
alpha[94]	0.62	0.00	0.25	0.08	0.46	0.63	0.80	1.07
alpha[95]	0.34	0.00	0.26	-0.20	0.17	0.35	0.52	0.84
alpha[96]	0.47	0.00	0.24	-0.02	0.32	0.48	0.64	0.92
alpha[97]	0.43	0.00	0.21	0.00	0.29	0.43	0.58	0.82
alpha[98]	0.18	0.00	0.27	-0.36	0.01	0.19	0.36	0.67
alpha[99]	-0.76	0.01	0.54	-1.90	-1.10	-0.72	-0.38	0.19
alpha[100]	-0.06	0.00	0.15	-0.35	-0.16	-0.06	0.04	0.22
alpha[101]	0.40	0.00	0.28	-0.16	0.22	0.41	0.60	0.90
alpha[102]	0.17	0.00	0.27	-0.38	-0.02	0.18	0.36	0.65
alpha[103]	0.18	0.01	0.38	-0.64	-0.05	0.20	0.44	0.88
alpha[104]	0.15	0.00	0.23	-0.32	0.00	0.15	0.31	0.58
alpha[105]	-0.03	0.00	0.35	-0.79	-0.25	-0.02	0.21	0.61
alpha[106]	0.01	0.00	0.28	-0.58	-0.17	0.03	0.21	0.53
alpha[107]	0.50	0.00	0.32	-0.15	0.29	0.51	0.71	1.08
alpha[108]	-0.53	0.01	0.49	-1.62	-0.85	-0.50	-0.18	0.34
alpha[109]	0.01	0.00	0.30	-0.63	-0.19	0.02	0.22	0.56
alpha[110]	-0.36	0.01	0.48	-1.36	-0.66	-0.34	-0.02	0.49
alpha[111]	0.14	0.00	0.30	-0.48	-0.05	0.16	0.35	0.69
alpha[112]	0.04	0.00	0.27	-0.54	-0.13	0.06	0.23	0.56
alpha[113]	-0.06	0.00	0.30	-0.68	-0.26	-0.05	0.15	0.47
alpha[114]	0.05	0.00	0.28	-0.53	-0.13	0.07	0.25	0.57
alpha[115]	0.12	0.00	0.31	-0.53	-0.09	0.14	0.35	0.68
alpha[116]	-0.26	0.00	0.40	-1.12	-0.53	-0.24	0.02	0.47
alpha[117]	0.16	0.00	0.24	-0.33	0.00	0.16	0.32	0.60
alpha[118]	-1.32	0.00	0.30	-1.95	-1.51	-1.31	-1.11	-0.76
alpha[119]	0.20	0.00	0.21	-0.22	0.06	0.20	0.34	0.60
alpha[120]	-0.08	0.00	0.41	-0.91	-0.36	-0.05	0.21	0.64
alpha[121]	0.10	0.00	0.33	-0.59	-0.10	0.12	0.34	0.71
alpha[122]	-1.06	0.01	0.51	-2.20	-1.37	-1.03	-0.71	-0.15
alpha[123]	-0.12	0.00	0.29	-0.72	-0.30	-0.11	0.08	0.42
alpha[124]	-0.48	0.00	0.31	-1.12	-0.68	-0.47	-0.26	0.09

alpha[125]	0.16	0.00	0.29	-0.44	-0.02	0.18	0.37	0.70
alpha[126]	-0.32	0.00	0.38	-1.13	-0.56	-0.31	-0.06	0.36
alpha[127]	-0.44	0.00	0.29	-1.04	-0.63	-0.43	-0.24	0.09
alpha[128]	-0.06	0.01	0.42	-0.93	-0.32	-0.04	0.24	0.68
alpha[129]	-0.28	0.00	0.23	-0.76	-0.43	-0.26	-0.12	0.15
alpha[130]	-0.20	0.00	0.25	-0.73	-0.37	-0.19	-0.03	0.28
alpha[131]	-0.06	0.01	0.46	-1.02	-0.35	-0.03	0.25	0.77
alpha[132]	0.01	0.00	0.34	-0.70	-0.20	0.02	0.24	0.61
alpha[133]	-0.02	0.00	0.32	-0.68	-0.23	-0.01	0.21	0.56
alpha[134]	-0.22	0.00	0.39	-1.04	-0.47	-0.21	0.05	0.47
alpha[135]	-0.30	0.01	0.46	-1.31	-0.60	-0.29	0.03	0.53
alpha[136]	-0.12	0.01	0.44	-1.08	-0.40	-0.10	0.19	0.69
alpha[137]	-0.82	0.01	0.51	-1.88	-1.13	-0.80	-0.47	0.07
alpha[138]	0.34	0.00	0.29	-0.24	0.15	0.36	0.54	0.87
alpha[139]	0.03	0.00	0.29	-0.59	-0.15	0.04	0.22	0.55
alpha[140]	0.24	0.00	0.30	-0.37	0.06	0.25	0.44	0.80
alpha[141]	0.07	0.00	0.33	-0.61	-0.15	0.08	0.30	0.66
alpha[142]	0.26	0.01	0.37	-0.53	0.02	0.28	0.53	0.94
alpha[143]	-0.25	0.00	0.35	-1.00	-0.47	-0.22	-0.02	0.39
alpha[144]	-0.05	0.00	0.34	-0.75	-0.27	-0.04	0.18	0.58
alpha[145]	0.37	0.00	0.30	-0.25	0.19	0.38	0.57	0.93
alpha[146]	-0.04	0.00	0.29	-0.64	-0.24	-0.04	0.16	0.50
alpha[147]	0.34	0.00	0.21	-0.08	0.20	0.35	0.49	0.73
alpha[148]	-0.28	0.00	0.36	-1.06	-0.51	-0.25	-0.04	0.37
alpha[149]	0.75	0.00	0.25	0.25	0.59	0.76	0.92	1.21
alpha[150]	-0.59	0.00	0.15	-0.91	-0.69	-0.59	-0.49	-0.29
alpha[151]	-0.33	0.00	0.31	-0.97	-0.54	-0.31	-0.11	0.24
alpha[152]	-0.07	0.00	0.24	-0.58	-0.23	-0.06	0.09	0.38
alpha[153]	0.52	0.00	0.29	-0.07	0.33	0.53	0.72	1.06
alpha[154]	0.39	0.00	0.28	-0.21	0.22	0.41	0.59	0.90
alpha[155]	-0.01	0.00	0.26	-0.54	-0.19	0.00	0.18	0.46
alpha[156]	-0.23	0.00	0.26	-0.78	-0.39	-0.22	-0.05	0.26
alpha[157]	-0.61	0.01	0.50	-1.66	-0.94	-0.58	-0.25	0.28
alpha[158]	-0.55	0.00	0.33	-1.24	-0.76	-0.54	-0.31	0.05
alpha[159]	0.22	0.00	0.25	-0.29	0.06	0.23	0.40	0.69
alpha[160]	-0.19	0.01	0.39	-1.01	-0.44	-0.17	0.08	0.50
alpha[161]	0.01	0.00	0.28	-0.60	-0.17	0.02	0.20	0.52
alpha[162]	-0.09	0.00	0.28	-0.68	-0.26	-0.08	0.10	0.43
alpha[163]	0.04	0.00	0.28	-0.55	-0.14	0.06	0.24	0.57
alpha[164]	0.02	0.00	0.33	-0.68	-0.19	0.04	0.25	0.64
alpha[165]	-0.24	0.00	0.29	-0.83	-0.44	-0.24	-0.04	0.27
alpha[166]	-0.35	0.00	0.40	-1.19	-0.62	-0.33	-0.05	0.37
alpha[167]	0.38	0.00	0.32	-0.28	0.17	0.39	0.61	0.98

alpha[168]	-0.19	0.00	0.33	-0.88	-0.40	-0.17	0.04	0.41
alpha[169]	-1.37	0.00	0.21	-1.79	-1.50	-1.37	-1.23	-0.97
alpha[170]	0.03	0.00	0.32	-0.63	-0.18	0.04	0.26	0.61
alpha[171]	-0.76	0.01	0.52	-1.88	-1.10	-0.73	-0.40	0.19
alpha[172]	0.16	0.00	0.31	-0.46	-0.04	0.18	0.37	0.73
alpha[173]	-0.27	0.00	0.38	-1.06	-0.51	-0.24	0.01	0.41
alpha[174]	-0.11	0.00	0.31	-0.76	-0.32	-0.10	0.11	0.45
alpha[175]	-0.26	0.00	0.28	-0.84	-0.44	-0.25	-0.07	0.27
alpha[176]	-0.16	0.00	0.32	-0.83	-0.36	-0.14	0.06	0.44
alpha[177]	0.54	0.00	0.31	-0.13	0.34	0.55	0.75	1.11
alpha[178]	-0.56	0.00	0.18	-0.92	-0.68	-0.56	-0.43	-0.22
alpha[179]	-0.44	0.00	0.40	-1.28	-0.70	-0.42	-0.16	0.26
alpha[180]	-0.01	0.00	0.30	-0.63	-0.20	0.01	0.20	0.56
alpha[181]	-0.08	0.00	0.32	-0.77	-0.29	-0.07	0.14	0.52
alpha[182]	-0.11	0.00	0.30	-0.71	-0.31	-0.10	0.11	0.45
alpha[183]	0.09	0.00	0.30	-0.54	-0.09	0.11	0.30	0.63
alpha[184]	-1.54	0.01	0.67	-2.94	-1.98	-1.51	-1.06	-0.35
alpha[185]	-0.05	0.00	0.33	-0.76	-0.26	-0.04	0.18	0.55
alpha[186]	-0.65	0.01	0.48	-1.69	-0.95	-0.61	-0.31	0.24
alpha[187]	-0.45	0.00	0.28	-1.04	-0.63	-0.43	-0.25	0.08
alpha[188]	0.25	0.00	0.31	-0.38	0.05	0.26	0.47	0.81
alpha[189]	0.22	0.00	0.29	-0.38	0.03	0.23	0.42	0.75
alpha[190]	-0.32	0.01	0.41	-1.15	-0.59	-0.30	-0.02	0.43
alpha[191]	-0.26	0.01	0.47	-1.22	-0.55	-0.23	0.06	0.56
alpha[192]	-0.31	0.00	0.34	-1.04	-0.53	-0.30	-0.08	0.32
alpha[193]	0.11	0.00	0.33	-0.58	-0.10	0.11	0.33	0.71
alpha[194]	-0.40	0.00	0.18	-0.76	-0.52	-0.40	-0.28	-0.06
alpha[195]	-0.73	0.00	0.13	-0.98	-0.81	-0.73	-0.64	-0.47
beta	1.49	0.02	0.59	0.31	1.10	1.47	1.89	2.64
log_theta[1]	-0.22	0.00	0.40	-1.05	-0.48	-0.20	0.05	0.50
log_theta[2]	0.38	0.00	0.27	-0.19	0.20	0.39	0.56	0.87
log_theta[3]	0.86	0.00	0.24	0.37	0.71	0.87	1.02	1.31
log_theta[4]	-0.13	0.00	0.40	-0.96	-0.39	-0.10	0.15	0.60
log_theta[5]	0.77	0.00	0.31	0.11	0.57	0.77	0.98	1.33
log_theta[6]	-0.47	0.00	0.23	-0.96	-0.62	-0.47	-0.32	-0.05
log_theta[7]	0.87	0.00	0.19	0.48	0.74	0.87	1.00	1.23
log_theta[8]	-0.20	0.00	0.31	-0.84	-0.39	-0.18	0.01	0.36
log_theta[9]	0.64	0.00	0.26	0.10	0.47	0.65	0.82	1.11
log_theta[10]	0.79	0.00	0.22	0.34	0.65	0.79	0.94	1.20
log_theta[11]	-0.01	0.01	0.47	-1.03	-0.31	0.01	0.32	0.82
log_theta[12]	1.05	0.00	0.30	0.43	0.86	1.06	1.26	1.59
log_theta[13]	0.10	0.00	0.30	-0.52	-0.10	0.11	0.31	0.66
log_theta[14]	0.78	0.00	0.22	0.33	0.64	0.78	0.93	1.18

log_theta[15]	0.40	0.00	0.27	-0.16	0.23	0.41	0.59	0.90
log_theta[16]	1.06	0.00	0.27	0.52	0.88	1.07	1.26	1.58
log_theta[17]	1.15	0.00	0.24	0.63	1.00	1.16	1.31	1.60
log_theta[18]	0.62	0.00	0.22	0.17	0.49	0.63	0.77	1.03
log_theta[19]	0.36	0.00	0.20	-0.04	0.24	0.37	0.50	0.74
log_theta[20]	0.55	0.00	0.40	-0.29	0.29	0.57	0.83	1.29
log_theta[21]	1.15	0.00	0.30	0.52	0.96	1.16	1.35	1.69
log_theta[22]	1.26	0.00	0.22	0.81	1.11	1.27	1.42	1.67
log_theta[23]	0.62	0.00	0.27	0.07	0.44	0.63	0.81	1.11
log_theta[24]	-0.02	0.00	0.41	-0.88	-0.29	-0.01	0.26	0.71
log_theta[25]	0.61	0.00	0.23	0.13	0.46	0.62	0.77	1.04
log_theta[26]	0.87	0.00	0.23	0.39	0.72	0.89	1.04	1.30
log_theta[27]	0.80	0.00	0.27	0.25	0.63	0.81	0.99	1.30
log_theta[28]	1.01	0.00	0.25	0.50	0.85	1.02	1.18	1.49
log_theta[29]	0.20	0.01	0.52	-0.91	-0.14	0.25	0.57	1.12
log_theta[30]	0.95	0.00	0.31	0.29	0.75	0.97	1.18	1.51
log_theta[31]	0.38	0.00	0.36	-0.38	0.15	0.40	0.63	1.05
log_theta[32]	-0.26	0.01	0.50	-1.28	-0.58	-0.22	0.08	0.64
log_theta[33]	0.63	0.00	0.29	0.03	0.45	0.65	0.84	1.16
log_theta[34]	0.46	0.00	0.30	-0.16	0.27	0.47	0.67	1.01
log_theta[35]	0.10	0.00	0.38	-0.72	-0.15	0.12	0.36	0.81
log_theta[36]	-0.06	0.00	0.25	-0.57	-0.22	-0.06	0.11	0.40
log_theta[37]	0.66	0.00	0.28	0.06	0.49	0.67	0.85	1.17
log_theta[38]	0.02	0.00	0.39	-0.80	-0.22	0.05	0.29	0.72
log_theta[39]	-0.29	0.00	0.32	-0.94	-0.50	-0.28	-0.06	0.29
log_theta[40]	0.66	0.00	0.32	0.00	0.46	0.68	0.88	1.26
log_theta[41]	-0.43	0.01	0.44	-1.34	-0.72	-0.41	-0.11	0.36
log_theta[42]	-0.21	0.00	0.32	-0.90	-0.41	-0.20	0.00	0.37
log_theta[43]	0.21	0.00	0.29	-0.39	0.02	0.23	0.41	0.76
log_theta[44]	-0.11	0.00	0.27	-0.66	-0.30	-0.10	0.07	0.37
log_theta[45]	0.85	0.00	0.21	0.43	0.71	0.86	1.00	1.23
log_theta[46]	0.04	0.00	0.22	-0.42	-0.10	0.06	0.20	0.46
log_theta[47]	0.28	0.00	0.29	-0.33	0.10	0.29	0.47	0.81
log_theta[48]	0.71	0.00	0.39	-0.14	0.46	0.73	0.99	1.42
log_theta[49]	0.25	0.00	0.27	-0.31	0.07	0.26	0.43	0.74
log_theta[50]	-0.05	0.00	0.28	-0.64	-0.23	-0.04	0.15	0.45
log_theta[51]	-0.09	0.00	0.28	-0.67	-0.27	-0.08	0.11	0.42
log_theta[52]	0.25	0.00	0.26	-0.31	0.07	0.25	0.43	0.74
log_theta[53]	-0.54	0.00	0.38	-1.34	-0.80	-0.53	-0.28	0.15
log_theta[54]	0.91	0.00	0.27	0.35	0.73	0.92	1.09	1.42
log_theta[55]	0.61	0.01	0.39	-0.21	0.36	0.62	0.88	1.31
log_theta[56]	0.02	0.00	0.23	-0.44	-0.13	0.03	0.19	0.43
log_theta[57]	0.77	0.00	0.28	0.18	0.59	0.77	0.96	1.28

log_theta[58]	-0.23	0.00	0.32	-0.91	-0.43	-0.21	-0.01	0.34
log_theta[59]	-0.35	0.00	0.37	-1.12	-0.58	-0.33	-0.10	0.32
log_theta[60]	0.34	0.00	0.35	-0.39	0.11	0.36	0.59	0.98
log_theta[61]	-0.07	0.00	0.35	-0.81	-0.29	-0.06	0.17	0.57
log_theta[62]	-0.17	0.00	0.39	-0.99	-0.42	-0.15	0.09	0.54
log_theta[63]	-0.09	0.00	0.25	-0.60	-0.25	-0.08	0.09	0.38
log_theta[64]	-0.38	0.01	0.44	-1.32	-0.66	-0.36	-0.07	0.40
log_theta[65]	0.10	0.01	0.40	-0.76	-0.15	0.12	0.38	0.84
log_theta[66]	-0.05	0.00	0.29	-0.67	-0.23	-0.04	0.15	0.47
log_theta[67]	-0.01	0.00	0.42	-0.86	-0.28	0.01	0.28	0.75
log_theta[68]	0.05	0.01	0.42	-0.83	-0.20	0.08	0.34	0.80
log_theta[69]	0.02	0.00	0.23	-0.46	-0.13	0.03	0.19	0.45
log_theta[70]	-0.26	0.01	0.42	-1.16	-0.54	-0.24	0.04	0.49
log_theta[71]	0.00	0.00	0.36	-0.76	-0.23	0.02	0.25	0.65
log_theta[72]	-0.81	0.01	0.52	-1.95	-1.14	-0.78	-0.43	0.13
log_theta[73]	0.57	0.00	0.34	-0.16	0.35	0.58	0.80	1.18
log_theta[74]	-0.48	0.00	0.34	-1.19	-0.70	-0.46	-0.25	0.16
log_theta[75]	0.27	0.01	0.40	-0.58	0.02	0.30	0.55	0.99
log_theta[76]	0.69	0.00	0.29	0.08	0.51	0.70	0.89	1.21
log_theta[77]	-0.04	0.00	0.27	-0.59	-0.21	-0.03	0.15	0.45
log_theta[78]	0.60	0.00	0.25	0.09	0.44	0.61	0.77	1.06
log_theta[79]	0.41	0.00	0.42	-0.46	0.14	0.43	0.70	1.15
log_theta[80]	0.66	0.01	0.44	-0.27	0.38	0.68	0.97	1.44
log_theta[81]	0.22	0.00	0.38	-0.60	-0.02	0.24	0.49	0.91
log_theta[82]	0.63	0.00	0.29	0.04	0.43	0.64	0.82	1.15
log_theta[83]	0.32	0.00	0.31	-0.33	0.13	0.34	0.54	0.88
log_theta[84]	0.89	0.00	0.25	0.39	0.73	0.90	1.06	1.36
log_theta[85]	0.47	0.00	0.32	-0.21	0.26	0.49	0.69	1.06
log_theta[86]	0.21	0.00	0.25	-0.30	0.05	0.22	0.38	0.69
log_theta[87]	0.29	0.00	0.26	-0.24	0.12	0.30	0.47	0.77
log_theta[88]	0.51	0.00	0.23	0.02	0.36	0.52	0.67	0.93
log_theta[89]	0.65	0.01	0.41	-0.19	0.39	0.67	0.93	1.41
log_theta[90]	0.58	0.00	0.29	-0.02	0.39	0.60	0.78	1.09
log_theta[91]	-0.82	0.00	0.36	-1.59	-1.06	-0.80	-0.57	-0.17
log_theta[92]	0.26	0.00	0.34	-0.45	0.05	0.28	0.50	0.87
log_theta[93]	-0.15	0.00	0.17	-0.50	-0.26	-0.15	-0.04	0.18
log_theta[94]	0.58	0.00	0.25	0.05	0.42	0.59	0.76	1.03
log_theta[95]	0.29	0.00	0.26	-0.24	0.12	0.30	0.47	0.78
log_theta[96]	0.38	0.00	0.24	-0.10	0.23	0.39	0.55	0.83
log_theta[97]	0.27	0.00	0.20	-0.14	0.13	0.27	0.41	0.64
log_theta[98]	0.09	0.00	0.26	-0.45	-0.09	0.10	0.27	0.57
log_theta[99]	-0.81	0.01	0.54	-1.95	-1.15	-0.77	-0.43	0.14
log_theta[100]	0.16	0.00	0.12	-0.08	0.08	0.16	0.24	0.39

log_theta[101]	0.35	0.00	0.28	-0.22	0.17	0.36	0.55	0.85
log_theta[102]	0.10	0.00	0.27	-0.45	-0.08	0.12	0.29	0.58
log_theta[103]	0.23	0.00	0.38	-0.58	-0.01	0.25	0.49	0.93
log_theta[104]	0.00	0.00	0.22	-0.47	-0.15	0.00	0.15	0.42
log_theta[105]	-0.09	0.00	0.35	-0.84	-0.30	-0.07	0.15	0.55
log_theta[106]	-0.11	0.00	0.28	-0.69	-0.29	-0.10	0.08	0.40
log_theta[107]	0.65	0.00	0.31	0.01	0.45	0.66	0.86	1.22
log_theta[108]	-0.57	0.01	0.49	-1.65	-0.89	-0.54	-0.22	0.30
log_theta[109]	-0.05	0.00	0.30	-0.69	-0.25	-0.04	0.16	0.50
log_theta[110]	-0.46	0.01	0.48	-1.46	-0.76	-0.43	-0.11	0.40
log_theta[111]	-0.01	0.00	0.29	-0.62	-0.20	0.00	0.20	0.52
log_theta[112]	-0.05	0.00	0.27	-0.63	-0.22	-0.04	0.13	0.46
log_theta[113]	-0.20	0.00	0.29	-0.79	-0.39	-0.18	0.02	0.34
log_theta[114]	-0.16	0.00	0.27	-0.72	-0.33	-0.14	0.04	0.33
log_theta[115]	0.02	0.00	0.31	-0.63	-0.18	0.04	0.24	0.58
log_theta[116]	-0.36	0.00	0.40	-1.22	-0.63	-0.34	-0.08	0.37
log_theta[117]	0.03	0.00	0.24	-0.46	-0.12	0.04	0.20	0.47
log_theta[118]	-1.13	0.00	0.30	-1.75	-1.31	-1.11	-0.92	-0.59
log_theta[119]	0.07	0.00	0.20	-0.34	-0.07	0.07	0.21	0.44
log_theta[120]	-0.12	0.00	0.40	-0.95	-0.39	-0.10	0.17	0.60
log_theta[121]	0.22	0.00	0.33	-0.48	0.01	0.24	0.45	0.81
log_theta[122]	-1.17	0.01	0.51	-2.31	-1.48	-1.14	-0.82	-0.27
log_theta[123]	-0.20	0.00	0.29	-0.80	-0.38	-0.18	0.00	0.35
log_theta[124]	-0.57	0.00	0.31	-1.21	-0.78	-0.57	-0.36	0.00
log_theta[125]	0.16	0.00	0.29	-0.45	-0.03	0.17	0.36	0.69
log_theta[126]	-0.29	0.00	0.38	-1.09	-0.53	-0.27	-0.02	0.39
log_theta[127]	-0.28	0.00	0.29	-0.88	-0.46	-0.27	-0.09	0.23
log_theta[128]	-0.09	0.01	0.42	-0.96	-0.35	-0.06	0.21	0.65
log_theta[129]	-0.26	0.00	0.23	-0.74	-0.41	-0.25	-0.10	0.16
log_theta[130]	-0.19	0.00	0.25	-0.71	-0.35	-0.17	-0.02	0.30
log_theta[131]	-0.09	0.01	0.46	-1.05	-0.38	-0.06	0.22	0.74
log_theta[132]	-0.04	0.00	0.34	-0.76	-0.24	-0.02	0.20	0.57
log_theta[133]	-0.15	0.00	0.32	-0.82	-0.36	-0.13	0.08	0.42
log_theta[134]	-0.38	0.00	0.38	-1.18	-0.62	-0.36	-0.10	0.31
log_theta[135]	-0.26	0.01	0.46	-1.27	-0.56	-0.24	0.07	0.57
log_theta[136]	-0.17	0.01	0.44	-1.13	-0.45	-0.15	0.13	0.64
log_theta[137]	-0.91	0.01	0.51	-1.97	-1.22	-0.89	-0.56	-0.02
log_theta[138]	0.20	0.00	0.28	-0.37	0.02	0.22	0.40	0.71
log_theta[139]	-0.07	0.00	0.28	-0.68	-0.25	-0.06	0.12	0.45
log_theta[140]	0.21	0.00	0.30	-0.40	0.02	0.22	0.41	0.77
log_theta[141]	-0.13	0.00	0.32	-0.81	-0.34	-0.11	0.10	0.44
log_theta[142]	0.07	0.00	0.37	-0.71	-0.16	0.10	0.33	0.73
log_theta[143]	-0.29	0.00	0.35	-1.03	-0.51	-0.27	-0.06	0.35

log_theta[144]	-0.23	0.00	0.34	-0.93	-0.44	-0.21	0.00	0.39
log_theta[145]	0.20	0.00	0.29	-0.40	0.02	0.22	0.39	0.74
log_theta[146]	-0.20	0.00	0.29	-0.77	-0.39	-0.19	0.00	0.33
log_theta[147]	0.24	0.00	0.20	-0.17	0.11	0.26	0.39	0.63
log_theta[148]	-0.40	0.00	0.36	-1.17	-0.63	-0.38	-0.16	0.23
log_theta[149]	0.72	0.00	0.25	0.22	0.56	0.73	0.89	1.18
log_theta[150]	-0.69	0.00	0.15	-1.00	-0.79	-0.69	-0.60	-0.41
log_theta[151]	-0.46	0.00	0.31	-1.11	-0.67	-0.45	-0.25	0.11
log_theta[152]	0.11	0.00	0.23	-0.36	-0.04	0.12	0.28	0.55
log_theta[153]	0.61	0.00	0.28	0.01	0.42	0.62	0.81	1.14
log_theta[154]	0.35	0.00	0.28	-0.25	0.17	0.36	0.54	0.86
log_theta[155]	-0.12	0.00	0.26	-0.65	-0.30	-0.11	0.06	0.35
log_theta[156]	-0.29	0.00	0.26	-0.84	-0.46	-0.28	-0.11	0.20
log_theta[157]	-0.59	0.01	0.50	-1.64	-0.93	-0.56	-0.23	0.30
log_theta[158]	-0.70	0.00	0.32	-1.40	-0.91	-0.69	-0.48	-0.12
log_theta[159]	0.09	0.00	0.25	-0.43	-0.07	0.10	0.26	0.54
log_theta[160]	-0.29	0.00	0.38	-1.09	-0.54	-0.28	-0.02	0.40
log_theta[161]	-0.15	0.00	0.27	-0.74	-0.32	-0.14	0.03	0.35
log_theta[162]	-0.23	0.00	0.27	-0.81	-0.40	-0.22	-0.04	0.27
log_theta[163]	-0.11	0.00	0.28	-0.69	-0.29	-0.09	0.09	0.41
log_theta[164]	0.02	0.00	0.33	-0.67	-0.19	0.04	0.25	0.64
log_theta[165]	-0.31	0.00	0.29	-0.91	-0.51	-0.30	-0.11	0.20
log_theta[166]	-0.33	0.00	0.40	-1.18	-0.60	-0.32	-0.04	0.39
log_theta[167]	0.37	0.00	0.32	-0.29	0.16	0.39	0.60	0.97
log_theta[168]	-0.23	0.00	0.33	-0.92	-0.45	-0.22	0.00	0.37
log_theta[169]	-1.50	0.00	0.20	-1.92	-1.62	-1.49	-1.36	-1.11
log_theta[170]	0.11	0.00	0.32	-0.54	-0.11	0.12	0.33	0.69
log_theta[171]	-0.76	0.01	0.52	-1.88	-1.10	-0.73	-0.40	0.19
log_theta[172]	0.21	0.00	0.31	-0.41	0.02	0.23	0.42	0.77
log_theta[173]	-0.32	0.00	0.38	-1.12	-0.56	-0.29	-0.04	0.35
log_theta[174]	-0.28	0.00	0.31	-0.92	-0.48	-0.27	-0.07	0.27
log_theta[175]	-0.47	0.00	0.27	-1.03	-0.65	-0.46	-0.28	0.04
log_theta[176]	-0.35	0.00	0.32	-1.01	-0.55	-0.33	-0.13	0.23
log_theta[177]	0.53	0.00	0.31	-0.13	0.33	0.54	0.75	1.10
log_theta[178]	-0.70	0.00	0.17	-1.05	-0.81	-0.69	-0.57	-0.37
log_theta[179]	-0.54	0.00	0.40	-1.38	-0.80	-0.51	-0.26	0.16
log_theta[180]	-0.14	0.00	0.30	-0.77	-0.33	-0.13	0.07	0.40
log_theta[181]	-0.24	0.00	0.32	-0.91	-0.45	-0.23	-0.02	0.34
log_theta[182]	-0.28	0.00	0.29	-0.87	-0.48	-0.28	-0.07	0.26
log_theta[183]	0.00	0.00	0.30	-0.62	-0.20	0.01	0.20	0.54
log_theta[184]	-1.72	0.01	0.67	-3.10	-2.17	-1.69	-1.25	-0.54
log_theta[185]	-0.17	0.00	0.33	-0.86	-0.38	-0.16	0.05	0.42
log_theta[186]	-0.73	0.01	0.48	-1.76	-1.04	-0.69	-0.39	0.15

```
log_theta[187]   -0.36    0.00  0.28   -0.95   -0.53   -0.34   -0.16    0.16
log_theta[188]    0.07    0.00  0.30   -0.55   -0.13    0.07    0.28    0.63
log_theta[189]    0.18    0.00  0.29   -0.42   -0.01    0.19    0.38    0.71
log_theta[190]   -0.52    0.00  0.41   -1.34   -0.80   -0.50   -0.23    0.21
log_theta[191]   -0.45    0.01  0.46   -1.40   -0.75   -0.42   -0.13    0.35
log_theta[192]   -0.46    0.00  0.34   -1.17   -0.67   -0.44   -0.23    0.17
log_theta[193]   -0.05    0.00  0.32   -0.72   -0.26   -0.03    0.17    0.54
log_theta[194]   -0.51    0.00  0.17   -0.86   -0.63   -0.51   -0.39   -0.18
log_theta[195]   -0.96    0.00  0.09   -1.14   -1.02   -0.96   -0.90   -0.78
lp__           3899.20    0.27 10.10 3878.04 3892.42 3899.44 3906.17 3918.17
               n_eff Rhat
alpha[1]        5602 1.00
alpha[2]        5353 1.00
alpha[3]        1801 1.00
alpha[4]        6402 1.00
alpha[5]        3839 1.00
alpha[6]        2697 1.00
alpha[7]        1280 1.00
alpha[8]        2444 1.00
alpha[9]        7007 1.00
alpha[10]       6769 1.00
alpha[11]       5326 1.00
alpha[12]       3184 1.00
alpha[13]       7037 1.00
alpha[14]       5152 1.00
alpha[15]       6688 1.00
alpha[16]       3999 1.00
alpha[17]       5227 1.00
alpha[18]       7790 1.00
alpha[19]       1716 1.00
alpha[20]       7103 1.00
alpha[21]       2823 1.00
alpha[22]       3373 1.00
alpha[23]       3537 1.00
alpha[24]       6272 1.00
alpha[25]       1939 1.00
alpha[26]       7168 1.00
alpha[27]       4880 1.00
alpha[28]       3360 1.00
alpha[29]       5525 1.00
alpha[30]       2275 1.00
alpha[31]       5210 1.00
alpha[32]       4910 1.00
```

```
alpha[33]       6337 1.00
alpha[34]       7642 1.00
alpha[35]       5706 1.00
alpha[36]       1603 1.00
alpha[37]       6640 1.00
alpha[38]       6007 1.00
alpha[39]       5696 1.00
alpha[40]       3497 1.00
alpha[41]       6344 1.00
alpha[42]       6968 1.00
alpha[43]       6500 1.00
alpha[44]       7545 1.00
alpha[45]       6435 1.00
alpha[46]       2626 1.00
alpha[47]       4582 1.00
alpha[48]       7025 1.00
alpha[49]       5531 1.00
alpha[50]       5505 1.00
alpha[51]       2527 1.00
alpha[52]       3781 1.00
alpha[53]       6777 1.00
alpha[54]       6574 1.00
alpha[55]       5317 1.00
alpha[56]       4673 1.00
alpha[57]       4641 1.00
alpha[58]       3673 1.00
alpha[59]       6107 1.00
alpha[60]       6158 1.00
alpha[61]       6868 1.00
alpha[62]       7548 1.00
alpha[63]       6702 1.00
alpha[64]       6853 1.00
alpha[65]       5511 1.00
alpha[66]       5096 1.00
alpha[67]       6025 1.00
alpha[68]       6463 1.00
alpha[69]       3133 1.00
alpha[70]       4889 1.00
alpha[71]       5643 1.00
alpha[72]       6563 1.00
alpha[73]       5727 1.00
alpha[74]       4574 1.00
alpha[75]       6290 1.00
```

```
alpha[76]       5454 1.00
alpha[77]       6395 1.00
alpha[78]       7575 1.00
alpha[79]       7388 1.00
alpha[80]       6727 1.00
alpha[81]       4470 1.00
alpha[82]       7146 1.00
alpha[83]       7486 1.00
alpha[84]       2536 1.00
alpha[85]       5144 1.00
alpha[86]       4699 1.00
alpha[87]       5368 1.00
alpha[88]       6075 1.00
alpha[89]       5754 1.00
alpha[90]       5459 1.00
alpha[91]       5953 1.00
alpha[92]       4724 1.00
alpha[93]       1989 1.00
alpha[94]       6642 1.00
alpha[95]       6626 1.00
alpha[96]       6230 1.00
alpha[97]       3180 1.00
alpha[98]       6706 1.00
alpha[99]       7278 1.00
alpha[100]      1447 1.00
alpha[101]      6432 1.00
alpha[102]      6038 1.00
alpha[103]      5727 1.00
alpha[104]      4301 1.00
alpha[105]      6598 1.00
alpha[106]      7153 1.00
alpha[107]      6315 1.00
alpha[108]      5316 1.00
alpha[109]      5996 1.00
alpha[110]      6677 1.00
alpha[111]      4987 1.00
alpha[112]      6226 1.00
alpha[113]      5690 1.00
alpha[114]      3220 1.00
alpha[115]      7385 1.00
alpha[116]      6707 1.00
alpha[117]      4198 1.00
alpha[118]      4297 1.00
```

```
alpha[119]      4353 1.00
alpha[120]      7209 1.00
alpha[121]      5930 1.00
alpha[122]      5974 1.00
alpha[123]      6400 1.00
alpha[124]      7057 1.00
alpha[125]      6947 1.00
alpha[126]      6031 1.00
alpha[127]      4017 1.00
alpha[128]      6689 1.00
alpha[129]      6382 1.00
alpha[130]      6995 1.00
alpha[131]      6669 1.00
alpha[132]      6540 1.00
alpha[133]      5481 1.00
alpha[134]      6153 1.00
alpha[135]      6882 1.00
alpha[136]      5940 1.00
alpha[137]      6580 1.00
alpha[138]      4549 1.00
alpha[139]      6808 1.00
alpha[140]      6598 1.00
alpha[141]      4570 1.00
alpha[142]      4994 1.00
alpha[143]      5991 1.00
alpha[144]      5594 1.00
alpha[145]      5728 1.00
alpha[146]      4800 1.00
alpha[147]      6239 1.00
alpha[148]      5406 1.00
alpha[149]      6199 1.00
alpha[150]      5104 1.00
alpha[151]      5791 1.00
alpha[152]      3761 1.00
alpha[153]      6257 1.00
alpha[154]      6689 1.00
alpha[155]      5243 1.00
alpha[156]      6509 1.00
alpha[157]      7001 1.00
alpha[158]      6343 1.00
alpha[159]      4994 1.00
alpha[160]      5669 1.00
alpha[161]      4874 1.00
```

```
alpha[162]      4272 1.00
alpha[163]      5180 1.00
alpha[164]      6284 1.00
alpha[165]      7850 1.00
alpha[166]      6976 1.00
alpha[167]      6817 1.00
alpha[168]      6217 1.00
alpha[169]      4715 1.00
alpha[170]      6715 1.00
alpha[171]      5704 1.00
alpha[172]      6795 1.00
alpha[173]      5977 1.00
alpha[174]      4947 1.00
alpha[175]      4220 1.00
alpha[176]      4892 1.00
alpha[177]      6800 1.00
alpha[178]      3893 1.00
alpha[179]      7213 1.00
alpha[180]      5247 1.00
alpha[181]      4613 1.00
alpha[182]      5184 1.00
alpha[183]      6135 1.00
alpha[184]      5915 1.00
alpha[185]      5792 1.00
alpha[186]      6593 1.00
alpha[187]      5308 1.00
alpha[188]      4900 1.00
alpha[189]      6898 1.00
alpha[190]      5715 1.00
alpha[191]      5941 1.00
alpha[192]      6992 1.00
alpha[193]      4927 1.00
alpha[194]      4356 1.00
alpha[195]       932 1.00
beta             573 1.01
log_theta[1]    6845 1.00
log_theta[2]    6890 1.00
log_theta[3]    6931 1.00
log_theta[4]    7743 1.00
log_theta[5]    7450 1.00
log_theta[6]    8580 1.00
log_theta[7]    8922 1.00
log_theta[8]    7139 1.00
```

```
log_theta[9]    8128 1.00
log_theta[10]   6771 1.00
log_theta[11]   5991 1.00
log_theta[12]   6921 1.00
log_theta[13]   7460 1.00
log_theta[14]   7181 1.00
log_theta[15]   6876 1.00
log_theta[16]   6239 1.00
log_theta[17]   7413 1.00
log_theta[18]   7754 1.00
log_theta[19]   8693 1.00
log_theta[20]   7524 1.00
log_theta[21]   7144 1.00
log_theta[22]   8079 1.00
log_theta[23]   6659 1.00
log_theta[24]   7045 1.00
log_theta[25]   8481 1.00
log_theta[26]   7371 1.00
log_theta[27]   6484 1.00
log_theta[28]   7232 1.00
log_theta[29]   6847 1.00
log_theta[30]   7787 1.00
log_theta[31]   7045 1.00
log_theta[32]   7019 1.00
log_theta[33]   7093 1.00
log_theta[34]   8113 1.00
log_theta[35]   6351 1.00
log_theta[36]   8275 1.00
log_theta[37]   6871 1.00
log_theta[38]   7073 1.00
log_theta[39]   7073 1.00
log_theta[40]   6237 1.00
log_theta[41]   6393 1.00
log_theta[42]   7039 1.00
log_theta[43]   8387 1.00
log_theta[44]   7907 1.00
log_theta[45]   6596 1.00
log_theta[46]   6642 1.00
log_theta[47]   5708 1.00
log_theta[48]   7068 1.00
log_theta[49]   6461 1.00
log_theta[50]   6073 1.00
log_theta[51]   8043 1.00
```

```
log_theta[52]   6984 1.00
log_theta[53]   6922 1.00
log_theta[54]   8102 1.00
log_theta[55]   5555 1.00
log_theta[56]   6507 1.00
log_theta[57]   6713 1.00
log_theta[58]   6864 1.00
log_theta[59]   6546 1.00
log_theta[60]   7702 1.00
log_theta[61]   6868 1.00
log_theta[62]   7792 1.00
log_theta[63]   7774 1.00
log_theta[64]   6983 1.00
log_theta[65]   5961 1.00
log_theta[66]   6348 1.00
log_theta[67]   6955 1.00
log_theta[68]   6543 1.00
log_theta[69]   7813 1.00
log_theta[70]   5717 1.00
log_theta[71]   6436 1.00
log_theta[72]   6856 1.00
log_theta[73]   6811 1.00
log_theta[74]   6170 1.00
log_theta[75]   6291 1.00
log_theta[76]   6354 1.00
log_theta[77]   6516 1.00
log_theta[78]   7570 1.00
log_theta[79]   7811 1.00
log_theta[80]   7676 1.00
log_theta[81]   6000 1.00
log_theta[82]   7185 1.00
log_theta[83]   7559 1.00
log_theta[84]   8655 1.00
log_theta[85]   6587 1.00
log_theta[86]   6471 1.00
log_theta[87]   7244 1.00
log_theta[88]   6110 1.00
log_theta[89]   5862 1.00
log_theta[90]   6327 1.00
log_theta[91]   7079 1.00
log_theta[92]   6236 1.00
log_theta[93]   8275 1.00
log_theta[94]   6712 1.00
```

```
log_theta[95]   7040 1.00
log_theta[96]   7666 1.00
log_theta[97]   7061 1.00
log_theta[98]   7850 1.00
log_theta[99]   7364 1.00
log_theta[100]  9882 1.00
log_theta[101]  6649 1.00
log_theta[102]  6218 1.00
log_theta[103]  5895 1.00
log_theta[104]  7538 1.00
log_theta[105]  6581 1.00
log_theta[106]  8018 1.00
log_theta[107]  8280 1.00
log_theta[108]  5419 1.00
log_theta[109]  6135 1.00
log_theta[110]  7257 1.00
log_theta[111]  6680 1.00
log_theta[112]  7248 1.00
log_theta[113]  7322 1.00
log_theta[114]  6818 1.00
log_theta[115]  8467 1.00
log_theta[116]  7135 1.00
log_theta[117]  6720 1.00
log_theta[118]  6472 1.00
log_theta[119]  9016 1.00
log_theta[120]  7378 1.00
log_theta[121]  6657 1.00
log_theta[122]  6327 1.00
log_theta[123]  6893 1.00
log_theta[124]  7725 1.00
log_theta[125]  6913 1.00
log_theta[126]  6041 1.00
log_theta[127]  6263 1.00
log_theta[128]  6737 1.00
log_theta[129]  6476 1.00
log_theta[130]  6996 1.00
log_theta[131]  6703 1.00
log_theta[132]  6647 1.00
log_theta[133]  6388 1.00
log_theta[134]  8437 1.00
log_theta[135]  6886 1.00
log_theta[136]  6079 1.00
log_theta[137]  6653 1.00
```

```
log_theta[138]  6011 1.00
log_theta[139]  7536 1.00
log_theta[140]  6762 1.00
log_theta[141]  6232 1.00
log_theta[142]  6581 1.00
log_theta[143]  6084 1.00
log_theta[144]  8010 1.00
log_theta[145]  8284 1.00
log_theta[146]  6920 1.00
log_theta[147]  8347 1.00
log_theta[148]  6347 1.00
log_theta[149]  6462 1.00
log_theta[150] 10114 1.00
log_theta[151]  7264 1.00
log_theta[152]  7222 1.00
log_theta[153]  6639 1.00
log_theta[154]  6987 1.00
log_theta[155]  6475 1.00
log_theta[156]  6836 1.00
log_theta[157]  7035 1.00
log_theta[158]  8056 1.00
log_theta[159]  6923 1.00
log_theta[160]  6037 1.00
log_theta[161]  6749 1.00
log_theta[162]  6445 1.00
log_theta[163]  7373 1.00
log_theta[164]  6288 1.00
log_theta[165]  8309 1.00
log_theta[166]  6965 1.00
log_theta[167]  6825 1.00
log_theta[168]  6295 1.00
log_theta[169]  7632 1.00
log_theta[170]  7170 1.00
log_theta[171]  5705 1.00
log_theta[172]  7076 1.00
log_theta[173]  6228 1.00
log_theta[174]  7200 1.00
log_theta[175]  8928 1.00
log_theta[176]  7234 1.00
log_theta[177]  6802 1.00
log_theta[178]  8916 1.00
log_theta[179]  7427 1.00
log_theta[180]  7031 1.00
```

```
log_theta[181]  6019 1.00
log_theta[182]  7113 1.00
log_theta[183]  6904 1.00
log_theta[184]  6701 1.00
log_theta[185]  6584 1.00
log_theta[186]  6783 1.00
log_theta[187]  5933 1.00
log_theta[188]  7482 1.00
log_theta[189]  7061 1.00
log_theta[190]  7261 1.00
log_theta[191]  6773 1.00
log_theta[192]  7988 1.00
log_theta[193]  6929 1.00
log_theta[194]  7075 1.00
log_theta[195]  8467 1.00
lp__            1420 1.00

Samples were drawn using NUTS(diag_e) at Sat Mar 18 20:45:56 2023.
For each parameter, n_eff is a crude measure of effective sample size,
and Rhat is the potential scale reduction factor on split chains (at
convergence, Rhat=1).
```

Model 3

```r
mod3 <- stan(data=stan_data, file="lab9_3.stan", seed = 1)
```

```
Running /Library/Frameworks/R.framework/Resources/bin/R CMD SHLIB foo.c
clang -mmacosx-version-min=10.13 -I"/Library/Frameworks/R.framework/Resources/include" -DNDEI
In file included from <built-in>:1:
In file included from /Library/Frameworks/R.framework/Versions/4.1/Resources/library/StanHeac
In file included from /Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEige
In file included from /Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEige
/Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEigen/include/Eigen/src/Co
namespace Eigen {
^
/Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEigen/include/Eigen/src/Co
namespace Eigen {
               ^
               ;
In file included from <built-in>:1:
In file included from /Library/Frameworks/R.framework/Versions/4.1/Resources/library/StanHeac
```

```
In file included from /Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEige
/Library/Frameworks/R.framework/Versions/4.1/Resources/library/RcppEigen/include/Eigen/Core:9
#include <complex>
         ^~~~~~~~~
3 errors generated.
make: *** [foo.o] Error 1

SAMPLING FOR MODEL 'lab9_3' NOW (CHAIN 1).
Chain 1:
Chain 1: Gradient evaluation took 6.8e-05 seconds
Chain 1: 1000 transitions using 10 leapfrog steps per transition would take 0.68 seconds.
Chain 1: Adjust your expectations accordingly!
Chain 1:
Chain 1:
Chain 1: Iteration:    1 / 2000 [  0%]  (Warmup)
Chain 1: Iteration:  200 / 2000 [ 10%]  (Warmup)
Chain 1: Iteration:  400 / 2000 [ 20%]  (Warmup)
Chain 1: Iteration:  600 / 2000 [ 30%]  (Warmup)
Chain 1: Iteration:  800 / 2000 [ 40%]  (Warmup)
Chain 1: Iteration: 1000 / 2000 [ 50%]  (Warmup)
Chain 1: Iteration: 1001 / 2000 [ 50%]  (Sampling)
Chain 1: Iteration: 1200 / 2000 [ 60%]  (Sampling)
Chain 1: Iteration: 1400 / 2000 [ 70%]  (Sampling)
Chain 1: Iteration: 1600 / 2000 [ 80%]  (Sampling)
Chain 1: Iteration: 1800 / 2000 [ 90%]  (Sampling)
Chain 1: Iteration: 2000 / 2000 [100%]  (Sampling)
Chain 1:
Chain 1:  Elapsed Time: 0.371509 seconds (Warm-up)
Chain 1:                0.326971 seconds (Sampling)
Chain 1:                0.69848 seconds (Total)
Chain 1:

SAMPLING FOR MODEL 'lab9_3' NOW (CHAIN 2).
Chain 2:
Chain 2: Gradient evaluation took 2.4e-05 seconds
Chain 2: 1000 transitions using 10 leapfrog steps per transition would take 0.24 seconds.
Chain 2: Adjust your expectations accordingly!
Chain 2:
Chain 2:
Chain 2: Iteration:    1 / 2000 [  0%]  (Warmup)
Chain 2: Iteration:  200 / 2000 [ 10%]  (Warmup)
Chain 2: Iteration:  400 / 2000 [ 20%]  (Warmup)
Chain 2: Iteration:  600 / 2000 [ 30%]  (Warmup)
```

```
Chain 2: Iteration:  800 / 2000 [ 40%]  (Warmup)
Chain 2: Iteration: 1000 / 2000 [ 50%]  (Warmup)
Chain 2: Iteration: 1001 / 2000 [ 50%]  (Sampling)
Chain 2: Iteration: 1200 / 2000 [ 60%]  (Sampling)
Chain 2: Iteration: 1400 / 2000 [ 70%]  (Sampling)
Chain 2: Iteration: 1600 / 2000 [ 80%]  (Sampling)
Chain 2: Iteration: 1800 / 2000 [ 90%]  (Sampling)
Chain 2: Iteration: 2000 / 2000 [100%]  (Sampling)
Chain 2:
Chain 2:  Elapsed Time: 0.368223 seconds (Warm-up)
Chain 2:                0.325988 seconds (Sampling)
Chain 2:                0.694211 seconds (Total)
Chain 2:

SAMPLING FOR MODEL 'lab9_3' NOW (CHAIN 3).
Chain 3:
Chain 3: Gradient evaluation took 2.3e-05 seconds
Chain 3: 1000 transitions using 10 leapfrog steps per transition would take 0.23 seconds.
Chain 3: Adjust your expectations accordingly!
Chain 3:
Chain 3:
Chain 3: Iteration:    1 / 2000 [  0%]  (Warmup)
Chain 3: Iteration:  200 / 2000 [ 10%]  (Warmup)
Chain 3: Iteration:  400 / 2000 [ 20%]  (Warmup)
Chain 3: Iteration:  600 / 2000 [ 30%]  (Warmup)
Chain 3: Iteration:  800 / 2000 [ 40%]  (Warmup)
Chain 3: Iteration: 1000 / 2000 [ 50%]  (Warmup)
Chain 3: Iteration: 1001 / 2000 [ 50%]  (Sampling)
Chain 3: Iteration: 1200 / 2000 [ 60%]  (Sampling)
Chain 3: Iteration: 1400 / 2000 [ 70%]  (Sampling)
Chain 3: Iteration: 1600 / 2000 [ 80%]  (Sampling)
Chain 3: Iteration: 1800 / 2000 [ 90%]  (Sampling)
Chain 3: Iteration: 2000 / 2000 [100%]  (Sampling)
Chain 3:
Chain 3:  Elapsed Time: 0.365691 seconds (Warm-up)
Chain 3:                0.327601 seconds (Sampling)
Chain 3:                0.693292 seconds (Total)
Chain 3:

SAMPLING FOR MODEL 'lab9_3' NOW (CHAIN 4).
Chain 4:
Chain 4: Gradient evaluation took 2.6e-05 seconds
Chain 4: 1000 transitions using 10 leapfrog steps per transition would take 0.26 seconds.
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```
Chain 4: Adjust your expectations accordingly!
Chain 4:
Chain 4:
Chain 4: Iteration:    1 / 2000 [  0%]  (Warmup)
Chain 4: Iteration:  200 / 2000 [ 10%]  (Warmup)
Chain 4: Iteration:  400 / 2000 [ 20%]  (Warmup)
Chain 4: Iteration:  600 / 2000 [ 30%]  (Warmup)
Chain 4: Iteration:  800 / 2000 [ 40%]  (Warmup)
Chain 4: Iteration: 1000 / 2000 [ 50%]  (Warmup)
Chain 4: Iteration: 1001 / 2000 [ 50%]  (Sampling)
Chain 4: Iteration: 1200 / 2000 [ 60%]  (Sampling)
Chain 4: Iteration: 1400 / 2000 [ 70%]  (Sampling)
Chain 4: Iteration: 1600 / 2000 [ 80%]  (Sampling)
Chain 4: Iteration: 1800 / 2000 [ 90%]  (Sampling)
Chain 4: Iteration: 2000 / 2000 [100%]  (Sampling)
Chain 4:
Chain 4:  Elapsed Time: 0.354013 seconds (Warm-up)
Chain 4:                0.324543 seconds (Sampling)
Chain 4:                0.678556 seconds (Total)
Chain 4:
```

```
mod3
```

```
Inference for Stan model: lab9_3.
4 chains, each with iter=2000; warmup=1000; thin=1;
post-warmup draws per chain=1000, total post-warmup draws=4000.

                mean se_mean    sd    2.5%     25%     50%     75%   97.5%
alpha[1]       -0.13    0.00  0.28   -0.70   -0.32   -0.12    0.06    0.40
alpha[2]        0.21    0.00  0.24   -0.29    0.05    0.21    0.38    0.67
alpha[3]        0.33    0.00  0.22   -0.11    0.19    0.34    0.48    0.76
alpha[4]       -0.14    0.00  0.28   -0.73   -0.32   -0.14    0.05    0.40
alpha[5]        0.34    0.00  0.26   -0.17    0.17    0.34    0.51    0.85
alpha[6]       -0.60    0.00  0.19   -0.99   -0.73   -0.60   -0.48   -0.25
alpha[7]        0.34    0.00  0.18   -0.02    0.22    0.34    0.46    0.69
alpha[8]       -0.43    0.00  0.22   -0.89   -0.58   -0.42   -0.27   -0.02
alpha[9]        0.57    0.00  0.24    0.08    0.41    0.58    0.73    1.02
alpha[10]       0.63    0.00  0.20    0.21    0.49    0.64    0.77    1.00
alpha[11]       0.00    0.00  0.30   -0.59   -0.21    0.00    0.21    0.57
alpha[12]       0.52    0.00  0.27    0.00    0.33    0.52    0.70    1.02
alpha[13]       0.03    0.00  0.24   -0.45   -0.13    0.03    0.19    0.48
alpha[14]       0.51    0.00  0.20    0.10    0.38    0.52    0.65    0.89
```

alpha[15]	0.26	0.00	0.24	-0.25	0.11	0.27	0.42	0.72
alpha[16]	0.62	0.00	0.25	0.13	0.46	0.63	0.79	1.10
alpha[17]	0.74	0.00	0.23	0.27	0.59	0.75	0.91	1.18
alpha[18]	0.49	0.00	0.20	0.09	0.35	0.49	0.63	0.88
alpha[19]	-0.01	0.00	0.19	-0.41	-0.14	-0.01	0.12	0.36
alpha[20]	0.28	0.00	0.31	-0.35	0.07	0.29	0.50	0.86
alpha[21]	0.52	0.00	0.27	-0.01	0.35	0.53	0.71	1.03
alpha[22]	0.79	0.00	0.21	0.37	0.66	0.80	0.93	1.19
alpha[23]	0.31	0.00	0.24	-0.19	0.15	0.31	0.48	0.78
alpha[24]	-0.02	0.00	0.29	-0.61	-0.21	-0.02	0.17	0.53
alpha[25]	0.19	0.00	0.20	-0.20	0.06	0.19	0.33	0.57
alpha[26]	0.66	0.00	0.22	0.23	0.51	0.66	0.81	1.06
alpha[27]	0.47	0.00	0.24	-0.03	0.32	0.48	0.63	0.93
alpha[28]	0.58	0.00	0.23	0.12	0.43	0.58	0.74	1.04
alpha[29]	0.02	0.00	0.32	-0.63	-0.18	0.03	0.23	0.62
alpha[30]	0.35	0.00	0.28	-0.21	0.16	0.35	0.53	0.89
alpha[31]	0.14	0.00	0.28	-0.44	-0.04	0.14	0.33	0.67
alpha[32]	-0.20	0.00	0.30	-0.79	-0.40	-0.19	0.02	0.37
alpha[33]	0.53	0.00	0.26	0.02	0.36	0.54	0.70	1.01
alpha[34]	0.29	0.00	0.24	-0.21	0.12	0.29	0.45	0.75
alpha[35]	-0.01	0.00	0.28	-0.57	-0.19	-0.01	0.18	0.51
alpha[36]	-0.40	0.00	0.21	-0.83	-0.54	-0.40	-0.26	-0.02
alpha[37]	0.43	0.00	0.24	-0.06	0.26	0.43	0.60	0.88
alpha[38]	-0.03	0.00	0.28	-0.59	-0.22	-0.03	0.16	0.48
alpha[39]	-0.05	0.00	0.25	-0.55	-0.21	-0.05	0.12	0.41
alpha[40]	0.28	0.00	0.25	-0.23	0.11	0.28	0.46	0.76
alpha[41]	-0.17	0.00	0.28	-0.75	-0.36	-0.16	0.02	0.37
alpha[42]	-0.10	0.00	0.24	-0.60	-0.27	-0.10	0.06	0.35
alpha[43]	0.09	0.00	0.25	-0.42	-0.08	0.10	0.26	0.55
alpha[44]	-0.09	0.00	0.23	-0.56	-0.24	-0.08	0.07	0.34
alpha[45]	0.71	0.00	0.20	0.31	0.58	0.72	0.85	1.10
alpha[46]	-0.16	0.00	0.21	-0.59	-0.30	-0.16	-0.02	0.24
alpha[47]	0.35	0.00	0.24	-0.16	0.19	0.36	0.52	0.81
alpha[48]	0.45	0.00	0.30	-0.15	0.26	0.46	0.66	1.03
alpha[49]	0.13	0.00	0.23	-0.33	-0.02	0.13	0.28	0.55
alpha[50]	0.07	0.00	0.24	-0.41	-0.09	0.08	0.23	0.52
alpha[51]	-0.27	0.00	0.22	-0.72	-0.41	-0.27	-0.12	0.15
alpha[52]	0.04	0.00	0.23	-0.42	-0.12	0.04	0.19	0.47
alpha[53]	-0.22	0.00	0.26	-0.75	-0.39	-0.21	-0.04	0.27
alpha[54]	0.74	0.00	0.25	0.24	0.58	0.74	0.91	1.21
alpha[55]	0.32	0.00	0.28	-0.25	0.14	0.32	0.51	0.88
alpha[56]	-0.06	0.00	0.20	-0.46	-0.20	-0.06	0.08	0.32
alpha[57]	0.65	0.00	0.27	0.11	0.48	0.65	0.83	1.16

alpha[58]	-0.35	0.00	0.24	-0.83	-0.50	-0.34	-0.19	0.09
alpha[59]	-0.07	0.00	0.27	-0.59	-0.25	-0.06	0.12	0.44
alpha[60]	0.39	0.00	0.28	-0.16	0.21	0.39	0.58	0.92
alpha[61]	0.01	0.00	0.27	-0.53	-0.17	0.02	0.20	0.52
alpha[62]	0.02	0.00	0.27	-0.54	-0.16	0.02	0.20	0.53
alpha[63]	-0.10	0.00	0.21	-0.53	-0.24	-0.10	0.04	0.29
alpha[64]	-0.09	0.00	0.29	-0.67	-0.28	-0.08	0.11	0.47
alpha[65]	0.20	0.00	0.29	-0.40	0.01	0.21	0.40	0.77
alpha[66]	0.13	0.00	0.24	-0.37	-0.03	0.13	0.29	0.60
alpha[67]	0.18	0.00	0.29	-0.42	-0.02	0.18	0.38	0.73
alpha[68]	0.04	0.00	0.29	-0.53	-0.15	0.04	0.24	0.58
alpha[69]	-0.16	0.00	0.21	-0.58	-0.30	-0.16	-0.01	0.22
alpha[70]	0.07	0.00	0.29	-0.51	-0.12	0.07	0.27	0.60
alpha[71]	0.16	0.00	0.29	-0.42	-0.04	0.17	0.37	0.69
alpha[72]	-0.18	0.00	0.31	-0.80	-0.39	-0.17	0.03	0.43
alpha[73]	0.30	0.00	0.26	-0.23	0.12	0.30	0.48	0.79
alpha[74]	-0.41	0.00	0.25	-0.93	-0.58	-0.40	-0.23	0.06
alpha[75]	0.21	0.00	0.29	-0.36	0.03	0.21	0.41	0.76
alpha[76]	0.40	0.00	0.24	-0.08	0.24	0.40	0.56	0.86
alpha[77]	-0.03	0.00	0.22	-0.48	-0.17	-0.03	0.12	0.39
alpha[78]	0.50	0.00	0.22	0.06	0.36	0.51	0.66	0.92
alpha[79]	0.21	0.00	0.31	-0.40	0.00	0.22	0.42	0.77
alpha[80]	0.30	0.00	0.31	-0.33	0.10	0.31	0.51	0.89
alpha[81]	0.03	0.00	0.28	-0.55	-0.14	0.04	0.22	0.58
alpha[82]	0.47	0.00	0.25	-0.03	0.30	0.48	0.64	0.94
alpha[83]	0.27	0.00	0.26	-0.25	0.11	0.28	0.45	0.77
alpha[84]	0.42	0.00	0.23	-0.04	0.27	0.43	0.57	0.86
alpha[85]	0.21	0.00	0.26	-0.30	0.04	0.21	0.40	0.70
alpha[86]	0.30	0.00	0.22	-0.16	0.16	0.31	0.45	0.73
alpha[87]	0.34	0.00	0.22	-0.13	0.20	0.35	0.49	0.77
alpha[88]	0.42	0.00	0.21	-0.02	0.28	0.42	0.56	0.82
alpha[89]	0.43	0.00	0.32	-0.20	0.22	0.43	0.64	1.03
alpha[90]	0.34	0.00	0.24	-0.15	0.17	0.34	0.51	0.80
alpha[91]	-0.33	0.00	0.25	-0.86	-0.50	-0.33	-0.16	0.15
alpha[92]	0.09	0.00	0.26	-0.43	-0.09	0.09	0.27	0.59
alpha[93]	0.14	0.00	0.16	-0.19	0.03	0.14	0.25	0.44
alpha[94]	0.48	0.00	0.23	0.01	0.33	0.49	0.65	0.93
alpha[95]	0.29	0.00	0.23	-0.18	0.14	0.30	0.45	0.71
alpha[96]	0.41	0.00	0.21	0.00	0.27	0.42	0.56	0.81
alpha[97]	0.41	0.00	0.19	0.02	0.29	0.42	0.55	0.79
alpha[98]	0.18	0.00	0.23	-0.27	0.03	0.18	0.34	0.61
alpha[99]	-0.24	0.00	0.31	-0.88	-0.45	-0.23	-0.03	0.34
alpha[100]	-0.11	0.00	0.12	-0.35	-0.19	-0.11	-0.03	0.12

alpha[101]	0.33	0.00	0.24	-0.15	0.17	0.33	0.49	0.77
alpha[102]	0.17	0.00	0.22	-0.27	0.02	0.17	0.32	0.59
alpha[103]	0.15	0.00	0.28	-0.40	-0.03	0.16	0.35	0.69
alpha[104]	0.18	0.00	0.20	-0.24	0.05	0.18	0.32	0.56
alpha[105]	0.04	0.00	0.26	-0.47	-0.13	0.06	0.22	0.52
alpha[106]	0.07	0.00	0.24	-0.40	-0.09	0.07	0.23	0.52
alpha[107]	0.33	0.00	0.26	-0.18	0.17	0.33	0.51	0.82
alpha[108]	-0.16	0.00	0.31	-0.78	-0.36	-0.15	0.04	0.43
alpha[109]	0.06	0.00	0.24	-0.43	-0.10	0.07	0.22	0.50
alpha[110]	-0.07	0.00	0.30	-0.68	-0.27	-0.07	0.13	0.50
alpha[111]	0.16	0.00	0.24	-0.34	0.00	0.16	0.33	0.62
alpha[112]	0.09	0.00	0.22	-0.37	-0.06	0.10	0.25	0.50
alpha[113]	0.03	0.00	0.25	-0.49	-0.13	0.03	0.19	0.50
alpha[114]	0.12	0.00	0.24	-0.37	-0.04	0.13	0.29	0.58
alpha[115]	0.14	0.00	0.24	-0.34	-0.01	0.15	0.31	0.59
alpha[116]	-0.05	0.00	0.28	-0.62	-0.23	-0.05	0.13	0.48
alpha[117]	0.18	0.00	0.20	-0.23	0.04	0.18	0.31	0.56
alpha[118]	-0.95	0.00	0.22	-1.41	-1.09	-0.95	-0.80	-0.56
alpha[119]	0.22	0.00	0.19	-0.17	0.10	0.23	0.34	0.57
alpha[120]	0.03	0.00	0.29	-0.54	-0.16	0.03	0.24	0.58
alpha[121]	0.09	0.00	0.26	-0.43	-0.08	0.10	0.27	0.58
alpha[122]	-0.40	0.00	0.29	-0.99	-0.59	-0.39	-0.20	0.14
alpha[123]	-0.03	0.00	0.23	-0.48	-0.18	-0.02	0.13	0.42
alpha[124]	-0.25	0.00	0.24	-0.72	-0.41	-0.25	-0.09	0.20
alpha[125]	0.16	0.00	0.24	-0.34	0.00	0.16	0.32	0.63
alpha[126]	-0.12	0.00	0.27	-0.68	-0.30	-0.12	0.06	0.40
alpha[127]	-0.30	0.00	0.23	-0.76	-0.45	-0.30	-0.15	0.13
alpha[128]	0.04	0.00	0.28	-0.51	-0.14	0.05	0.23	0.56
alpha[129]	-0.19	0.00	0.19	-0.58	-0.32	-0.19	-0.06	0.17
alpha[130]	-0.12	0.00	0.21	-0.54	-0.26	-0.12	0.02	0.28
alpha[131]	0.05	0.00	0.32	-0.58	-0.16	0.05	0.27	0.67
alpha[132]	0.06	0.00	0.25	-0.43	-0.11	0.07	0.24	0.53
alpha[133]	0.06	0.00	0.25	-0.45	-0.11	0.07	0.24	0.53
alpha[134]	-0.04	0.00	0.28	-0.62	-0.22	-0.04	0.15	0.47
alpha[135]	-0.08	0.00	0.29	-0.65	-0.27	-0.08	0.11	0.46
alpha[136]	0.02	0.00	0.31	-0.60	-0.18	0.02	0.23	0.60
alpha[137]	-0.28	0.00	0.31	-0.90	-0.47	-0.26	-0.06	0.32
alpha[138]	0.30	0.00	0.25	-0.21	0.13	0.31	0.47	0.77
alpha[139]	0.08	0.00	0.23	-0.38	-0.08	0.08	0.24	0.51
alpha[140]	0.21	0.00	0.24	-0.28	0.05	0.21	0.37	0.67
alpha[141]	0.13	0.00	0.26	-0.40	-0.05	0.14	0.30	0.61
alpha[142]	0.24	0.00	0.28	-0.32	0.06	0.25	0.44	0.79
alpha[143]	-0.09	0.00	0.26	-0.62	-0.27	-0.08	0.09	0.40

alpha[144]	0.04	0.00	0.27	-0.48	-0.13	0.05	0.23	0.55
alpha[145]	0.33	0.00	0.25	-0.20	0.16	0.33	0.50	0.80
alpha[146]	0.04	0.00	0.24	-0.44	-0.13	0.05	0.21	0.48
alpha[147]	0.31	0.00	0.19	-0.07	0.18	0.32	0.45	0.68
alpha[148]	-0.09	0.00	0.26	-0.63	-0.26	-0.09	0.09	0.40
alpha[149]	0.58	0.00	0.23	0.11	0.42	0.58	0.74	1.02
alpha[150]	-0.49	0.00	0.13	-0.75	-0.58	-0.49	-0.39	-0.24
alpha[151]	-0.15	0.00	0.26	-0.67	-0.32	-0.14	0.03	0.34
alpha[152]	-0.07	0.00	0.20	-0.48	-0.20	-0.07	0.06	0.31
alpha[153]	0.37	0.00	0.24	-0.13	0.21	0.37	0.53	0.82
alpha[154]	0.32	0.00	0.24	-0.16	0.17	0.33	0.48	0.76
alpha[155]	0.06	0.00	0.22	-0.38	-0.10	0.06	0.21	0.48
alpha[156]	-0.12	0.00	0.22	-0.56	-0.26	-0.11	0.04	0.30
alpha[157]	-0.21	0.00	0.29	-0.81	-0.40	-0.20	-0.01	0.35
alpha[158]	-0.29	0.00	0.24	-0.77	-0.44	-0.28	-0.13	0.17
alpha[159]	0.22	0.00	0.21	-0.20	0.09	0.23	0.37	0.60
alpha[160]	-0.03	0.00	0.27	-0.58	-0.21	-0.02	0.16	0.49
alpha[161]	0.07	0.00	0.23	-0.41	-0.07	0.08	0.23	0.50
alpha[162]	0.00	0.00	0.23	-0.46	-0.15	0.01	0.16	0.43
alpha[163]	0.10	0.00	0.24	-0.38	-0.06	0.11	0.27	0.56
alpha[164]	0.06	0.00	0.26	-0.46	-0.11	0.07	0.23	0.56
alpha[165]	-0.12	0.00	0.23	-0.59	-0.27	-0.11	0.04	0.33
alpha[166]	-0.12	0.00	0.28	-0.69	-0.30	-0.11	0.06	0.39
alpha[167]	0.28	0.00	0.27	-0.26	0.10	0.29	0.47	0.79
alpha[168]	-0.06	0.00	0.25	-0.56	-0.23	-0.06	0.11	0.40
alpha[169]	-1.08	0.00	0.17	-1.44	-1.19	-1.07	-0.96	-0.75
alpha[170]	0.06	0.00	0.26	-0.45	-0.11	0.07	0.23	0.55
alpha[171]	-0.24	0.00	0.31	-0.88	-0.44	-0.23	-0.03	0.34
alpha[172]	0.15	0.00	0.24	-0.36	-0.02	0.15	0.31	0.61
alpha[173]	-0.08	0.00	0.27	-0.62	-0.26	-0.08	0.10	0.42
alpha[174]	0.00	0.00	0.25	-0.50	-0.16	0.00	0.17	0.47
alpha[175]	-0.10	0.00	0.23	-0.56	-0.25	-0.10	0.06	0.32
alpha[176]	-0.02	0.00	0.24	-0.51	-0.18	-0.02	0.15	0.44
alpha[177]	0.40	0.00	0.26	-0.12	0.22	0.40	0.57	0.88
alpha[178]	-0.43	0.00	0.15	-0.73	-0.53	-0.43	-0.33	-0.14
alpha[179]	-0.16	0.00	0.27	-0.70	-0.34	-0.16	0.02	0.35
alpha[180]	0.07	0.00	0.24	-0.42	-0.10	0.08	0.24	0.53
alpha[181]	0.02	0.00	0.25	-0.50	-0.14	0.03	0.19	0.49
alpha[182]	0.01	0.00	0.23	-0.47	-0.14	0.02	0.17	0.47
alpha[183]	0.13	0.00	0.23	-0.34	-0.03	0.13	0.29	0.56
alpha[184]	-0.45	0.00	0.32	-1.13	-0.67	-0.44	-0.23	0.14
alpha[185]	0.04	0.00	0.25	-0.47	-0.12	0.05	0.21	0.52
alpha[186]	-0.23	0.00	0.29	-0.82	-0.42	-0.22	-0.02	0.32

alpha[187]	-0.29	0.00	0.23	-0.74	-0.44	-0.28	-0.14	0.14
alpha[188]	0.24	0.00	0.24	-0.25	0.08	0.25	0.41	0.70
alpha[189]	0.20	0.00	0.24	-0.30	0.04	0.21	0.37	0.67
alpha[190]	-0.08	0.00	0.28	-0.65	-0.27	-0.08	0.11	0.45
alpha[191]	-0.03	0.00	0.30	-0.66	-0.22	-0.02	0.19	0.55
alpha[192]	-0.12	0.00	0.25	-0.62	-0.29	-0.11	0.06	0.37
alpha[193]	0.14	0.00	0.26	-0.37	-0.03	0.15	0.32	0.62
alpha[194]	-0.30	0.00	0.16	-0.62	-0.41	-0.30	-0.19	0.02
alpha[195]	-0.61	0.00	0.10	-0.82	-0.69	-0.61	-0.54	-0.41
beta	1.96	0.01	0.33	1.29	1.75	1.97	2.18	2.61
mu	0.09	0.00	0.04	0.02	0.06	0.09	0.11	0.16
sigma	0.39	0.00	0.03	0.33	0.36	0.39	0.41	0.45
log_theta[1]	0.02	0.00	0.28	-0.55	-0.17	0.02	0.21	0.56
log_theta[2]	0.33	0.00	0.24	-0.16	0.17	0.34	0.50	0.79
log_theta[3]	0.79	0.00	0.21	0.36	0.66	0.79	0.93	1.18
log_theta[4]	0.12	0.00	0.28	-0.47	-0.06	0.12	0.31	0.64
log_theta[5]	0.65	0.00	0.26	0.13	0.49	0.66	0.83	1.14
log_theta[6]	-0.28	0.00	0.19	-0.65	-0.39	-0.27	-0.15	0.07
log_theta[7]	0.83	0.00	0.17	0.49	0.72	0.83	0.94	1.15
log_theta[8]	0.07	0.00	0.22	-0.38	-0.08	0.07	0.22	0.47
log_theta[9]	0.44	0.00	0.24	-0.04	0.29	0.45	0.61	0.89
log_theta[10]	0.64	0.00	0.20	0.23	0.51	0.65	0.79	1.02
log_theta[11]	0.17	0.00	0.30	-0.42	-0.03	0.18	0.38	0.74
log_theta[12]	0.83	0.00	0.27	0.30	0.64	0.83	1.01	1.33
log_theta[13]	0.15	0.00	0.24	-0.33	-0.01	0.16	0.31	0.61
log_theta[14]	0.68	0.00	0.20	0.27	0.55	0.69	0.82	1.06
log_theta[15]	0.34	0.00	0.24	-0.18	0.18	0.35	0.50	0.80
log_theta[16]	0.84	0.00	0.25	0.35	0.68	0.85	1.01	1.32
log_theta[17]	0.91	0.00	0.23	0.44	0.76	0.92	1.07	1.35
log_theta[18]	0.52	0.00	0.20	0.12	0.39	0.53	0.66	0.91
log_theta[19]	0.39	0.00	0.19	0.01	0.27	0.40	0.53	0.74
log_theta[20]	0.43	0.00	0.31	-0.21	0.22	0.43	0.64	1.00
log_theta[21]	0.92	0.00	0.27	0.40	0.74	0.93	1.11	1.42
log_theta[22]	1.05	0.00	0.21	0.63	0.92	1.06	1.19	1.45
log_theta[23]	0.55	0.00	0.24	0.06	0.39	0.55	0.71	1.01
log_theta[24]	0.13	0.00	0.29	-0.46	-0.07	0.14	0.32	0.68
log_theta[25]	0.60	0.00	0.19	0.21	0.48	0.61	0.73	0.97
log_theta[26]	0.69	0.00	0.22	0.27	0.55	0.70	0.85	1.10
log_theta[27]	0.66	0.00	0.24	0.18	0.50	0.67	0.82	1.12
log_theta[28]	0.84	0.00	0.23	0.38	0.69	0.84	1.00	1.29
log_theta[29]	0.39	0.00	0.32	-0.26	0.18	0.40	0.61	0.99
log_theta[30]	0.84	0.00	0.28	0.28	0.66	0.85	1.03	1.37
log_theta[31]	0.38	0.00	0.28	-0.20	0.20	0.38	0.57	0.91

log_theta[32]	0.15	0.00	0.30	-0.44	-0.06	0.15	0.37	0.72
log_theta[33]	0.43	0.00	0.26	-0.07	0.26	0.43	0.61	0.91
log_theta[34]	0.39	0.00	0.24	-0.11	0.23	0.40	0.55	0.85
log_theta[35]	0.23	0.00	0.28	-0.33	0.05	0.24	0.43	0.75
log_theta[36]	0.11	0.00	0.20	-0.31	-0.02	0.12	0.25	0.48
log_theta[37]	0.52	0.00	0.24	0.03	0.35	0.52	0.69	0.96
log_theta[38]	0.17	0.00	0.28	-0.38	-0.01	0.18	0.36	0.69
log_theta[39]	-0.20	0.00	0.25	-0.71	-0.37	-0.20	-0.03	0.24
log_theta[40]	0.58	0.00	0.25	0.08	0.41	0.59	0.76	1.05
log_theta[41]	-0.14	0.00	0.28	-0.72	-0.32	-0.13	0.05	0.41
log_theta[42]	-0.08	0.00	0.24	-0.57	-0.24	-0.07	0.08	0.38
log_theta[43]	0.24	0.00	0.25	-0.26	0.08	0.25	0.42	0.70
log_theta[44]	-0.02	0.00	0.23	-0.48	-0.17	-0.01	0.13	0.41
log_theta[45]	0.69	0.00	0.20	0.29	0.55	0.70	0.83	1.07
log_theta[46]	0.13	0.00	0.21	-0.29	0.00	0.14	0.27	0.52
log_theta[47]	0.17	0.00	0.24	-0.34	0.01	0.18	0.34	0.63
log_theta[48]	0.42	0.00	0.30	-0.18	0.22	0.42	0.62	0.99
log_theta[49]	0.25	0.00	0.23	-0.21	0.10	0.25	0.40	0.67
log_theta[50]	-0.03	0.00	0.24	-0.51	-0.18	-0.01	0.14	0.42
log_theta[51]	0.09	0.00	0.22	-0.38	-0.05	0.10	0.24	0.51
log_theta[52]	0.28	0.00	0.23	-0.18	0.13	0.29	0.44	0.72
log_theta[53]	-0.28	0.00	0.26	-0.82	-0.45	-0.27	-0.11	0.20
log_theta[54]	0.61	0.00	0.25	0.11	0.45	0.61	0.78	1.08
log_theta[55]	0.46	0.00	0.28	-0.13	0.28	0.46	0.65	1.02
log_theta[56]	0.08	0.00	0.20	-0.32	-0.05	0.08	0.22	0.45
log_theta[57]	0.50	0.00	0.27	-0.05	0.32	0.50	0.67	1.00
log_theta[58]	0.02	0.00	0.24	-0.46	-0.13	0.03	0.19	0.47
log_theta[59]	-0.20	0.00	0.27	-0.73	-0.38	-0.19	-0.01	0.31
log_theta[60]	0.14	0.00	0.28	-0.42	-0.05	0.14	0.33	0.66
log_theta[61]	0.01	0.00	0.27	-0.53	-0.17	0.02	0.20	0.52
log_theta[62]	-0.07	0.00	0.27	-0.63	-0.25	-0.06	0.11	0.44
log_theta[63]	0.00	0.00	0.21	-0.42	-0.14	0.01	0.14	0.39
log_theta[64]	-0.16	0.00	0.29	-0.74	-0.36	-0.16	0.04	0.40
log_theta[65]	0.04	0.00	0.29	-0.55	-0.15	0.05	0.24	0.61
log_theta[66]	-0.06	0.00	0.24	-0.55	-0.22	-0.05	0.11	0.42
log_theta[67]	-0.08	0.00	0.29	-0.66	-0.28	-0.07	0.12	0.48
log_theta[68]	0.15	0.00	0.29	-0.43	-0.04	0.15	0.35	0.69
log_theta[69]	0.11	0.00	0.20	-0.29	-0.02	0.11	0.26	0.49
log_theta[70]	-0.20	0.00	0.29	-0.78	-0.39	-0.20	0.00	0.34
log_theta[71]	-0.02	0.00	0.29	-0.60	-0.22	-0.01	0.19	0.51
log_theta[72]	-0.39	0.00	0.32	-1.02	-0.61	-0.38	-0.18	0.22
log_theta[73]	0.47	0.00	0.26	-0.07	0.29	0.48	0.66	0.96
log_theta[74]	-0.16	0.00	0.25	-0.67	-0.33	-0.15	0.02	0.31

log_theta[75]	0.21	0.00	0.29	-0.36	0.03	0.22	0.42	0.77
log_theta[76]	0.57	0.00	0.24	0.09	0.40	0.57	0.73	1.03
log_theta[77]	0.03	0.00	0.22	-0.42	-0.11	0.03	0.18	0.44
log_theta[78]	0.46	0.00	0.22	0.02	0.32	0.47	0.62	0.88
log_theta[79]	0.33	0.00	0.31	-0.28	0.13	0.34	0.55	0.90
log_theta[80]	0.46	0.00	0.31	-0.17	0.26	0.47	0.67	1.05
log_theta[81]	0.31	0.00	0.28	-0.27	0.13	0.32	0.49	0.85
log_theta[82]	0.44	0.00	0.25	-0.06	0.27	0.45	0.61	0.91
log_theta[83]	0.24	0.00	0.26	-0.29	0.07	0.25	0.42	0.73
log_theta[84]	0.79	0.00	0.22	0.34	0.64	0.79	0.94	1.21
log_theta[85]	0.43	0.00	0.26	-0.09	0.25	0.43	0.61	0.92
log_theta[86]	0.14	0.00	0.22	-0.32	0.00	0.15	0.29	0.58
log_theta[87]	0.21	0.00	0.22	-0.25	0.07	0.22	0.36	0.64
log_theta[88]	0.41	0.00	0.21	-0.03	0.27	0.41	0.55	0.81
log_theta[89]	0.35	0.00	0.32	-0.27	0.14	0.35	0.57	0.95
log_theta[90]	0.48	0.00	0.24	-0.01	0.32	0.48	0.65	0.94
log_theta[91]	-0.52	0.00	0.25	-1.05	-0.68	-0.51	-0.35	-0.04
log_theta[92]	0.30	0.00	0.26	-0.23	0.12	0.30	0.49	0.79
log_theta[93]	-0.16	0.00	0.16	-0.48	-0.26	-0.16	-0.06	0.13
log_theta[94]	0.43	0.00	0.23	-0.04	0.28	0.44	0.60	0.88
log_theta[95]	0.22	0.00	0.23	-0.24	0.07	0.23	0.38	0.64
log_theta[96]	0.29	0.00	0.21	-0.12	0.15	0.30	0.44	0.69
log_theta[97]	0.19	0.00	0.19	-0.19	0.07	0.20	0.33	0.57
log_theta[98]	0.06	0.00	0.23	-0.39	-0.09	0.06	0.22	0.48
log_theta[99]	-0.31	0.00	0.31	-0.94	-0.51	-0.30	-0.09	0.28
log_theta[100]	0.18	0.00	0.11	-0.05	0.10	0.18	0.25	0.39
log_theta[101]	0.26	0.00	0.24	-0.21	0.10	0.27	0.42	0.70
log_theta[102]	0.08	0.00	0.22	-0.37	-0.06	0.08	0.24	0.51
log_theta[103]	0.22	0.00	0.28	-0.34	0.04	0.22	0.41	0.75
log_theta[104]	-0.02	0.00	0.20	-0.44	-0.16	-0.02	0.12	0.35
log_theta[105]	-0.03	0.00	0.26	-0.54	-0.20	-0.02	0.15	0.45
log_theta[106]	-0.09	0.00	0.24	-0.57	-0.25	-0.09	0.07	0.36
log_theta[107]	0.53	0.00	0.25	0.02	0.37	0.53	0.71	1.01
log_theta[108]	-0.21	0.00	0.31	-0.84	-0.41	-0.21	-0.01	0.37
log_theta[109]	-0.03	0.00	0.24	-0.51	-0.18	-0.01	0.13	0.41
log_theta[110]	-0.21	0.00	0.30	-0.81	-0.40	-0.20	0.00	0.36
log_theta[111]	-0.03	0.00	0.24	-0.53	-0.19	-0.03	0.14	0.44
log_theta[112]	-0.03	0.00	0.22	-0.49	-0.18	-0.03	0.12	0.37
log_theta[113]	-0.15	0.00	0.25	-0.66	-0.31	-0.14	0.02	0.32
log_theta[114]	-0.16	0.00	0.24	-0.64	-0.32	-0.15	0.00	0.29
log_theta[115]	0.01	0.00	0.24	-0.47	-0.14	0.02	0.18	0.46
log_theta[116]	-0.19	0.00	0.28	-0.76	-0.37	-0.18	0.00	0.35
log_theta[117]	0.01	0.00	0.20	-0.39	-0.12	0.01	0.15	0.39

log_theta[118]	-0.70	0.00	0.22	-1.14	-0.84	-0.69	-0.55	-0.31
log_theta[119]	0.04	0.00	0.19	-0.34	-0.08	0.05	0.17	0.40
log_theta[120]	-0.02	0.00	0.29	-0.60	-0.22	-0.02	0.18	0.53
log_theta[121]	0.25	0.00	0.26	-0.28	0.07	0.26	0.42	0.73
log_theta[122]	-0.54	0.00	0.29	-1.13	-0.73	-0.52	-0.34	0.00
log_theta[123]	-0.13	0.00	0.23	-0.58	-0.28	-0.12	0.03	0.31
log_theta[124]	-0.37	0.00	0.24	-0.85	-0.53	-0.37	-0.21	0.07
log_theta[125]	0.14	0.00	0.24	-0.35	-0.01	0.15	0.31	0.62
log_theta[126]	-0.08	0.00	0.27	-0.63	-0.25	-0.07	0.11	0.45
log_theta[127]	-0.10	0.00	0.23	-0.55	-0.25	-0.09	0.06	0.34
log_theta[128]	0.00	0.00	0.28	-0.55	-0.18	0.01	0.19	0.51
log_theta[129]	-0.17	0.00	0.19	-0.56	-0.30	-0.17	-0.04	0.20
log_theta[130]	-0.10	0.00	0.21	-0.52	-0.24	-0.10	0.04	0.30
log_theta[131]	0.01	0.00	0.32	-0.61	-0.20	0.01	0.23	0.63
log_theta[132]	0.01	0.00	0.25	-0.48	-0.17	0.01	0.19	0.47
log_theta[133]	-0.11	0.00	0.25	-0.62	-0.28	-0.11	0.07	0.36
log_theta[134]	-0.24	0.00	0.28	-0.81	-0.42	-0.24	-0.06	0.28
log_theta[135]	-0.03	0.00	0.29	-0.60	-0.22	-0.02	0.17	0.51
log_theta[136]	-0.05	0.00	0.31	-0.68	-0.25	-0.05	0.15	0.54
log_theta[137]	-0.40	0.00	0.31	-1.03	-0.59	-0.39	-0.19	0.20
log_theta[138]	0.11	0.00	0.25	-0.40	-0.06	0.12	0.29	0.58
log_theta[139]	-0.05	0.00	0.23	-0.52	-0.21	-0.04	0.11	0.39
log_theta[140]	0.16	0.00	0.24	-0.33	0.01	0.17	0.32	0.63
log_theta[141]	-0.13	0.00	0.26	-0.64	-0.30	-0.12	0.05	0.35
log_theta[142]	-0.01	0.00	0.28	-0.58	-0.19	0.00	0.18	0.54
log_theta[143]	-0.15	0.00	0.26	-0.68	-0.32	-0.14	0.03	0.35
log_theta[144]	-0.19	0.00	0.27	-0.72	-0.36	-0.18	0.00	0.32
log_theta[145]	0.10	0.00	0.25	-0.42	-0.06	0.11	0.27	0.58
log_theta[146]	-0.16	0.00	0.24	-0.64	-0.33	-0.15	0.01	0.29
log_theta[147]	0.19	0.00	0.19	-0.20	0.05	0.19	0.32	0.55
log_theta[148]	-0.26	0.00	0.26	-0.80	-0.43	-0.25	-0.08	0.23
log_theta[149]	0.54	0.00	0.23	0.08	0.38	0.54	0.70	0.98
log_theta[150]	-0.63	0.00	0.13	-0.89	-0.71	-0.63	-0.54	-0.37
log_theta[151]	-0.33	0.00	0.26	-0.85	-0.49	-0.32	-0.15	0.17
log_theta[152]	0.18	0.00	0.20	-0.22	0.05	0.19	0.31	0.56
log_theta[153]	0.49	0.00	0.24	0.00	0.33	0.49	0.65	0.94
log_theta[154]	0.26	0.00	0.24	-0.22	0.10	0.26	0.42	0.70
log_theta[155]	-0.09	0.00	0.22	-0.54	-0.24	-0.09	0.05	0.33
log_theta[156]	-0.20	0.00	0.22	-0.65	-0.35	-0.20	-0.05	0.21
log_theta[157]	-0.19	0.00	0.29	-0.79	-0.38	-0.18	0.01	0.37
log_theta[158]	-0.49	0.00	0.24	-0.98	-0.64	-0.49	-0.33	-0.05
log_theta[159]	0.04	0.00	0.21	-0.39	-0.10	0.05	0.19	0.43
log_theta[160]	-0.16	0.00	0.27	-0.71	-0.34	-0.15	0.03	0.36

log_theta[161]	-0.14	0.00	0.23	-0.61	-0.28	-0.13	0.02	0.29
log_theta[162]	-0.18	0.00	0.23	-0.64	-0.34	-0.18	-0.02	0.25
log_theta[163]	-0.10	0.00	0.24	-0.58	-0.26	-0.09	0.07	0.35
log_theta[164]	0.06	0.00	0.26	-0.46	-0.10	0.07	0.23	0.56
log_theta[165]	-0.21	0.00	0.23	-0.68	-0.36	-0.20	-0.05	0.23
log_theta[166]	-0.11	0.00	0.28	-0.66	-0.28	-0.09	0.08	0.41
log_theta[167]	0.28	0.00	0.27	-0.27	0.10	0.28	0.47	0.79
log_theta[168]	-0.12	0.00	0.25	-0.63	-0.29	-0.12	0.06	0.35
log_theta[169]	-1.24	0.00	0.17	-1.60	-1.36	-1.23	-1.12	-0.93
log_theta[170]	0.16	0.00	0.26	-0.35	-0.01	0.16	0.33	0.65
log_theta[171]	-0.24	0.00	0.31	-0.88	-0.44	-0.23	-0.03	0.34
log_theta[172]	0.22	0.00	0.24	-0.29	0.05	0.22	0.38	0.68
log_theta[173]	-0.15	0.00	0.27	-0.70	-0.33	-0.15	0.03	0.35
log_theta[174]	-0.22	0.00	0.24	-0.72	-0.39	-0.22	-0.05	0.25
log_theta[175]	-0.37	0.00	0.22	-0.83	-0.52	-0.37	-0.22	0.06
log_theta[176]	-0.27	0.00	0.24	-0.76	-0.43	-0.27	-0.10	0.18
log_theta[177]	0.39	0.00	0.26	-0.13	0.21	0.39	0.56	0.87
log_theta[178]	-0.61	0.00	0.15	-0.91	-0.71	-0.61	-0.51	-0.33
log_theta[179]	-0.29	0.00	0.27	-0.83	-0.47	-0.29	-0.11	0.22
log_theta[180]	-0.11	0.00	0.24	-0.61	-0.27	-0.11	0.06	0.34
log_theta[181]	-0.19	0.00	0.25	-0.71	-0.36	-0.18	-0.02	0.27
log_theta[182]	-0.22	0.00	0.23	-0.69	-0.37	-0.21	-0.06	0.23
log_theta[183]	0.00	0.00	0.23	-0.46	-0.16	0.00	0.16	0.44
log_theta[184]	-0.70	0.00	0.32	-1.38	-0.91	-0.69	-0.47	-0.10
log_theta[185]	-0.12	0.00	0.26	-0.64	-0.29	-0.11	0.05	0.36
log_theta[186]	-0.33	0.00	0.29	-0.93	-0.53	-0.33	-0.13	0.21
log_theta[187]	-0.17	0.00	0.23	-0.63	-0.32	-0.17	-0.02	0.26
log_theta[188]	0.00	0.00	0.24	-0.49	-0.16	0.01	0.16	0.46
log_theta[189]	0.15	0.00	0.24	-0.35	-0.01	0.15	0.31	0.61
log_theta[190]	-0.35	0.00	0.29	-0.93	-0.54	-0.34	-0.15	0.18
log_theta[191]	-0.28	0.00	0.30	-0.91	-0.47	-0.27	-0.07	0.28
log_theta[192]	-0.31	0.00	0.25	-0.81	-0.48	-0.30	-0.13	0.18
log_theta[193]	-0.06	0.00	0.25	-0.57	-0.23	-0.05	0.11	0.41
log_theta[194]	-0.44	0.00	0.16	-0.77	-0.55	-0.44	-0.33	-0.13
log_theta[195]	-0.92	0.00	0.09	-1.10	-0.99	-0.92	-0.86	-0.75
lp__	4013.21	0.42	12.10	3988.79	4005.48	4013.45	4021.39	4036.47

	n_eff	Rhat
alpha[1]	12483	1.00
alpha[2]	9707	1.00
alpha[3]	6206	1.00
alpha[4]	9382	1.00
alpha[5]	8669	1.00
alpha[6]	7341	1.00

```
alpha[7]        5340 1.00
alpha[8]        6361 1.00
alpha[9]       10936 1.00
alpha[10]       8505 1.00
alpha[11]       7934 1.00
alpha[12]      10551 1.00
alpha[13]      10620 1.00
alpha[14]      10055 1.00
alpha[15]       7586 1.00
alpha[16]       9542 1.00
alpha[17]       7781 1.00
alpha[18]      10335 1.00
alpha[19]       8310 1.00
alpha[20]      11792 1.00
alpha[21]       7645 1.00
alpha[22]       7775 1.00
alpha[23]       9876 1.00
alpha[24]       8451 1.00
alpha[25]       7365 1.00
alpha[26]       8965 1.00
alpha[27]       9751 1.00
alpha[28]       8875 1.00
alpha[29]       9441 1.00
alpha[30]       9191 1.00
alpha[31]      10010 1.00
alpha[32]       9429 1.00
alpha[33]       9557 1.00
alpha[34]       8703 1.00
alpha[35]       9703 1.00
alpha[36]       7373 1.00
alpha[37]       9050 1.00
alpha[38]       9425 1.00
alpha[39]       7738 1.00
alpha[40]       8673 1.00
alpha[41]       9872 1.00
alpha[42]       7934 1.00
alpha[43]       8212 1.00
alpha[44]      11211 1.00
alpha[45]       9762 1.00
alpha[46]       8392 1.00
alpha[47]      10202 1.00
alpha[48]      11069 1.00
alpha[49]       9805 1.00
```

```
alpha[50]       8590 1.00
alpha[51]       6567 1.00
alpha[52]      10230 1.00
alpha[53]       8252 1.00
alpha[54]       8890 1.00
alpha[55]       9255 1.00
alpha[56]       8735 1.00
alpha[57]       9549 1.00
alpha[58]       8537 1.00
alpha[59]       8126 1.00
alpha[60]       9770 1.00
alpha[61]      10622 1.00
alpha[62]       9487 1.00
alpha[63]      10214 1.00
alpha[64]       8460 1.00
alpha[65]      11648 1.00
alpha[66]      11682 1.00
alpha[67]       8662 1.00
alpha[68]      11021 1.00
alpha[69]       8212 1.00
alpha[70]       9041 1.00
alpha[71]       9525 1.00
alpha[72]       8857 1.00
alpha[73]      10997 1.00
alpha[74]       7420 1.00
alpha[75]       9303 1.00
alpha[76]      10251 1.00
alpha[77]       9615 1.00
alpha[78]      11456 1.00
alpha[79]       8927 1.00
alpha[80]      10670 1.00
alpha[81]       8812 1.00
alpha[82]       9391 1.00
alpha[83]      10046 1.00
alpha[84]       9282 1.00
alpha[85]      10695 1.00
alpha[86]       7812 1.00
alpha[87]       9353 1.00
alpha[88]       7661 1.00
alpha[89]       9790 1.00
alpha[90]      11011 1.00
alpha[91]       8319 1.00
alpha[92]       9628 1.00
```

```
alpha[93]       7204 1.00
alpha[94]      10268 1.00
alpha[95]       9329 1.00
alpha[96]       9608 1.00
alpha[97]       9769 1.00
alpha[98]       8743 1.00
alpha[99]       8397 1.00
alpha[100]      6135 1.00
alpha[101]      9770 1.00
alpha[102]     10347 1.00
alpha[103]      9679 1.00
alpha[104]     10013 1.00
alpha[105]     10797 1.00
alpha[106]      9076 1.00
alpha[107]      8413 1.00
alpha[108]     10364 1.00
alpha[109]      8724 1.00
alpha[110]      8534 1.00
alpha[111]     10579 1.00
alpha[112]     10810 1.00
alpha[113]      8620 1.00
alpha[114]      8172 1.00
alpha[115]      9808 1.00
alpha[116]     10496 1.00
alpha[117]      8053 1.00
alpha[118]      7705 1.00
alpha[119]      8664 1.00
alpha[120]      9445 1.00
alpha[121]     10334 1.00
alpha[122]      7828 1.00
alpha[123]      8973 1.00
alpha[124]      8497 1.00
alpha[125]      8817 1.00
alpha[126]      9967 1.00
alpha[127]      8394 1.00
alpha[128]      8733 1.00
alpha[129]     11991 1.00
alpha[130]      9548 1.00
alpha[131]      9816 1.00
alpha[132]      9865 1.00
alpha[133]      9501 1.00
alpha[134]     10133 1.00
alpha[135]      9143 1.00
```

```
alpha[136]     12295 1.00
alpha[137]      8624 1.00
alpha[138]      8796 1.00
alpha[139]      9303 1.00
alpha[140]      9583 1.00
alpha[141]      9161 1.00
alpha[142]      9252 1.00
alpha[143]      9136 1.00
alpha[144]      9621 1.00
alpha[145]      9504 1.00
alpha[146]      7549 1.00
alpha[147]      8083 1.00
alpha[148]      9269 1.00
alpha[149]      8618 1.00
alpha[150]      9396 1.00
alpha[151]     10829 1.00
alpha[152]      8810 1.00
alpha[153]      7872 1.00
alpha[154]      8026 1.00
alpha[155]      8258 1.00
alpha[156]      9598 1.00
alpha[157]      7494 1.00
alpha[158]     10764 1.00
alpha[159]      8921 1.00
alpha[160]     10245 1.00
alpha[161]      9213 1.00
alpha[162]     11382 1.00
alpha[163]      9658 1.00
alpha[164]      9360 1.00
alpha[165]     11309 1.00
alpha[166]      7905 1.00
alpha[167]      9047 1.00
alpha[168]      9891 1.00
alpha[169]      7547 1.00
alpha[170]      9190 1.00
alpha[171]      8098 1.00
alpha[172]      9073 1.00
alpha[173]     10310 1.00
alpha[174]      8780 1.00
alpha[175]      8309 1.00
alpha[176]      8838 1.00
alpha[177]     10487 1.00
alpha[178]      7824 1.00
```

```
alpha[179]      7852 1.00
alpha[180]      8766 1.00
alpha[181]     10770 1.00
alpha[182]      8431 1.00
alpha[183]     10163 1.00
alpha[184]      7440 1.00
alpha[185]      9774 1.00
alpha[186]      9484 1.00
alpha[187]     10134 1.00
alpha[188]      8233 1.00
alpha[189]      7987 1.00
alpha[190]      8574 1.00
alpha[191]      9880 1.00
alpha[192]      6939 1.00
alpha[193]      9190 1.00
alpha[194]      9810 1.00
alpha[195]      4745 1.00
beta            2458 1.00
mu              4218 1.00
sigma           1768 1.00
log_theta[1]   12324 1.00
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log_theta[3]    8400 1.00
log_theta[4]    9069 1.00
log_theta[5]    9084 1.00
log_theta[6]    8013 1.00
log_theta[7]    7705 1.00
log_theta[8]    7008 1.00
log_theta[9]   10651 1.00
log_theta[10]   8514 1.00
log_theta[11]   8056 1.00
log_theta[12]  10312 1.00
log_theta[13]  10667 1.00
log_theta[14]  10719 1.00
log_theta[15]   7808 1.00
log_theta[16]   9953 1.00
log_theta[17]   8248 1.00
log_theta[18]  10411 1.00
log_theta[19]  10309 1.00
log_theta[20]  11846 1.00
log_theta[21]   7700 1.00
log_theta[22]   8086 1.00
log_theta[23]  11008 1.00
```

```
log_theta[24]   8186 1.00
log_theta[25]   8893 1.00
log_theta[26]   8975 1.00
log_theta[27]   9647 1.00
log_theta[28]   9873 1.00
log_theta[29]   8793 1.00
log_theta[30]   9979 1.00
log_theta[31]   9902 1.00
log_theta[32]   9383 1.00
log_theta[33]   9649 1.00
log_theta[34]   8827 1.00
log_theta[35]   9469 1.00
log_theta[36]   8597 1.00
log_theta[37]   9221 1.00
log_theta[38]   8965 1.00
log_theta[39]   7882 1.00
log_theta[40]   8335 1.00
log_theta[41]   9909 1.00
log_theta[42]   7942 1.00
log_theta[43]   8684 1.00
log_theta[44]  11259 1.00
log_theta[45]   9741 1.00
log_theta[46]   8361 1.00
log_theta[47]  10584 1.00
log_theta[48]  11086 1.00
log_theta[49]   9749 1.00
log_theta[50]   8897 1.00
log_theta[51]   7172 1.00
log_theta[52]  11081 1.00
log_theta[53]   8273 1.00
log_theta[54]   8898 1.00
log_theta[55]   9286 1.00
log_theta[56]   9124 1.00
log_theta[57]   9633 1.00
log_theta[58]   8953 1.00
log_theta[59]   8614 1.00
log_theta[60]   9804 1.00
log_theta[61]  10622 1.00
log_theta[62]   9547 1.00
log_theta[63]  10156 1.00
log_theta[64]   8255 1.00
log_theta[65]  11927 1.00
log_theta[66]  11898 1.00
```

```
log_theta[67]   8433 1.00
log_theta[68]  10992 1.00
log_theta[69]   8873 1.00
log_theta[70]   9483 1.00
log_theta[71]   9395 1.00
log_theta[72]   8832 1.00
log_theta[73]  11279 1.00
log_theta[74]   7358 1.00
log_theta[75]   9308 1.00
log_theta[76]  10468 1.00
log_theta[77]   9738 1.00
log_theta[78]  11483 1.00
log_theta[79]   8718 1.00
log_theta[80]  10222 1.00
log_theta[81]   9000 1.00
log_theta[82]   9409 1.00
log_theta[83]  10052 1.00
log_theta[84]  11068 1.00
log_theta[85]  10655 1.00
log_theta[86]   8043 1.00
log_theta[87]   9179 1.00
log_theta[88]   7630 1.00
log_theta[89]   9543 1.00
log_theta[90]  11470 1.00
log_theta[91]   8479 1.00
log_theta[92]   9981 1.00
log_theta[93]   9215 1.00
log_theta[94]  10126 1.00
log_theta[95]   9312 1.00
log_theta[96]   9787 1.00
log_theta[97]  11377 1.00
log_theta[98]   8789 1.00
log_theta[99]   8461 1.00
log_theta[100]  9530 1.00
log_theta[101]  9856 1.00
log_theta[102] 10913 1.00
log_theta[103]  9702 1.00
log_theta[104] 10599 1.00
log_theta[105] 10839 1.00
log_theta[106]  9480 1.00
log_theta[107]  8690 1.00
log_theta[108] 10386 1.00
log_theta[109]  8932 1.00
```

```
log_theta[110]  8546 1.00
log_theta[111] 10888 1.00
log_theta[112] 11360 1.00
log_theta[113]  8556 1.00
log_theta[114]  8505 1.00
log_theta[115] 10103 1.00
log_theta[116] 10547 1.00
log_theta[117]  8505 1.00
log_theta[118]  7599 1.00
log_theta[119] 10070 1.00
log_theta[120]  9495 1.00
log_theta[121] 10531 1.00
log_theta[122]  8125 1.00
log_theta[123]  9086 1.00
log_theta[124]  8628 1.00
log_theta[125]  8803 1.00
log_theta[126]  9892 1.00
log_theta[127]  8490 1.00
log_theta[128]  8747 1.00
log_theta[129] 11956 1.00
log_theta[130]  9484 1.00
log_theta[131]  9880 1.00
log_theta[132]  9883 1.00
log_theta[133]  9651 1.00
log_theta[134] 10451 1.00
log_theta[135]  9057 1.00
log_theta[136] 12197 1.00
log_theta[137]  8748 1.00
log_theta[138]  9291 1.00
log_theta[139]  9652 1.00
log_theta[140]  9613 1.00
log_theta[141]  9656 1.00
log_theta[142]  9095 1.00
log_theta[143]  9142 1.00
log_theta[144]  9642 1.00
log_theta[145]  9621 1.00
log_theta[146]  8006 1.00
log_theta[147]  8100 1.00
log_theta[148]  9621 1.00
log_theta[149]  8636 1.00
log_theta[150] 10594 1.00
log_theta[151] 11384 1.00
log_theta[152]  9041 1.00
```

```
log_theta[153]  8185 1.00
log_theta[154]  7994 1.00
log_theta[155]  9029 1.00
log_theta[156]  9724 1.00
log_theta[157]  7448 1.00
log_theta[158] 11123 1.00
log_theta[159]  8750 1.00
log_theta[160] 10277 1.00
log_theta[161] 10216 1.00
log_theta[162] 11391 1.00
log_theta[163]  9992 1.00
log_theta[164]  9349 1.00
log_theta[165] 11574 1.00
log_theta[166]  7907 1.00
log_theta[167]  9059 1.00
log_theta[168]  9804 1.00
log_theta[169]  8109 1.00
log_theta[170]  9363 1.00
log_theta[171]  8100 1.00
log_theta[172]  8947 1.00
log_theta[173] 10317 1.00
log_theta[174]  8934 1.00
log_theta[175]  8915 1.00
log_theta[176]  8630 1.00
log_theta[177] 10462 1.00
log_theta[178]  8810 1.00
log_theta[179]  7920 1.00
log_theta[180]  9092 1.00
log_theta[181] 10653 1.00
log_theta[182]  9234 1.00
log_theta[183] 10589 1.00
log_theta[184]  7973 1.00
log_theta[185]  9794 1.00
log_theta[186]  9559 1.00
log_theta[187]  9812 1.00
log_theta[188]  8852 1.00
log_theta[189]  8192 1.00
log_theta[190]  8823 1.00
log_theta[191]  9676 1.00
log_theta[192]  7376 1.00
log_theta[193]  9350 1.00
log_theta[194] 10842 1.00
log_theta[195]  8098 1.00
```

```
lp__             844 1.01

Samples were drawn using NUTS(diag_e) at Sat Mar 18 20:46:24 2023.
For each parameter, n_eff is a crude measure of effective sample size,
and Rhat is the potential scale reduction factor on split chains (at
convergence, Rhat=1).
```

Question 3

Make two plots (appropriately labeled and described) that illustrate the differences in estimated θ_i's across regions and the differences in θs across models.

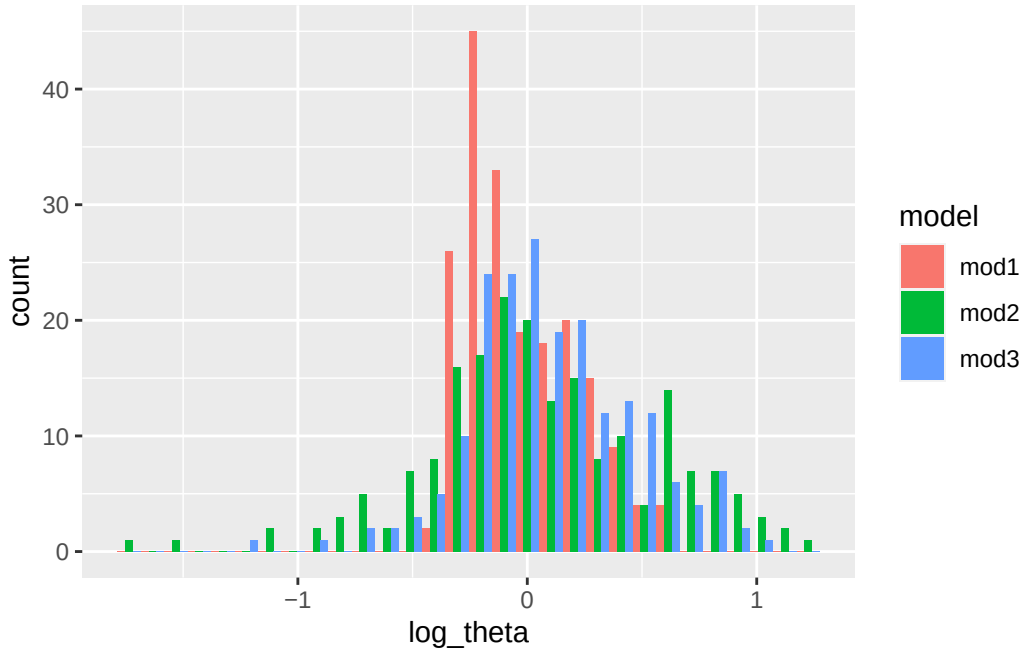
```
res_mod1 <- mod1 |>
  gather_draws(log_theta[i]) |>
  median_qi() |>
  rename(median_mod1 = .value,
         lower_mod1 = .lower,
         upper_mod1 = .upper) |>
  select(i, median_mod1:upper_mod1)

res_mod2 <- mod2 |>
  gather_draws(log_theta[i]) |>
  median_qi() |>
  rename(median_mod2 = .value,
         lower_mod2 = .lower,
         upper_mod2 = .upper) |>
  select(i, median_mod2:upper_mod2)

res_mod3 <- mod3 |>
  gather_draws(log_theta[i]) |>
  median_qi() |>
  rename(median_mod3 = .value,
         lower_mod3 = .lower,
         upper_mod3 = .upper) |>
  select(i, median_mod3:upper_mod3)

res <- res_mod1 |>
  left_join(res_mod2) |>
  left_join(res_mod3)
```

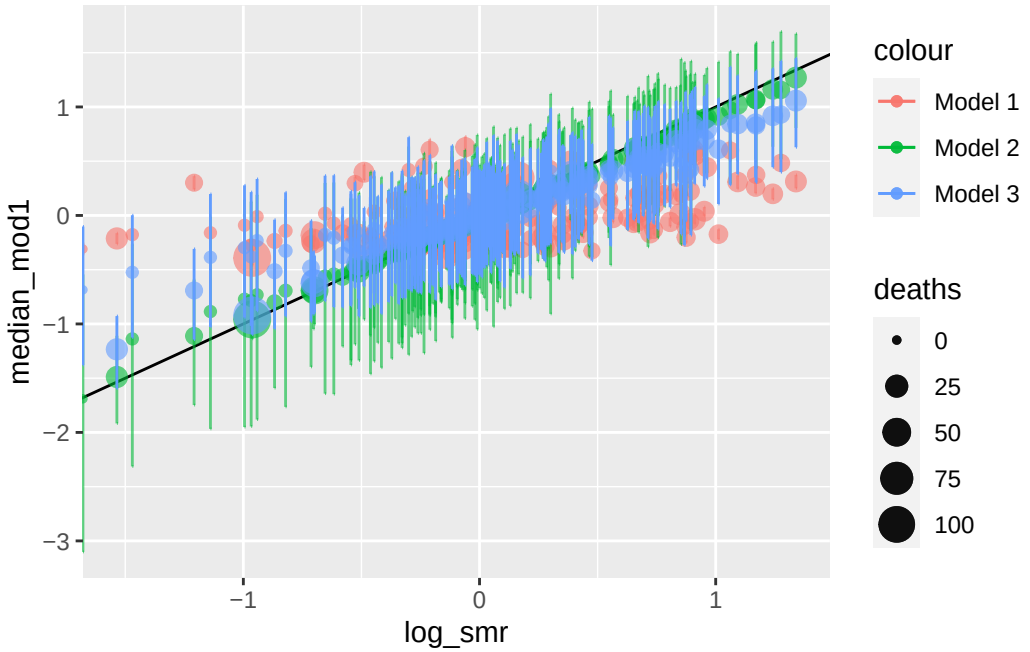
```
res |>
  select(median_mod1,
         median_mod2,
         median_mod3) |>
  pivot_longer(median_mod1:median_mod3, names_to = "model", values_to = "log_theta") |>
  mutate(model = str_remove(model, "median_")) |>
  ggplot(aes(log_theta, fill = model)) +
  geom_histogram(position = "dodge")
```



This is a histogram of the median of simulated log_theta for each region from the three models. All estimations are centered around 0 and majority values are within 1 and -1. The log_theta from model1 have smaller variation compared to model2 and model3.

```
res |>
  mutate(deaths = observe.i) |>
  mutate(log_smr = log(observe.i/expect.i)) |>
  ggplot(aes(log_smr, median_mod1, color="Model 1"))+
  geom_point(aes(size = deaths), alpha=0.6)+
  geom_errorbar(aes(ymin = lower_mod1, ymax = upper_mod1, color="Model 1"), alpha=0.6)+
  geom_abline(slope = 1, intercept = 0)+
  geom_point(aes(log_smr, median_mod2, color="Model 2", size = deaths), alpha=0.6)+
```

```
geom_errorbar(aes(ymin = lower_mod2, ymax = upper_mod2, color="Model 2"), alpha=0.6)+
geom_point(aes(log_smr, median_mod3, color="Model 3", size = deaths), alpha=0.6)+
geom_errorbar(aes(ymin = lower_mod3, ymax = upper_mod3, color="Model 3"))
```



This is a scatter plot of medians of simulated $\log\theta_i$ vs $log(\frac{\text{observed deaths}}{\text{expected deaths}})$ across regions. The size of the dot represents the size of observed deaths. I am also plotting the upper and lower bound for each median $\log\theta_i$. We see that medians of simulated $\log\theta_i$ from model2 lie more closely along the diagonal line, meaning that simulation of θ_is from model2 are more accurate estimation of the actual relative risk.