Week 9: Hierarchical GLM

15/03/23

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?

Answer

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

Answer

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

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

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

and

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

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)
library(here)

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

```
mod1lab9 <- stan(data = stan_data, file = here("code/models/lab9_1.stan"))
```

```
SAMPLING FOR MODEL 'anon_model' NOW (CHAIN 1).
Chain 1:
Chain 1: Gradient evaluation took 3.2e-05 seconds
Chain 1: 1000 transitions using 10 leapfrog steps per transition would take 0.32 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:                0.072 seconds (Sampling)
Chain 1:                0.147 seconds (Total)
Chain 1:

SAMPLING FOR MODEL 'anon_model' NOW (CHAIN 2).
Chain 2:
Chain 2: Gradient evaluation took 1.5e-05 seconds
Chain 2: 1000 transitions using 10 leapfrog steps per transition would take 0.15 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: 0.079 seconds (Warm-up)
Chain 2:                0.063 seconds (Sampling)
Chain 2:                0.142 seconds (Total)
Chain 2:

SAMPLING FOR MODEL 'anon_model' NOW (CHAIN 3).
```

```
Chain 3:
Chain 3: Gradient evaluation took 1.3e-05 seconds
Chain 3: 1000 transitions using 10 leapfrog steps per transition would take 0.13 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: 0.072 seconds (Warm-up)
Chain 3:                0.072 seconds (Sampling)
Chain 3:                0.144 seconds (Total)
Chain 3:

SAMPLING FOR MODEL 'anon_model' NOW (CHAIN 4).
Chain 4:
Chain 4: Gradient evaluation took 1.4e-05 seconds
Chain 4: 1000 transitions using 10 leapfrog steps per transition would take 0.14 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: 0.075 seconds (Warm-up)
Chain 4:                0.07 seconds (Sampling)
Chain 4:                0.145 seconds (Total)
Chain 4:
```

```
mod1lab9
```

```
Inference for Stan model: anon_model.
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	0.01	0.03
beta	2.43	0.00	0.18	2.08	2.31	2.43	2.55	2.77
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	0.46	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	0.44
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	0.03	0.05
log_theta[11]	0.20	0.00	0.03	0.15	0.19	0.21	0.22	0.25
log_theta[12]	0.37	0.00	0.03	0.31	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	0.22	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	0.21	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	0.57
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	0.46	0.49	0.51	0.56
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	0.18	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	0.23	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]	0.45	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	0.69
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	0.35	0.39	0.42	0.44	0.49
log_theta[33]	-0.13	0.00	0.02	-0.17	-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	0.12	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	0.03	0.14	0.17	0.19	0.20	0.23
log_theta[44]	0.08	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	0.19
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	-0.07	-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	-0.18	-0.15
log_theta[58]	0.45	0.00	0.04	0.37	0.43	0.45	0.48	0.53
log_theta[59]	-0.17	0.00	0.02	-0.21	-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	-0.27
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	-0.07
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	0.02	-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	0.11
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	0.03	0.14	0.17	0.19	0.20	0.23
log_theta[81]	0.33	0.00	0.03	0.27	0.31	0.33	0.35	0.39
log_theta[82]	-0.04	0.00	0.02	-0.08	-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	0.45	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	-0.22	-0.21	-0.19	-0.16
log_theta[87]	-0.17	0.00	0.02	-0.21	-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	0.23	0.26	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	-0.09	-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	-0.14	-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	-0.13	-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	-0.05
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	-0.12	-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	-0.27	-0.24	-0.23	-0.21	-0.18

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	-0.21	-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	-0.27	-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	0.03	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	0.22	0.25	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	-0.01
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]	0.06	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	-0.20	-0.17	-0.16	-0.14	-0.11
log_theta[138]	-0.24	0.00	0.03	-0.29	-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	-0.10	-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	-0.21
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	0.02	-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	-0.04	-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	0.06
log_theta[158]	-0.26	0.00	0.03	-0.32	-0.28	-0.26	-0.24	-0.21
log_theta[159]	-0.23	0.00	0.03	-0.28	-0.25	-0.23	-0.22	-0.18
log_theta[160]	-0.17	0.00	0.02	-0.22	-0.19	-0.17	-0.15	-0.13
log_theta[161]	-0.27	0.00	0.03	-0.32	-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]	0.00	0.00	0.02	-0.04	-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	0.01	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	-0.37	-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	-0.25	-0.24	-0.22	-0.19
log_theta[179]	-0.17	0.00	0.02	-0.22	-0.19	-0.17	-0.15	-0.12
log_theta[180]	-0.23	0.00	0.03	-0.28	-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	-0.35	-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	0.02	-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	-0.25	-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	0.97	3708.17	3710.38	3711.05	3711.48	3711.75

	n_eff	Rhat
alpha	3293	1
beta	3422	1

log_theta[1]	3434	1
log_theta[2]	3401	1
log_theta[3]	3568	1
log_theta[4]	3539	1
log_theta[5]	3560	1
log_theta[6]	3563	1
log_theta[7]	3566	1
log_theta[8]	3565	1
log_theta[9]	3215	1
log_theta[10]	3293	1
log_theta[11]	3469	1
log_theta[12]	3559	1
log_theta[13]	3393	1
log_theta[14]	3463	1
log_theta[15]	3305	1
log_theta[16]	3515	1
log_theta[17]	3465	1
log_theta[18]	3293	1
log_theta[19]	3569	1
log_theta[20]	3433	1
log_theta[21]	3569	1
log_theta[22]	3541	1
log_theta[23]	3529	1
log_theta[24]	3438	1
log_theta[25]	3569	1
log_theta[26]	3293	1
log_theta[27]	3488	1
log_theta[28]	3540	1
log_theta[29]	3568	1
log_theta[30]	3566	1
log_theta[31]	3532	1
log_theta[32]	3565	1
log_theta[33]	3221	1
log_theta[34]	3360	1
log_theta[35]	3532	1
log_theta[36]	3564	1
log_theta[37]	3330	1
log_theta[38]	3501	1
log_theta[39]	3218	1
log_theta[40]	3557	1
log_theta[41]	3293	1
log_theta[42]	3293	1
log_theta[43]	3450	1

log_theta[44]	3294	1
log_theta[45]	3291	1
log_theta[46]	3554	1
log_theta[47]	3227	1
log_theta[48]	3272	1
log_theta[49]	3392	1
log_theta[50]	3222	1
log_theta[51]	3567	1
log_theta[52]	3533	1
log_theta[53]	3241	1
log_theta[54]	3215	1
log_theta[55]	3416	1
log_theta[56]	3427	1
log_theta[57]	3218	1
log_theta[58]	3568	1
log_theta[59]	3215	1
log_theta[60]	3262	1
log_theta[61]	3293	1
log_theta[62]	3226	1
log_theta[63]	3356	1
log_theta[64]	3232	1
log_theta[65]	3220	1
log_theta[66]	3226	1
log_theta[67]	3261	1
log_theta[68]	3367	1
log_theta[69]	3547	1
log_theta[70]	3268	1
log_theta[71]	3225	1
log_theta[72]	3239	1
log_theta[73]	3469	1
log_theta[74]	3535	1
log_theta[75]	3293	1
log_theta[76]	3462	1
log_theta[77]	3293	1
log_theta[78]	3268	1
log_theta[79]	3401	1
log_theta[80]	3450	1
log_theta[81]	3547	1
log_theta[82]	3282	1
log_theta[83]	3272	1
log_theta[84]	3567	1
log_theta[85]	3510	1
log_theta[86]	3219	1

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log_theta[87]   3215    1
log_theta[88]   3302    1
log_theta[89]   3230    1
log_theta[90]   3422    1
log_theta[91]   3226    1
log_theta[92]   3511    1
log_theta[93]   3285    1
log_theta[94]   3255    1
log_theta[95]   3242    1
log_theta[96]   3216    1
log_theta[97]   3243    1
log_theta[98]   3215    1
log_theta[99]   3240    1
log_theta[100]  3552    1
log_theta[101]  3239    1
log_theta[102]  3225    1
log_theta[103]  3294    1
log_theta[104]  3236    1
log_theta[105]  3237    1
log_theta[106]  3219    1
log_theta[107]  3499    1
log_theta[108]  3251    1
log_theta[109]  3226    1
log_theta[110]  3215    1
log_theta[111]  3230    1
log_theta[112]  3215    1
log_theta[113]  3223    1
log_theta[114]  3274    1
log_theta[115]  3215    1
log_theta[116]  3215    1
log_theta[117]  3220    1
log_theta[118]  3537    1
log_theta[119]  3223    1
log_theta[120]  3250    1
log_theta[121]  3444    1
log_theta[122]  3215    1
log_theta[123]  3219    1
log_theta[124]  3215    1
log_theta[125]  3304    1
log_theta[126]  3293    1
log_theta[127]  3504    1
log_theta[128]  3267    1
log_theta[129]  3293    1
```

```
log_theta[130]  3293    1
log_theta[131]  3270    1
log_theta[132]  3249    1
log_theta[133]  3222    1
log_theta[134]  3236    1
log_theta[135]  3293    1
log_theta[136]  3237    1
log_theta[137]  3215    1
log_theta[138]  3229    1
log_theta[139]  3215    1
log_theta[140]  3262    1
log_theta[141]  3263    1
log_theta[142]  3258    1
log_theta[143]  3249    1
log_theta[144]  3249    1
log_theta[145]  3246    1
log_theta[146]  3234    1
log_theta[147]  3215    1
log_theta[148]  3220    1
log_theta[149]  3265    1
log_theta[150]  3215    1
log_theta[151]  3226    1
log_theta[152]  3536    1
log_theta[153]  3390    1
log_theta[154]  3242    1
log_theta[155]  3217    1
log_theta[156]  3227    1
log_theta[157]  3293    1
log_theta[158]  3236    1
log_theta[159]  3226    1
log_theta[160]  3215    1
log_theta[161]  3239    1
log_theta[162]  3228    1
log_theta[163]  3233    1
log_theta[164]  3293    1
log_theta[165]  3223    1
log_theta[166]  3293    1
log_theta[167]  3297    1
log_theta[168]  3244    1
log_theta[169]  3220    1
log_theta[170]  3351    1
log_theta[171]  3293    1
log_theta[172]  3294    1
```

```
log_theta[173]  3238    1
log_theta[174]  3245    1
log_theta[175]  3270    1
log_theta[176]  3258    1
log_theta[177]  3304    1
log_theta[178]  3227    1
log_theta[179]  3215    1
log_theta[180]  3226    1
log_theta[181]  3240    1
log_theta[182]  3250    1
log_theta[183]  3215    1
log_theta[184]  3255    1
log_theta[185]  3220    1
log_theta[186]  3218    1
log_theta[187]  3385    1
log_theta[188]  3254    1
log_theta[189]  3252    1
log_theta[190]  3267    1
log_theta[191]  3262    1
log_theta[192]  3229    1
log_theta[193]  3236    1
log_theta[194]  3216    1
log_theta[195]  3291    1
lp__            1857    1

Samples were drawn using NUTS(diag_e) at Wed Mar 15 17:49:55 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

```
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)
                  )
```

```r
mod2lab9 <- stan(data = stan_data, file = here("code/models/lab9_2.stan"))
```

```
SAMPLING FOR MODEL 'anon_model' NOW (CHAIN 1).
Chain 1:
Chain 1: Gradient evaluation took 2.9e-05 seconds
Chain 1: 1000 transitions using 10 leapfrog steps per transition would take 0.29 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: 0.367 seconds (Warm-up)
Chain 1:                0.34 seconds (Sampling)
Chain 1:                0.707 seconds (Total)
Chain 1:

SAMPLING FOR MODEL 'anon_model' NOW (CHAIN 2).
Chain 2:
Chain 2: Gradient evaluation took 1.6e-05 seconds
Chain 2: 1000 transitions using 10 leapfrog steps per transition would take 0.16 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: 0.356 seconds (Warm-up)
Chain 2:                0.37 seconds (Sampling)
Chain 2:                0.726 seconds (Total)
Chain 2:

SAMPLING FOR MODEL 'anon_model' NOW (CHAIN 3).
Chain 3:
Chain 3: Gradient evaluation took 1.9e-05 seconds
Chain 3: 1000 transitions using 10 leapfrog steps per transition would take 0.19 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: 0.389 seconds (Warm-up)
Chain 3:                0.366 seconds (Sampling)
Chain 3:                0.755 seconds (Total)
Chain 3:

SAMPLING FOR MODEL 'anon_model' NOW (CHAIN 4).
Chain 4:
Chain 4: Gradient evaluation took 1.8e-05 seconds
Chain 4: 1000 transitions using 10 leapfrog steps per transition would take 0.18 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: 0.415 seconds (Warm-up)
Chain 4:                0.395 seconds (Sampling)
Chain 4:                0.81 seconds (Total)
Chain 4:
```

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mod2lab9
```

```
Inference for Stan model: anon_model.
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    0.00 0.41   -1.21   -0.59   -0.31   -0.04    0.42
alpha[2]        0.28    0.00 0.28   -0.31    0.10    0.29    0.47    0.79
alpha[3]        0.52    0.01 0.27   -0.05    0.34    0.53    0.71    1.03
alpha[4]       -0.32    0.01 0.41   -1.18   -0.58   -0.30   -0.04    0.42
alpha[5]        0.54    0.01 0.32   -0.15    0.34    0.56    0.76    1.13
alpha[6]       -0.72    0.00 0.25   -1.22   -0.88   -0.71   -0.55   -0.25
alpha[7]        0.51    0.01 0.24    0.03    0.34    0.51    0.68    0.97
alpha[8]       -0.56    0.01 0.33   -1.25   -0.78   -0.55   -0.34    0.07
alpha[9]        0.73    0.00 0.26    0.19    0.57    0.75    0.91    1.22
alpha[10]       0.78    0.00 0.21    0.37    0.64    0.79    0.92    1.16
alpha[11]      -0.14    0.01 0.46   -1.10   -0.43   -0.11    0.19    0.67
alpha[12]       0.82    0.01 0.32    0.17    0.60    0.83    1.04    1.40
alpha[13]       0.00    0.00 0.31   -0.63   -0.20    0.02    0.22    0.56
alpha[14]       0.66    0.00 0.22    0.21    0.51    0.67    0.81    1.06
alpha[15]       0.33    0.00 0.28   -0.26    0.16    0.35    0.53    0.85
alpha[16]       0.91    0.00 0.29    0.33    0.71    0.92    1.11    1.43
alpha[17]       1.02    0.00 0.25    0.51    0.86    1.03    1.20    1.50
```

alpha[18]	0.60	0.00	0.22	0.15	0.46	0.61	0.76	1.01
alpha[19]	0.07	0.01	0.22	-0.38	-0.08	0.07	0.22	0.50
alpha[20]	0.45	0.00	0.40	-0.39	0.19	0.48	0.73	1.18
alpha[21]	0.86	0.01	0.32	0.18	0.66	0.87	1.08	1.46
alpha[22]	1.07	0.00	0.24	0.57	0.91	1.08	1.24	1.52
alpha[23]	0.45	0.00	0.29	-0.15	0.27	0.46	0.66	0.99
alpha[24]	-0.13	0.01	0.42	-1.00	-0.40	-0.11	0.16	0.62
alpha[25]	0.31	0.01	0.26	-0.25	0.13	0.31	0.49	0.81
alpha[26]	0.85	0.00	0.24	0.35	0.69	0.85	1.01	1.30
alpha[27]	0.67	0.00	0.27	0.11	0.49	0.68	0.86	1.17
alpha[28]	0.83	0.00	0.25	0.30	0.66	0.83	1.00	1.31
alpha[29]	-0.07	0.01	0.51	-1.15	-0.41	-0.05	0.28	0.89
alpha[30]	0.59	0.01	0.33	-0.11	0.37	0.60	0.82	1.23
alpha[31]	0.19	0.01	0.36	-0.58	-0.03	0.21	0.44	0.86
alpha[32]	-0.51	0.01	0.49	-1.54	-0.82	-0.48	-0.16	0.38
alpha[33]	0.71	0.00	0.29	0.11	0.52	0.72	0.91	1.25
alpha[34]	0.39	0.00	0.30	-0.22	0.21	0.41	0.60	0.93
alpha[35]	-0.08	0.01	0.40	-0.95	-0.34	-0.06	0.19	0.64
alpha[36]	-0.44	0.01	0.29	-1.01	-0.63	-0.44	-0.25	0.11
alpha[37]	0.60	0.00	0.28	0.04	0.41	0.61	0.79	1.10
alpha[38]	-0.13	0.01	0.39	-0.93	-0.39	-0.12	0.14	0.58
alpha[39]	-0.18	0.00	0.31	-0.85	-0.38	-0.16	0.04	0.39
alpha[40]	0.44	0.01	0.32	-0.22	0.23	0.45	0.67	1.03
alpha[41]	-0.46	0.01	0.44	-1.38	-0.74	-0.43	-0.15	0.35
alpha[42]	-0.23	0.00	0.32	-0.89	-0.44	-0.22	0.00	0.34
alpha[43]	0.10	0.00	0.30	-0.52	-0.10	0.12	0.32	0.64
alpha[44]	-0.16	0.00	0.27	-0.72	-0.34	-0.15	0.03	0.33
alpha[45]	0.87	0.00	0.21	0.45	0.74	0.87	1.01	1.25
alpha[46]	-0.17	0.00	0.25	-0.69	-0.33	-0.17	-0.01	0.30
alpha[47]	0.42	0.00	0.29	-0.19	0.23	0.43	0.61	0.96
alpha[48]	0.74	0.00	0.38	-0.06	0.50	0.76	1.01	1.45
alpha[49]	0.16	0.00	0.27	-0.39	-0.02	0.17	0.35	0.64
alpha[50]	0.02	0.00	0.28	-0.56	-0.16	0.04	0.22	0.53
alpha[51]	-0.35	0.01	0.29	-0.93	-0.55	-0.34	-0.15	0.20
alpha[52]	0.06	0.00	0.28	-0.52	-0.12	0.07	0.26	0.57
alpha[53]	-0.49	0.00	0.38	-1.27	-0.74	-0.47	-0.23	0.21
alpha[54]	1.00	0.00	0.28	0.43	0.82	1.01	1.19	1.50
alpha[55]	0.51	0.00	0.38	-0.29	0.27	0.53	0.78	1.21
alpha[56]	-0.08	0.00	0.23	-0.55	-0.23	-0.07	0.08	0.35
alpha[57]	0.88	0.00	0.29	0.29	0.69	0.89	1.07	1.40
alpha[58]	-0.50	0.01	0.34	-1.21	-0.73	-0.48	-0.26	0.12
alpha[59]	-0.26	0.00	0.38	-1.07	-0.51	-0.24	0.00	0.43
alpha[60]	0.53	0.00	0.37	-0.23	0.30	0.54	0.78	1.22

alpha[61]	-0.07	0.00	0.36	-0.82	-0.31	-0.06	0.19	0.60
alpha[62]	-0.11	0.00	0.39	-0.93	-0.37	-0.10	0.19	0.59
alpha[63]	-0.15	0.00	0.24	-0.65	-0.30	-0.15	0.01	0.30
alpha[64]	-0.33	0.01	0.45	-1.34	-0.61	-0.31	-0.03	0.51
alpha[65]	0.22	0.00	0.40	-0.59	-0.04	0.24	0.50	0.94
alpha[66]	0.09	0.00	0.29	-0.51	-0.10	0.10	0.29	0.62
alpha[67]	0.16	0.01	0.44	-0.74	-0.13	0.17	0.47	0.94
alpha[68]	-0.03	0.00	0.41	-0.89	-0.29	0.00	0.27	0.74
alpha[69]	-0.18	0.00	0.25	-0.72	-0.34	-0.17	-0.01	0.28
alpha[70]	-0.06	0.01	0.43	-0.96	-0.34	-0.04	0.24	0.70
alpha[71]	0.14	0.01	0.37	-0.65	-0.10	0.15	0.40	0.83
alpha[72]	-0.66	0.01	0.55	-1.80	-1.00	-0.63	-0.27	0.32
alpha[73]	0.44	0.00	0.35	-0.28	0.23	0.46	0.68	1.08
alpha[74]	-0.67	0.00	0.36	-1.42	-0.90	-0.65	-0.42	-0.04
alpha[75]	0.27	0.00	0.39	-0.54	0.02	0.29	0.54	0.95
alpha[76]	0.57	0.00	0.29	-0.05	0.39	0.59	0.77	1.10
alpha[77]	-0.08	0.00	0.27	-0.64	-0.26	-0.07	0.10	0.41
alpha[78]	0.63	0.00	0.24	0.13	0.47	0.63	0.79	1.07
alpha[79]	0.30	0.01	0.44	-0.60	0.02	0.33	0.60	1.06
alpha[80]	0.53	0.01	0.44	-0.38	0.25	0.55	0.85	1.36
alpha[81]	0.01	0.01	0.40	-0.84	-0.25	0.03	0.29	0.72
alpha[82]	0.65	0.00	0.28	0.05	0.47	0.66	0.84	1.17
alpha[83]	0.35	0.00	0.31	-0.29	0.14	0.36	0.56	0.92
alpha[84]	0.62	0.01	0.27	0.07	0.45	0.64	0.81	1.13
alpha[85]	0.32	0.00	0.30	-0.31	0.12	0.33	0.53	0.89
alpha[86]	0.33	0.00	0.25	-0.19	0.16	0.34	0.51	0.80
alpha[87]	0.38	0.00	0.26	-0.16	0.21	0.40	0.57	0.86
alpha[88]	0.52	0.00	0.23	0.04	0.37	0.53	0.69	0.95
alpha[89]	0.72	0.01	0.40	-0.13	0.46	0.74	1.00	1.44
alpha[90]	0.47	0.00	0.29	-0.12	0.28	0.48	0.68	0.99
alpha[91]	-0.69	0.00	0.38	-1.47	-0.94	-0.67	-0.42	0.00
alpha[92]	0.11	0.00	0.35	-0.62	-0.13	0.12	0.35	0.75
alpha[93]	0.06	0.00	0.19	-0.33	-0.07	0.06	0.20	0.44
alpha[94]	0.62	0.00	0.26	0.09	0.44	0.63	0.80	1.09
alpha[95]	0.34	0.00	0.26	-0.21	0.16	0.35	0.51	0.82
alpha[96]	0.48	0.00	0.24	-0.01	0.31	0.49	0.65	0.90
alpha[97]	0.42	0.00	0.21	-0.01	0.28	0.43	0.57	0.83
alpha[98]	0.18	0.00	0.27	-0.37	0.01	0.18	0.36	0.68
alpha[99]	-0.76	0.01	0.53	-1.85	-1.11	-0.73	-0.39	0.18
alpha[100]	-0.05	0.00	0.15	-0.36	-0.15	-0.05	0.05	0.23
alpha[101]	0.40	0.00	0.28	-0.20	0.22	0.42	0.60	0.92
alpha[102]	0.17	0.00	0.26	-0.36	0.00	0.18	0.34	0.65
alpha[103]	0.19	0.00	0.39	-0.63	-0.07	0.21	0.46	0.90

alpha[104]	0.15	0.00	0.23	-0.33	0.00	0.15	0.30	0.58
alpha[105]	-0.04	0.00	0.34	-0.74	-0.26	-0.02	0.20	0.57
alpha[106]	0.00	0.00	0.28	-0.59	-0.17	0.01	0.19	0.53
alpha[107]	0.50	0.00	0.33	-0.16	0.29	0.51	0.73	1.10
alpha[108]	-0.53	0.01	0.49	-1.57	-0.84	-0.50	-0.20	0.34
alpha[109]	0.01	0.00	0.29	-0.60	-0.17	0.03	0.22	0.54
alpha[110]	-0.37	0.01	0.51	-1.45	-0.69	-0.33	0.00	0.54
alpha[111]	0.14	0.00	0.30	-0.48	-0.06	0.15	0.34	0.67
alpha[112]	0.05	0.00	0.27	-0.51	-0.13	0.06	0.25	0.56
alpha[113]	-0.07	0.00	0.29	-0.69	-0.25	-0.06	0.13	0.47
alpha[114]	0.05	0.00	0.28	-0.52	-0.14	0.05	0.24	0.57
alpha[115]	0.11	0.00	0.31	-0.54	-0.07	0.14	0.33	0.66
alpha[116]	-0.26	0.01	0.41	-1.12	-0.52	-0.23	0.01	0.48
alpha[117]	0.15	0.00	0.24	-0.34	0.00	0.16	0.31	0.61
alpha[118]	-1.31	0.00	0.31	-1.97	-1.51	-1.30	-1.10	-0.76
alpha[119]	0.20	0.00	0.22	-0.24	0.05	0.20	0.34	0.61
alpha[120]	-0.09	0.01	0.42	-0.98	-0.36	-0.07	0.20	0.66
alpha[121]	0.11	0.00	0.33	-0.58	-0.11	0.12	0.34	0.71
alpha[122]	-1.07	0.01	0.53	-2.22	-1.41	-1.03	-0.70	-0.12
alpha[123]	-0.12	0.00	0.30	-0.73	-0.32	-0.11	0.09	0.42
alpha[124]	-0.48	0.00	0.32	-1.17	-0.68	-0.47	-0.26	0.10
alpha[125]	0.17	0.00	0.29	-0.44	-0.02	0.18	0.38	0.72
alpha[126]	-0.32	0.00	0.38	-1.11	-0.56	-0.30	-0.05	0.37
alpha[127]	-0.43	0.00	0.30	-1.07	-0.63	-0.42	-0.23	0.12
alpha[128]	-0.06	0.01	0.42	-0.95	-0.33	-0.04	0.24	0.70
alpha[129]	-0.28	0.00	0.22	-0.72	-0.43	-0.27	-0.12	0.13
alpha[130]	-0.21	0.00	0.26	-0.75	-0.37	-0.20	-0.03	0.27
alpha[131]	-0.06	0.01	0.46	-1.06	-0.36	-0.04	0.25	0.77
alpha[132]	0.01	0.00	0.34	-0.70	-0.21	0.03	0.24	0.64
alpha[133]	-0.02	0.00	0.32	-0.67	-0.23	-0.01	0.20	0.58
alpha[134]	-0.23	0.00	0.39	-1.05	-0.47	-0.21	0.04	0.48
alpha[135]	-0.29	0.01	0.44	-1.23	-0.57	-0.26	0.01	0.49
alpha[136]	-0.13	0.01	0.46	-1.10	-0.43	-0.11	0.19	0.69
alpha[137]	-0.82	0.01	0.54	-1.93	-1.19	-0.80	-0.44	0.14
alpha[138]	0.34	0.00	0.29	-0.28	0.16	0.35	0.54	0.89
alpha[139]	0.03	0.00	0.28	-0.55	-0.15	0.04	0.22	0.54
alpha[140]	0.24	0.00	0.29	-0.38	0.04	0.24	0.44	0.77
alpha[141]	0.07	0.00	0.33	-0.63	-0.14	0.09	0.30	0.67
alpha[142]	0.26	0.00	0.37	-0.52	0.02	0.28	0.52	0.95
alpha[143]	-0.27	0.00	0.36	-1.04	-0.49	-0.25	-0.02	0.40
alpha[144]	-0.06	0.00	0.34	-0.77	-0.28	-0.05	0.17	0.57
alpha[145]	0.37	0.00	0.30	-0.24	0.18	0.38	0.58	0.93
alpha[146]	-0.05	0.00	0.30	-0.68	-0.24	-0.03	0.16	0.52

alpha[147]	0.33	0.00	0.22	-0.11	0.20	0.34	0.48	0.75
alpha[148]	-0.29	0.00	0.37	-1.03	-0.54	-0.28	-0.03	0.38
alpha[149]	0.76	0.00	0.26	0.23	0.59	0.77	0.94	1.22
alpha[150]	-0.59	0.00	0.15	-0.91	-0.70	-0.59	-0.49	-0.30
alpha[151]	-0.34	0.00	0.33	-1.01	-0.55	-0.33	-0.11	0.25
alpha[152]	-0.06	0.00	0.24	-0.53	-0.22	-0.05	0.10	0.39
alpha[153]	0.52	0.00	0.29	-0.09	0.33	0.53	0.72	1.05
alpha[154]	0.40	0.00	0.27	-0.13	0.22	0.41	0.59	0.89
alpha[155]	-0.01	0.00	0.27	-0.57	-0.18	0.00	0.17	0.49
alpha[156]	-0.23	0.00	0.26	-0.79	-0.40	-0.22	-0.05	0.25
alpha[157]	-0.59	0.01	0.49	-1.65	-0.90	-0.56	-0.25	0.28
alpha[158]	-0.56	0.00	0.32	-1.23	-0.76	-0.54	-0.33	0.03
alpha[159]	0.22	0.00	0.25	-0.30	0.05	0.23	0.39	0.68
alpha[160]	-0.19	0.00	0.39	-1.04	-0.42	-0.17	0.08	0.54
alpha[161]	0.00	0.00	0.27	-0.56	-0.17	0.01	0.19	0.51
alpha[162]	-0.09	0.00	0.27	-0.66	-0.27	-0.08	0.11	0.41
alpha[163]	0.04	0.00	0.29	-0.58	-0.15	0.05	0.24	0.58
alpha[164]	0.02	0.00	0.34	-0.70	-0.20	0.03	0.25	0.64
alpha[165]	-0.25	0.00	0.30	-0.87	-0.43	-0.24	-0.06	0.29
alpha[166]	-0.36	0.00	0.42	-1.25	-0.63	-0.34	-0.05	0.40
alpha[167]	0.38	0.00	0.32	-0.30	0.17	0.39	0.61	0.95
alpha[168]	-0.20	0.00	0.34	-0.90	-0.41	-0.19	0.03	0.42
alpha[169]	-1.37	0.00	0.21	-1.81	-1.51	-1.37	-1.23	-0.98
alpha[170]	0.04	0.00	0.33	-0.64	-0.17	0.05	0.26	0.64
alpha[171]	-0.75	0.01	0.54	-1.91	-1.09	-0.72	-0.38	0.20
alpha[172]	0.16	0.00	0.31	-0.49	-0.03	0.18	0.38	0.74
alpha[173]	-0.27	0.00	0.39	-1.10	-0.52	-0.25	0.01	0.45
alpha[174]	-0.12	0.00	0.31	-0.75	-0.32	-0.11	0.09	0.43
alpha[175]	-0.26	0.00	0.28	-0.83	-0.45	-0.26	-0.07	0.27
alpha[176]	-0.17	0.00	0.32	-0.83	-0.37	-0.15	0.05	0.42
alpha[177]	0.54	0.00	0.31	-0.10	0.35	0.56	0.75	1.11
alpha[178]	-0.56	0.00	0.18	-0.93	-0.68	-0.56	-0.44	-0.22
alpha[179]	-0.44	0.01	0.41	-1.32	-0.70	-0.42	-0.16	0.28
alpha[180]	0.00	0.00	0.30	-0.61	-0.21	0.01	0.21	0.54
alpha[181]	-0.09	0.00	0.32	-0.74	-0.30	-0.07	0.13	0.50
alpha[182]	-0.11	0.00	0.29	-0.69	-0.29	-0.10	0.10	0.43
alpha[183]	0.09	0.00	0.30	-0.53	-0.10	0.10	0.30	0.65
alpha[184]	-1.53	0.01	0.65	-2.88	-1.96	-1.50	-1.07	-0.41
alpha[185]	-0.05	0.00	0.33	-0.76	-0.26	-0.03	0.18	0.54
alpha[186]	-0.65	0.01	0.47	-1.66	-0.95	-0.63	-0.32	0.22
alpha[187]	-0.44	0.00	0.28	-1.03	-0.63	-0.43	-0.24	0.09
alpha[188]	0.24	0.00	0.30	-0.40	0.05	0.25	0.45	0.81
alpha[189]	0.22	0.00	0.30	-0.39	0.03	0.24	0.43	0.76

alpha[190]	-0.33	0.01	0.42	-1.22	-0.60	-0.32	-0.04	0.44
alpha[191]	-0.26	0.01	0.46	-1.26	-0.56	-0.25	0.06	0.58
alpha[192]	-0.31	0.00	0.35	-1.03	-0.53	-0.29	-0.06	0.34
alpha[193]	0.10	0.00	0.33	-0.57	-0.11	0.11	0.33	0.70
alpha[194]	-0.41	0.00	0.19	-0.79	-0.53	-0.40	-0.28	-0.05
alpha[195]	-0.73	0.00	0.13	-0.99	-0.82	-0.73	-0.65	-0.47
beta	1.45	0.02	0.61	0.28	1.04	1.44	1.85	2.66
log_theta[1]	-0.22	0.00	0.41	-1.09	-0.48	-0.19	0.06	0.54
log_theta[2]	0.37	0.00	0.27	-0.22	0.20	0.38	0.56	0.87
log_theta[3]	0.86	0.00	0.24	0.36	0.70	0.86	1.02	1.29
log_theta[4]	-0.13	0.00	0.41	-0.98	-0.39	-0.11	0.16	0.59
log_theta[5]	0.77	0.00	0.31	0.11	0.58	0.79	0.98	1.34
log_theta[6]	-0.48	0.00	0.23	-0.94	-0.63	-0.47	-0.32	-0.04
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	0.30	-0.82	-0.39	-0.19	0.01	0.37
log_theta[9]	0.64	0.00	0.26	0.10	0.48	0.65	0.82	1.12
log_theta[10]	0.79	0.00	0.21	0.38	0.66	0.80	0.94	1.17
log_theta[11]	-0.01	0.01	0.45	-0.95	-0.31	0.01	0.31	0.81
log_theta[12]	1.05	0.00	0.31	0.42	0.84	1.06	1.26	1.60
log_theta[13]	0.09	0.00	0.30	-0.54	-0.11	0.11	0.30	0.64
log_theta[14]	0.78	0.00	0.21	0.34	0.64	0.80	0.93	1.18
log_theta[15]	0.39	0.00	0.28	-0.20	0.22	0.41	0.59	0.90
log_theta[16]	1.07	0.00	0.28	0.49	0.88	1.07	1.26	1.59
log_theta[17]	1.15	0.00	0.25	0.64	0.99	1.16	1.32	1.61
log_theta[18]	0.63	0.00	0.22	0.18	0.49	0.64	0.78	1.03
log_theta[19]	0.37	0.00	0.19	-0.02	0.24	0.37	0.50	0.72
log_theta[20]	0.56	0.00	0.40	-0.28	0.30	0.58	0.84	1.28
log_theta[21]	1.15	0.00	0.30	0.52	0.96	1.17	1.36	1.70
log_theta[22]	1.26	0.00	0.23	0.79	1.12	1.27	1.43	1.68
log_theta[23]	0.63	0.00	0.28	0.04	0.45	0.64	0.82	1.14
log_theta[24]	-0.02	0.01	0.41	-0.89	-0.29	0.00	0.27	0.72
log_theta[25]	0.61	0.00	0.24	0.12	0.46	0.62	0.78	1.05
log_theta[26]	0.87	0.00	0.24	0.38	0.72	0.88	1.04	1.33
log_theta[27]	0.81	0.00	0.26	0.25	0.63	0.82	0.99	1.30
log_theta[28]	1.02	0.00	0.24	0.51	0.86	1.03	1.18	1.47
log_theta[29]	0.20	0.01	0.51	-0.89	-0.13	0.22	0.55	1.12
log_theta[30]	0.95	0.00	0.31	0.32	0.76	0.97	1.17	1.52
log_theta[31]	0.37	0.00	0.36	-0.39	0.15	0.39	0.61	1.02
log_theta[32]	-0.25	0.01	0.49	-1.29	-0.56	-0.21	0.09	0.62
log_theta[33]	0.64	0.00	0.29	0.04	0.46	0.65	0.84	1.17
log_theta[34]	0.47	0.00	0.29	-0.14	0.29	0.48	0.67	1.00
log_theta[35]	0.10	0.00	0.39	-0.74	-0.16	0.12	0.37	0.82
log_theta[36]	-0.06	0.00	0.25	-0.58	-0.22	-0.05	0.11	0.41

log_theta[37]	0.66	0.00	0.27	0.11	0.48	0.67	0.86	1.16
log_theta[38]	0.02	0.00	0.38	-0.78	-0.23	0.03	0.28	0.72
log_theta[39]	-0.29	0.00	0.31	-0.95	-0.49	-0.27	-0.08	0.26
log_theta[40]	0.66	0.00	0.31	0.03	0.46	0.68	0.88	1.23
log_theta[41]	-0.43	0.01	0.44	-1.36	-0.71	-0.41	-0.13	0.38
log_theta[42]	-0.21	0.00	0.32	-0.87	-0.42	-0.20	0.02	0.36
log_theta[43]	0.22	0.00	0.30	-0.40	0.02	0.23	0.43	0.75
log_theta[44]	-0.11	0.00	0.27	-0.67	-0.29	-0.10	0.08	0.37
log_theta[45]	0.85	0.00	0.21	0.44	0.72	0.86	1.00	1.23
log_theta[46]	0.04	0.00	0.23	-0.43	-0.10	0.04	0.20	0.47
log_theta[47]	0.28	0.00	0.29	-0.31	0.10	0.29	0.48	0.83
log_theta[48]	0.72	0.00	0.38	-0.09	0.48	0.73	0.98	1.42
log_theta[49]	0.25	0.00	0.27	-0.30	0.07	0.26	0.44	0.72
log_theta[50]	-0.05	0.00	0.28	-0.63	-0.23	-0.03	0.15	0.46
log_theta[51]	-0.08	0.00	0.28	-0.64	-0.27	-0.07	0.11	0.41
log_theta[52]	0.24	0.00	0.27	-0.33	0.07	0.26	0.43	0.73
log_theta[53]	-0.54	0.00	0.38	-1.32	-0.79	-0.52	-0.28	0.17
log_theta[54]	0.90	0.00	0.28	0.34	0.73	0.91	1.09	1.41
log_theta[55]	0.61	0.00	0.38	-0.19	0.36	0.63	0.88	1.31
log_theta[56]	0.03	0.00	0.23	-0.45	-0.12	0.03	0.19	0.46
log_theta[57]	0.76	0.00	0.28	0.19	0.58	0.78	0.96	1.27
log_theta[58]	-0.22	0.00	0.32	-0.90	-0.43	-0.21	0.00	0.36
log_theta[59]	-0.36	0.00	0.38	-1.16	-0.60	-0.34	-0.09	0.33
log_theta[60]	0.34	0.00	0.36	-0.43	0.12	0.36	0.58	1.02
log_theta[61]	-0.07	0.00	0.36	-0.82	-0.31	-0.06	0.19	0.60
log_theta[62]	-0.17	0.00	0.39	-1.00	-0.43	-0.16	0.12	0.53
log_theta[63]	-0.08	0.00	0.24	-0.57	-0.23	-0.07	0.08	0.37
log_theta[64]	-0.39	0.01	0.45	-1.39	-0.67	-0.36	-0.08	0.45
log_theta[65]	0.10	0.00	0.39	-0.71	-0.16	0.11	0.38	0.81
log_theta[66]	-0.05	0.00	0.29	-0.64	-0.23	-0.04	0.15	0.48
log_theta[67]	-0.03	0.00	0.43	-0.90	-0.32	-0.01	0.28	0.75
log_theta[68]	0.05	0.00	0.41	-0.80	-0.21	0.07	0.34	0.81
log_theta[69]	0.02	0.00	0.24	-0.49	-0.13	0.03	0.18	0.47
log_theta[70]	-0.26	0.01	0.42	-1.15	-0.54	-0.24	0.04	0.50
log_theta[71]	0.00	0.00	0.37	-0.77	-0.23	0.01	0.26	0.68
log_theta[72]	-0.82	0.01	0.55	-1.96	-1.16	-0.79	-0.43	0.17
log_theta[73]	0.57	0.00	0.34	-0.15	0.35	0.58	0.81	1.20
log_theta[74]	-0.49	0.00	0.35	-1.22	-0.72	-0.47	-0.24	0.13
log_theta[75]	0.27	0.00	0.39	-0.54	0.03	0.29	0.54	0.95
log_theta[76]	0.70	0.00	0.29	0.09	0.51	0.71	0.89	1.23
log_theta[77]	-0.04	0.00	0.27	-0.60	-0.21	-0.02	0.15	0.46
log_theta[78]	0.60	0.00	0.24	0.10	0.44	0.60	0.77	1.04
log_theta[79]	0.40	0.01	0.43	-0.49	0.11	0.43	0.70	1.16

log_theta[80]	0.65	0.01	0.44	-0.26	0.37	0.67	0.96	1.46
log_theta[81]	0.21	0.00	0.39	-0.63	-0.05	0.24	0.49	0.91
log_theta[82]	0.62	0.00	0.28	0.03	0.45	0.64	0.82	1.15
log_theta[83]	0.32	0.00	0.31	-0.31	0.12	0.34	0.53	0.89
log_theta[84]	0.90	0.00	0.25	0.37	0.74	0.91	1.07	1.36
log_theta[85]	0.47	0.00	0.30	-0.15	0.28	0.48	0.68	1.02
log_theta[86]	0.21	0.00	0.25	-0.31	0.05	0.22	0.38	0.68
log_theta[87]	0.29	0.00	0.26	-0.25	0.12	0.30	0.47	0.76
log_theta[88]	0.51	0.00	0.23	0.04	0.36	0.52	0.68	0.95
log_theta[89]	0.66	0.01	0.40	-0.20	0.40	0.68	0.94	1.38
log_theta[90]	0.57	0.00	0.29	-0.02	0.38	0.58	0.78	1.09
log_theta[91]	-0.83	0.00	0.38	-1.61	-1.08	-0.81	-0.56	-0.15
log_theta[92]	0.26	0.00	0.35	-0.46	0.03	0.28	0.51	0.91
log_theta[93]	-0.16	0.00	0.17	-0.51	-0.27	-0.16	-0.04	0.17
log_theta[94]	0.58	0.00	0.26	0.05	0.41	0.59	0.76	1.06
log_theta[95]	0.29	0.00	0.26	-0.26	0.12	0.30	0.47	0.78
log_theta[96]	0.39	0.00	0.23	-0.10	0.23	0.40	0.56	0.81
log_theta[97]	0.26	0.00	0.20	-0.15	0.13	0.27	0.40	0.64
log_theta[98]	0.09	0.00	0.27	-0.45	-0.08	0.10	0.27	0.58
log_theta[99]	-0.81	0.01	0.53	-1.91	-1.16	-0.78	-0.44	0.13
log_theta[100]	0.16	0.00	0.12	-0.08	0.08	0.16	0.24	0.38
log_theta[101]	0.35	0.00	0.28	-0.25	0.17	0.37	0.55	0.87
log_theta[102]	0.11	0.00	0.26	-0.43	-0.06	0.12	0.28	0.58
log_theta[103]	0.23	0.00	0.39	-0.59	-0.02	0.25	0.51	0.95
log_theta[104]	-0.01	0.00	0.22	-0.46	-0.15	0.00	0.15	0.42
log_theta[105]	-0.09	0.00	0.34	-0.79	-0.31	-0.07	0.15	0.52
log_theta[106]	-0.11	0.00	0.28	-0.71	-0.29	-0.10	0.07	0.40
log_theta[107]	0.65	0.00	0.32	-0.01	0.43	0.66	0.88	1.22
log_theta[108]	-0.57	0.01	0.49	-1.62	-0.88	-0.54	-0.24	0.30
log_theta[109]	-0.05	0.00	0.29	-0.66	-0.23	-0.04	0.16	0.48
log_theta[110]	-0.46	0.01	0.51	-1.54	-0.79	-0.43	-0.10	0.45
log_theta[111]	-0.01	0.00	0.29	-0.61	-0.20	0.01	0.20	0.52
log_theta[112]	-0.04	0.00	0.27	-0.59	-0.22	-0.03	0.15	0.46
log_theta[113]	-0.20	0.00	0.29	-0.81	-0.37	-0.19	0.00	0.34
log_theta[114]	-0.16	0.00	0.27	-0.71	-0.34	-0.14	0.03	0.34
log_theta[115]	0.02	0.00	0.30	-0.63	-0.17	0.04	0.23	0.56
log_theta[116]	-0.36	0.00	0.41	-1.23	-0.61	-0.33	-0.08	0.38
log_theta[117]	0.03	0.00	0.24	-0.46	-0.12	0.04	0.19	0.47
log_theta[118]	-1.13	0.00	0.30	-1.73	-1.32	-1.12	-0.92	-0.59
log_theta[119]	0.07	0.00	0.21	-0.36	-0.07	0.07	0.21	0.46
log_theta[120]	-0.13	0.01	0.42	-1.01	-0.40	-0.11	0.16	0.63
log_theta[121]	0.22	0.00	0.33	-0.46	0.01	0.24	0.45	0.81
log_theta[122]	-1.17	0.01	0.53	-2.31	-1.50	-1.13	-0.80	-0.22

log_theta[123]	-0.20	0.00	0.30	-0.80	-0.40	-0.18	0.02	0.35
log_theta[124]	-0.57	0.00	0.32	-1.27	-0.77	-0.56	-0.35	0.01
log_theta[125]	0.16	0.00	0.29	-0.45	-0.03	0.18	0.37	0.71
log_theta[126]	-0.28	0.00	0.38	-1.07	-0.53	-0.26	-0.01	0.40
log_theta[127]	-0.28	0.00	0.30	-0.91	-0.47	-0.27	-0.08	0.26
log_theta[128]	-0.09	0.01	0.42	-0.98	-0.36	-0.07	0.21	0.67
log_theta[129]	-0.26	0.00	0.22	-0.70	-0.41	-0.25	-0.10	0.14
log_theta[130]	-0.19	0.00	0.26	-0.73	-0.35	-0.18	-0.01	0.29
log_theta[131]	-0.09	0.01	0.46	-1.08	-0.38	-0.07	0.22	0.74
log_theta[132]	-0.03	0.00	0.34	-0.75	-0.25	-0.01	0.20	0.59
log_theta[133]	-0.14	0.00	0.32	-0.81	-0.35	-0.13	0.07	0.44
log_theta[134]	-0.38	0.00	0.39	-1.20	-0.62	-0.36	-0.11	0.32
log_theta[135]	-0.25	0.01	0.44	-1.19	-0.53	-0.23	0.05	0.54
log_theta[136]	-0.19	0.01	0.46	-1.14	-0.49	-0.16	0.14	0.64
log_theta[137]	-0.91	0.01	0.54	-2.03	-1.28	-0.89	-0.52	0.05
log_theta[138]	0.20	0.00	0.29	-0.41	0.02	0.21	0.40	0.74
log_theta[139]	-0.07	0.00	0.28	-0.64	-0.25	-0.05	0.12	0.44
log_theta[140]	0.20	0.00	0.29	-0.41	0.01	0.21	0.41	0.75
log_theta[141]	-0.12	0.00	0.32	-0.80	-0.32	-0.10	0.10	0.46
log_theta[142]	0.08	0.00	0.37	-0.70	-0.16	0.10	0.33	0.75
log_theta[143]	-0.31	0.00	0.36	-1.07	-0.53	-0.29	-0.06	0.36
log_theta[144]	-0.23	0.00	0.34	-0.94	-0.44	-0.21	0.00	0.38
log_theta[145]	0.20	0.00	0.30	-0.40	0.02	0.21	0.40	0.76
log_theta[146]	-0.20	0.00	0.29	-0.80	-0.39	-0.18	0.01	0.35
log_theta[147]	0.24	0.00	0.21	-0.19	0.10	0.25	0.38	0.64
log_theta[148]	-0.41	0.00	0.36	-1.15	-0.66	-0.40	-0.15	0.25
log_theta[149]	0.73	0.00	0.26	0.20	0.56	0.74	0.91	1.20
log_theta[150]	-0.70	0.00	0.15	-0.99	-0.80	-0.70	-0.60	-0.41
log_theta[151]	-0.47	0.00	0.32	-1.14	-0.67	-0.47	-0.25	0.11
log_theta[152]	0.12	0.00	0.22	-0.32	-0.03	0.13	0.28	0.53
log_theta[153]	0.61	0.00	0.29	0.01	0.42	0.62	0.81	1.13
log_theta[154]	0.35	0.00	0.27	-0.18	0.18	0.36	0.54	0.84
log_theta[155]	-0.12	0.00	0.26	-0.67	-0.29	-0.11	0.06	0.37
log_theta[156]	-0.29	0.00	0.26	-0.86	-0.46	-0.28	-0.11	0.18
log_theta[157]	-0.58	0.01	0.49	-1.63	-0.89	-0.55	-0.23	0.30
log_theta[158]	-0.71	0.00	0.32	-1.38	-0.91	-0.69	-0.48	-0.14
log_theta[159]	0.08	0.00	0.24	-0.41	-0.08	0.09	0.25	0.55
log_theta[160]	-0.29	0.00	0.39	-1.13	-0.52	-0.27	-0.02	0.44
log_theta[161]	-0.15	0.00	0.27	-0.70	-0.33	-0.14	0.03	0.34
log_theta[162]	-0.22	0.00	0.27	-0.79	-0.40	-0.21	-0.03	0.25
log_theta[163]	-0.11	0.00	0.29	-0.71	-0.29	-0.10	0.09	0.42
log_theta[164]	0.02	0.00	0.34	-0.70	-0.20	0.03	0.25	0.64
log_theta[165]	-0.32	0.00	0.29	-0.94	-0.50	-0.31	-0.13	0.22

log_theta[166]	-0.34	0.00	0.42	-1.24	-0.61	-0.32	-0.04	0.42
log_theta[167]	0.37	0.00	0.32	-0.31	0.16	0.39	0.61	0.95
log_theta[168]	-0.24	0.00	0.33	-0.95	-0.46	-0.23	-0.01	0.37
log_theta[169]	-1.50	0.00	0.20	-1.92	-1.63	-1.49	-1.35	-1.11
log_theta[170]	0.11	0.00	0.33	-0.56	-0.09	0.13	0.33	0.71
log_theta[171]	-0.75	0.01	0.54	-1.92	-1.09	-0.72	-0.38	0.20
log_theta[172]	0.22	0.00	0.31	-0.44	0.02	0.23	0.43	0.78
log_theta[173]	-0.32	0.00	0.40	-1.15	-0.58	-0.30	-0.04	0.39
log_theta[174]	-0.28	0.00	0.30	-0.91	-0.48	-0.27	-0.07	0.27
log_theta[175]	-0.46	0.00	0.27	-1.02	-0.64	-0.46	-0.27	0.04
log_theta[176]	-0.35	0.00	0.31	-1.01	-0.54	-0.33	-0.14	0.23
log_theta[177]	0.54	0.00	0.31	-0.11	0.34	0.55	0.74	1.10
log_theta[178]	-0.70	0.00	0.18	-1.04	-0.82	-0.69	-0.57	-0.38
log_theta[179]	-0.54	0.01	0.41	-1.41	-0.80	-0.52	-0.26	0.18
log_theta[180]	-0.14	0.00	0.30	-0.74	-0.33	-0.12	0.07	0.39
log_theta[181]	-0.25	0.00	0.32	-0.89	-0.45	-0.23	-0.04	0.33
log_theta[182]	-0.28	0.00	0.28	-0.86	-0.46	-0.27	-0.08	0.24
log_theta[183]	-0.01	0.00	0.30	-0.63	-0.20	0.00	0.20	0.55
log_theta[184]	-1.71	0.01	0.65	-3.04	-2.12	-1.68	-1.24	-0.57
log_theta[185]	-0.17	0.00	0.33	-0.88	-0.38	-0.16	0.06	0.42
log_theta[186]	-0.73	0.01	0.47	-1.74	-1.03	-0.71	-0.40	0.14
log_theta[187]	-0.35	0.00	0.28	-0.94	-0.54	-0.34	-0.16	0.16
log_theta[188]	0.06	0.00	0.30	-0.56	-0.12	0.07	0.27	0.61
log_theta[189]	0.18	0.00	0.30	-0.43	-0.01	0.19	0.39	0.72
log_theta[190]	-0.53	0.00	0.41	-1.40	-0.78	-0.51	-0.24	0.21
log_theta[191]	-0.45	0.01	0.46	-1.43	-0.75	-0.43	-0.14	0.36
log_theta[192]	-0.45	0.00	0.34	-1.15	-0.67	-0.43	-0.21	0.17
log_theta[193]	-0.05	0.00	0.32	-0.73	-0.25	-0.04	0.17	0.54
log_theta[194]	-0.52	0.00	0.18	-0.89	-0.63	-0.51	-0.40	-0.17
log_theta[195]	-0.96	0.00	0.09	-1.15	-1.03	-0.96	-0.90	-0.78
lp__	3898.30	0.25	9.90	3877.67	3891.82	3898.91	3905.13	3916.39

	n_eff	Rhat
alpha[1]	6876	1
alpha[2]	6564	1
alpha[3]	2049	1
alpha[4]	5876	1
alpha[5]	3731	1
alpha[6]	2948	1
alpha[7]	1586	1
alpha[8]	2187	1
alpha[9]	5677	1
alpha[10]	7981	1
alpha[11]	6280	1

```
alpha[12]       3797    1
alpha[13]       6559    1
alpha[14]       4681    1
alpha[15]       5277    1
alpha[16]       5919    1
alpha[17]       5385    1
alpha[18]       6978    1
alpha[19]       1878    1
alpha[20]       6572    1
alpha[21]       2931    1
alpha[22]       3582    1
alpha[23]       4646    1
alpha[24]       6177    1
alpha[25]       2229    1
alpha[26]       6705    1
alpha[27]       5213    1
alpha[28]       4497    1
alpha[29]       5928    1
alpha[30]       2460    1
alpha[31]       5186    1
alpha[32]       6329    1
alpha[33]       6672    1
alpha[34]       5074    1
alpha[35]       6000    1
alpha[36]       1833    1
alpha[37]       7396    1
alpha[38]       5581    1
alpha[39]       5873    1
alpha[40]       3816    1
alpha[41]       7299    1
alpha[42]       5529    1
alpha[43]       5881    1
alpha[44]       6407    1
alpha[45]       6793    1
alpha[46]       3121    1
alpha[47]       5605    1
alpha[48]       7530    1
alpha[49]       6169    1
alpha[50]       7523    1
alpha[51]       3385    1
alpha[52]       4629    1
alpha[53]       7789    1
alpha[54]       5741    1
```

```
alpha[55]       6843    1
alpha[56]       7270    1
alpha[57]       5247    1
alpha[58]       4053    1
alpha[59]       6736    1
alpha[60]       5887    1
alpha[61]       7836    1
alpha[62]       7759    1
alpha[63]       6147    1
alpha[64]       6733    1
alpha[65]       6740    1
alpha[66]       5358    1
alpha[67]       6313    1
alpha[68]       7934    1
alpha[69]       3300    1
alpha[70]       6079    1
alpha[71]       5021    1
alpha[72]       6783    1
alpha[73]       5217    1
alpha[74]       5826    1
alpha[75]       7082    1
alpha[76]       5973    1
alpha[77]       6834    1
alpha[78]       7513    1
alpha[79]       6345    1
alpha[80]       6515    1
alpha[81]       6182    1
alpha[82]       7694    1
alpha[83]       7652    1
alpha[84]       2683    1
alpha[85]       5744    1
alpha[86]       5920    1
alpha[87]       5402    1
alpha[88]       7110    1
alpha[89]       5836    1
alpha[90]       6191    1
alpha[91]       5912    1
alpha[92]       5770    1
alpha[93]       2203    1
alpha[94]       7870    1
alpha[95]       7079    1
alpha[96]       6624    1
alpha[97]       4080    1
```

```
alpha[98]       7494    1
alpha[99]       6723    1
alpha[100]      1643    1
alpha[101]      7098    1
alpha[102]      7596    1
alpha[103]      6742    1
alpha[104]      4715    1
alpha[105]      7695    1
alpha[106]      4941    1
alpha[107]      5237    1
alpha[108]      7034    1
alpha[109]      6845    1
alpha[110]      6557    1
alpha[111]      5858    1
alpha[112]      6230    1
alpha[113]      5420    1
alpha[114]      4457    1
alpha[115]      6792    1
alpha[116]      6568    1
alpha[117]      5015    1
alpha[118]      4965    1
alpha[119]      4718    1
alpha[120]      6704    1
alpha[121]      5372    1
alpha[122]      5939    1
alpha[123]      7456    1
alpha[124]      6087    1
alpha[125]      7885    1
alpha[126]      6357    1
alpha[127]      5383    1
alpha[128]      6153    1
alpha[129]      7560    1
alpha[130]      6904    1
alpha[131]      6637    1
alpha[132]      7195    1
alpha[133]      5629    1
alpha[134]      6201    1
alpha[135]      6886    1
alpha[136]      6924    1
alpha[137]      6787    1
alpha[138]      5475    1
alpha[139]      6409    1
alpha[140]      7362    1
```

```
alpha[141]      5673    1
alpha[142]      5699    1
alpha[143]      7618    1
alpha[144]      5401    1
alpha[145]      5763    1
alpha[146]      5896    1
alpha[147]      4965    1
alpha[148]      6944    1
alpha[149]      7685    1
alpha[150]      3826    1
alpha[151]      6184    1
alpha[152]      3978    1
alpha[153]      7385    1
alpha[154]      7893    1
alpha[155]      5099    1
alpha[156]      6179    1
alpha[157]      8234    1
alpha[158]      4984    1
alpha[159]      4497    1
alpha[160]      7832    1
alpha[161]      5216    1
alpha[162]      5400    1
alpha[163]      5086    1
alpha[164]      7560    1
alpha[165]      7386    1
alpha[166]      7429    1
alpha[167]      8540    1
alpha[168]      6427    1
alpha[169]      5178    1
alpha[170]      6773    1
alpha[171]      6810    1
alpha[172]      6885    1
alpha[173]      8223    1
alpha[174]      6027    1
alpha[175]      5110    1
alpha[176]      5142    1
alpha[177]      6778    1
alpha[178]      3712    1
alpha[179]      6350    1
alpha[180]      6383    1
alpha[181]      6429    1
alpha[182]      4713    1
alpha[183]      6126    1
```

```
alpha[184]      6201    1
alpha[185]      5976    1
alpha[186]      6928    1
alpha[187]      6238    1
alpha[188]      5082    1
alpha[189]      8039    1
alpha[190]      5429    1
alpha[191]      6467    1
alpha[192]      5736    1
alpha[193]      6001    1
alpha[194]      5088    1
alpha[195]      1144    1
beta             698    1
log_theta[1]    7352    1
log_theta[2]    7585    1
log_theta[3]    7713    1
log_theta[4]    6984    1
log_theta[5]    7831    1
log_theta[6]    8368    1
log_theta[7]    8001    1
log_theta[8]    8320    1
log_theta[9]    7010    1
log_theta[10]   8023    1
log_theta[11]   6758    1
log_theta[12]   7356    1
log_theta[13]   8118    1
log_theta[14]   7193    1
log_theta[15]   5792    1
log_theta[16]   8833    1
log_theta[17]   7809    1
log_theta[18]   7105    1
log_theta[19]   8929    1
log_theta[20]   7302    1
log_theta[21]   7038    1
log_theta[22]   7250    1
log_theta[23]   8666    1
log_theta[24]   6767    1
log_theta[25]   8035    1
log_theta[26]   6895    1
log_theta[27]   7691    1
log_theta[28]   8499    1
log_theta[29]   6783    1
log_theta[30]   8343    1
```

```
log_theta[31]   7084    1
log_theta[32]   7668    1
log_theta[33]   7683    1
log_theta[34]   5507    1
log_theta[35]   7499    1
log_theta[36]   8506    1
log_theta[37]   8196    1
log_theta[38]   6911    1
log_theta[39]   7473    1
log_theta[40]   6714    1
log_theta[41]   7297    1
log_theta[42]   5572    1
log_theta[43]   8136    1
log_theta[44]   6578    1
log_theta[45]   6877    1
log_theta[46]   7836    1
log_theta[47]   7754    1
log_theta[48]   7623    1
log_theta[49]   7241    1
log_theta[50]   8252    1
log_theta[51]   9439    1
log_theta[52]   7116    1
log_theta[53]   8164    1
log_theta[54]   6775    1
log_theta[55]   7453    1
log_theta[56]   8945    1
log_theta[57]   6204    1
log_theta[58]   9008    1
log_theta[59]   7030    1
log_theta[60]   8541    1
log_theta[61]   7838    1
log_theta[62]   7792    1
log_theta[63]   6860    1
log_theta[64]   6710    1
log_theta[65]   7692    1
log_theta[66]   6692    1
log_theta[67]   8409    1
log_theta[68]   8138    1
log_theta[69]   6863    1
log_theta[70]   6901    1
log_theta[71]   6133    1
log_theta[72]   7519    1
log_theta[73]   5973    1
```

```
log_theta[74]   9507    1
log_theta[75]   7087    1
log_theta[76]   7811    1
log_theta[77]   6987    1
log_theta[78]   7519    1
log_theta[79]   6725    1
log_theta[80]   6862    1
log_theta[81]   7546    1
log_theta[82]   7738    1
log_theta[83]   7715    1
log_theta[84]   7121    1
log_theta[85]   8960    1
log_theta[86]   7895    1
log_theta[87]   6930    1
log_theta[88]   7078    1
log_theta[89]   5976    1
log_theta[90]   6874    1
log_theta[91]   7068    1
log_theta[92]   6785    1
log_theta[93]   7836    1
log_theta[94]   8199    1
log_theta[95]   7246    1
log_theta[96]   7743    1
log_theta[97]   7630    1
log_theta[98]   8693    1
log_theta[99]   6769    1
log_theta[100]  8905    1
log_theta[101]  7410    1
log_theta[102]  8130    1
log_theta[103]  6862    1
log_theta[104]  9511    1
log_theta[105]  7818    1
log_theta[106]  6415    1
log_theta[107]  7141    1
log_theta[108]  7235    1
log_theta[109]  7243    1
log_theta[110]  6813    1
log_theta[111]  7409    1
log_theta[112]  7702    1
log_theta[113]  6782    1
log_theta[114]  8140    1
log_theta[115]  7591    1
log_theta[116]  6973    1
```

```
log_theta[117]  7820    1
log_theta[118]  8658    1
log_theta[119]  8352    1
log_theta[120]  6669    1
log_theta[121]  6231    1
log_theta[122]  6222    1
log_theta[123]  8072    1
log_theta[124]  6467    1
log_theta[125]  7859    1
log_theta[126]  6391    1
log_theta[127]  7298    1
log_theta[128]  6056    1
log_theta[129]  7602    1
log_theta[130]  7014    1
log_theta[131]  6724    1
log_theta[132]  7435    1
log_theta[133]  7205    1
log_theta[134]  6620    1
log_theta[135]  6890    1
log_theta[136]  6993    1
log_theta[137]  6843    1
log_theta[138]  7881    1
log_theta[139]  8097    1
log_theta[140]  7345    1
log_theta[141]  7922    1
log_theta[142]  7256    1
log_theta[143]  7696    1
log_theta[144]  7069    1
log_theta[145]  7727    1
log_theta[146]  7261    1
log_theta[147]  6506    1
log_theta[148]  7840    1
log_theta[149]  7779    1
log_theta[150]  9323    1
log_theta[151]  7438    1
log_theta[152]  9098    1
log_theta[153]  7872    1
log_theta[154]  8304    1
log_theta[155]  6290    1
log_theta[156]  6879    1
log_theta[157]  8240    1
log_theta[158]  7193    1
log_theta[159]  7834    1
```

```
log_theta[160]  8270    1
log_theta[161]  7635    1
log_theta[162]  8390    1
log_theta[163]  7169    1
log_theta[164]  7549    1
log_theta[165]  8007    1
log_theta[166]  7420    1
log_theta[167]  8545    1
log_theta[168]  6785    1
log_theta[169]  8476    1
log_theta[170]  7269    1
log_theta[171]  6809    1
log_theta[172]  7243    1
log_theta[173]  8169    1
log_theta[174]  8296    1
log_theta[175]  9187    1
log_theta[176]  7088    1
log_theta[177]  6808    1
log_theta[178]  8661    1
log_theta[179]  6576    1
log_theta[180]  8294    1
log_theta[181] 10012    1
log_theta[182]  8240    1
log_theta[183]  7273    1
log_theta[184]  6396    1
log_theta[185]  7151    1
log_theta[186]  7077    1
log_theta[187]  7491    1
log_theta[188]  8158    1
log_theta[189]  8181    1
log_theta[190]  7082    1
log_theta[191]  7335    1
log_theta[192]  8320    1
log_theta[193]  7378    1
log_theta[194]  8145    1
log_theta[195]  7477    1
lp__            1617    1

Samples were drawn using NUTS(diag_e) at Wed Mar 15 17:50:40 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

```
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)
                  )
```

```
mod3lab9 <- stan(data = stan_data, file = here("code/models/lab9_3.stan"))
```

```
SAMPLING FOR MODEL 'anon_model' NOW (CHAIN 1).
Chain 1:
Chain 1: Gradient evaluation took 3.8e-05 seconds
Chain 1: 1000 transitions using 10 leapfrog steps per transition would take 0.38 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: 0.259 seconds (Warm-up)
Chain 1:                0.241 seconds (Sampling)
Chain 1:                0.5 seconds (Total)
Chain 1:

SAMPLING FOR MODEL 'anon_model' NOW (CHAIN 2).
```

```
Chain 2:
Chain 2: Gradient evaluation took 1.5e-05 seconds
Chain 2: 1000 transitions using 10 leapfrog steps per transition would take 0.15 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: 0.266 seconds (Warm-up)
Chain 2:                0.247 seconds (Sampling)
Chain 2:                0.513 seconds (Total)
Chain 2:

SAMPLING FOR MODEL 'anon_model' 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: 0.276 seconds (Warm-up)
Chain 3:                0.246 seconds (Sampling)
Chain 3:                0.522 seconds (Total)
Chain 3:

SAMPLING FOR MODEL 'anon_model' NOW (CHAIN 4).
Chain 4:
Chain 4: Gradient evaluation took 2e-05 seconds
Chain 4: 1000 transitions using 10 leapfrog steps per transition would take 0.2 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: 0.277 seconds (Warm-up)
Chain 4:                0.249 seconds (Sampling)
Chain 4:                0.526 seconds (Total)
Chain 4:
```

```
mod3lab9
```

```
Inference for Stan model: anon_model.
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    0.38
alpha[2]        0.22    0.00  0.23   -0.25    0.07    0.22    0.38    0.64
alpha[3]        0.34    0.00  0.22   -0.10    0.19    0.34    0.48    0.74
alpha[4]       -0.14    0.00  0.27   -0.67   -0.33   -0.13    0.05    0.38
```

alpha[5]	0.33	0.00	0.25	-0.17	0.17	0.34	0.51	0.81
alpha[6]	-0.61	0.00	0.20	-1.00	-0.73	-0.60	-0.47	-0.23
alpha[7]	0.34	0.00	0.19	-0.04	0.21	0.34	0.46	0.70
alpha[8]	-0.44	0.00	0.23	-0.90	-0.59	-0.44	-0.27	0.01
alpha[9]	0.58	0.00	0.24	0.09	0.42	0.58	0.74	1.03
alpha[10]	0.63	0.00	0.21	0.21	0.49	0.63	0.78	1.03
alpha[11]	-0.01	0.00	0.30	-0.62	-0.21	-0.01	0.19	0.56
alpha[12]	0.51	0.00	0.26	-0.02	0.34	0.52	0.69	1.02
alpha[13]	0.03	0.00	0.24	-0.46	-0.13	0.04	0.20	0.49
alpha[14]	0.51	0.00	0.20	0.12	0.38	0.51	0.65	0.89
alpha[15]	0.26	0.00	0.24	-0.22	0.11	0.27	0.43	0.71
alpha[16]	0.62	0.00	0.25	0.12	0.46	0.63	0.79	1.10
alpha[17]	0.74	0.00	0.23	0.26	0.58	0.74	0.89	1.19
alpha[18]	0.48	0.00	0.20	0.08	0.35	0.49	0.62	0.88
alpha[19]	-0.02	0.00	0.19	-0.38	-0.14	-0.01	0.11	0.34
alpha[20]	0.28	0.00	0.29	-0.31	0.09	0.29	0.49	0.85
alpha[21]	0.53	0.00	0.26	0.01	0.35	0.53	0.71	1.03
alpha[22]	0.79	0.00	0.22	0.36	0.65	0.80	0.94	1.21
alpha[23]	0.31	0.00	0.24	-0.19	0.15	0.31	0.48	0.77
alpha[24]	-0.02	0.00	0.29	-0.62	-0.21	-0.02	0.17	0.53
alpha[25]	0.19	0.00	0.21	-0.24	0.05	0.19	0.33	0.60
alpha[26]	0.66	0.00	0.22	0.21	0.51	0.66	0.81	1.08
alpha[27]	0.47	0.00	0.24	-0.01	0.31	0.47	0.63	0.92
alpha[28]	0.58	0.00	0.23	0.15	0.43	0.59	0.74	1.00
alpha[29]	0.02	0.00	0.32	-0.62	-0.19	0.03	0.24	0.63
alpha[30]	0.34	0.00	0.27	-0.20	0.17	0.34	0.52	0.85
alpha[31]	0.13	0.00	0.27	-0.43	-0.04	0.14	0.32	0.66
alpha[32]	-0.20	0.00	0.30	-0.79	-0.40	-0.19	0.01	0.36
alpha[33]	0.52	0.00	0.25	0.02	0.36	0.53	0.69	1.01
alpha[34]	0.29	0.00	0.24	-0.20	0.13	0.29	0.46	0.76
alpha[35]	-0.01	0.00	0.27	-0.55	-0.20	0.00	0.17	0.49
alpha[36]	-0.41	0.00	0.20	-0.81	-0.54	-0.40	-0.27	-0.01
alpha[37]	0.43	0.00	0.24	-0.04	0.27	0.44	0.60	0.87
alpha[38]	-0.04	0.00	0.27	-0.58	-0.22	-0.04	0.14	0.46
alpha[39]	-0.04	0.00	0.25	-0.54	-0.20	-0.03	0.13	0.42
alpha[40]	0.28	0.00	0.26	-0.24	0.10	0.29	0.46	0.79
alpha[41]	-0.16	0.00	0.29	-0.75	-0.35	-0.15	0.03	0.38
alpha[42]	-0.11	0.00	0.25	-0.62	-0.27	-0.10	0.07	0.37
alpha[43]	0.08	0.00	0.24	-0.41	-0.07	0.09	0.25	0.52
alpha[44]	-0.09	0.00	0.22	-0.53	-0.24	-0.09	0.06	0.34
alpha[45]	0.71	0.00	0.21	0.29	0.57	0.71	0.85	1.10
alpha[46]	-0.17	0.00	0.20	-0.58	-0.29	-0.16	-0.03	0.21
alpha[47]	0.35	0.00	0.24	-0.14	0.19	0.36	0.52	0.82

alpha[48]	0.45	0.00	0.29	-0.12	0.26	0.46	0.65	1.01
alpha[49]	0.12	0.00	0.23	-0.33	-0.03	0.13	0.28	0.55
alpha[50]	0.07	0.00	0.24	-0.41	-0.09	0.07	0.23	0.51
alpha[51]	-0.28	0.00	0.22	-0.72	-0.43	-0.27	-0.12	0.15
alpha[52]	0.04	0.00	0.23	-0.40	-0.11	0.05	0.21	0.47
alpha[53]	-0.22	0.00	0.27	-0.76	-0.40	-0.21	-0.03	0.29
alpha[54]	0.74	0.00	0.25	0.26	0.58	0.74	0.91	1.22
alpha[55]	0.32	0.00	0.28	-0.24	0.14	0.32	0.51	0.85
alpha[56]	-0.06	0.00	0.20	-0.48	-0.19	-0.06	0.08	0.33
alpha[57]	0.65	0.00	0.25	0.15	0.48	0.65	0.82	1.13
alpha[58]	-0.35	0.00	0.24	-0.84	-0.51	-0.35	-0.19	0.09
alpha[59]	-0.07	0.00	0.28	-0.64	-0.25	-0.06	0.12	0.44
alpha[60]	0.39	0.00	0.29	-0.18	0.20	0.40	0.59	0.94
alpha[61]	0.01	0.00	0.26	-0.51	-0.16	0.02	0.19	0.52
alpha[62]	0.02	0.00	0.29	-0.55	-0.17	0.02	0.21	0.56
alpha[63]	-0.10	0.00	0.20	-0.52	-0.23	-0.10	0.04	0.28
alpha[64]	-0.09	0.00	0.29	-0.65	-0.27	-0.08	0.11	0.46
alpha[65]	0.20	0.00	0.29	-0.41	0.01	0.21	0.40	0.74
alpha[66]	0.13	0.00	0.23	-0.35	-0.03	0.13	0.29	0.57
alpha[67]	0.18	0.00	0.31	-0.45	-0.02	0.18	0.39	0.76
alpha[68]	0.04	0.00	0.29	-0.56	-0.15	0.05	0.25	0.59
alpha[69]	-0.16	0.00	0.20	-0.56	-0.29	-0.16	-0.03	0.22
alpha[70]	0.07	0.00	0.30	-0.53	-0.13	0.07	0.27	0.64
alpha[71]	0.16	0.00	0.28	-0.41	-0.03	0.17	0.34	0.68
alpha[72]	-0.17	0.00	0.31	-0.80	-0.38	-0.17	0.04	0.43
alpha[73]	0.30	0.00	0.26	-0.22	0.12	0.30	0.48	0.79
alpha[74]	-0.41	0.00	0.24	-0.90	-0.57	-0.40	-0.25	0.04
alpha[75]	0.20	0.00	0.30	-0.40	0.01	0.21	0.41	0.78
alpha[76]	0.40	0.00	0.25	-0.10	0.24	0.41	0.57	0.86
alpha[77]	-0.03	0.00	0.22	-0.48	-0.18	-0.03	0.13	0.38
alpha[78]	0.50	0.00	0.21	0.07	0.36	0.51	0.65	0.91
alpha[79]	0.21	0.00	0.30	-0.40	0.01	0.21	0.41	0.79
alpha[80]	0.30	0.00	0.31	-0.30	0.08	0.30	0.51	0.89
alpha[81]	0.04	0.00	0.28	-0.50	-0.15	0.05	0.23	0.56
alpha[82]	0.48	0.00	0.25	0.00	0.32	0.48	0.64	0.95
alpha[83]	0.28	0.00	0.25	-0.23	0.11	0.29	0.45	0.74
alpha[84]	0.42	0.00	0.23	-0.04	0.27	0.42	0.58	0.86
alpha[85]	0.21	0.00	0.26	-0.29	0.05	0.22	0.39	0.71
alpha[86]	0.30	0.00	0.22	-0.15	0.16	0.31	0.45	0.73
alpha[87]	0.34	0.00	0.22	-0.10	0.19	0.34	0.49	0.75
alpha[88]	0.42	0.00	0.21	0.00	0.28	0.42	0.56	0.80
alpha[89]	0.42	0.00	0.32	-0.20	0.21	0.43	0.63	1.02
alpha[90]	0.34	0.00	0.25	-0.17	0.16	0.34	0.51	0.83

alpha[91]	-0.33	0.00	0.25	-0.85	-0.49	-0.32	-0.16	0.16
alpha[92]	0.09	0.00	0.26	-0.45	-0.08	0.10	0.27	0.59
alpha[93]	0.14	0.00	0.17	-0.20	0.02	0.14	0.25	0.46
alpha[94]	0.48	0.00	0.23	0.03	0.33	0.49	0.64	0.91
alpha[95]	0.29	0.00	0.23	-0.19	0.14	0.29	0.45	0.72
alpha[96]	0.41	0.00	0.22	-0.02	0.26	0.42	0.57	0.81
alpha[97]	0.41	0.00	0.19	0.03	0.29	0.42	0.54	0.77
alpha[98]	0.18	0.00	0.23	-0.29	0.04	0.18	0.33	0.62
alpha[99]	-0.23	0.00	0.31	-0.86	-0.44	-0.23	-0.02	0.34
alpha[100]	-0.11	0.00	0.12	-0.37	-0.20	-0.11	-0.03	0.11
alpha[101]	0.33	0.00	0.23	-0.14	0.18	0.33	0.48	0.76
alpha[102]	0.17	0.00	0.21	-0.26	0.03	0.17	0.32	0.58
alpha[103]	0.15	0.00	0.28	-0.40	-0.03	0.16	0.34	0.69
alpha[104]	0.18	0.00	0.19	-0.21	0.06	0.19	0.32	0.55
alpha[105]	0.05	0.00	0.26	-0.46	-0.12	0.05	0.22	0.53
alpha[106]	0.07	0.00	0.23	-0.38	-0.08	0.07	0.22	0.49
alpha[107]	0.33	0.00	0.27	-0.20	0.15	0.34	0.52	0.83
alpha[108]	-0.17	0.00	0.29	-0.75	-0.36	-0.16	0.04	0.38
alpha[109]	0.07	0.00	0.24	-0.42	-0.09	0.07	0.23	0.50
alpha[110]	-0.07	0.00	0.30	-0.69	-0.28	-0.06	0.14	0.50
alpha[111]	0.16	0.00	0.24	-0.32	0.00	0.17	0.34	0.62
alpha[112]	0.09	0.00	0.23	-0.36	-0.06	0.10	0.24	0.52
alpha[113]	0.03	0.00	0.23	-0.44	-0.13	0.04	0.19	0.46
alpha[114]	0.12	0.00	0.24	-0.36	-0.04	0.13	0.28	0.58
alpha[115]	0.14	0.00	0.25	-0.37	-0.03	0.14	0.31	0.63
alpha[116]	-0.06	0.00	0.28	-0.61	-0.25	-0.06	0.13	0.45
alpha[117]	0.18	0.00	0.21	-0.25	0.04	0.18	0.32	0.57
alpha[118]	-0.95	0.00	0.21	-1.37	-1.09	-0.94	-0.80	-0.55
alpha[119]	0.21	0.00	0.19	-0.16	0.09	0.22	0.35	0.56
alpha[120]	0.03	0.00	0.28	-0.53	-0.16	0.03	0.23	0.56
alpha[121]	0.10	0.00	0.25	-0.41	-0.06	0.10	0.27	0.57
alpha[122]	-0.40	0.00	0.29	-1.00	-0.59	-0.40	-0.20	0.13
alpha[123]	-0.02	0.00	0.23	-0.49	-0.18	-0.02	0.14	0.43
alpha[124]	-0.26	0.00	0.24	-0.76	-0.41	-0.25	-0.10	0.18
alpha[125]	0.15	0.00	0.24	-0.33	0.00	0.16	0.32	0.60
alpha[126]	-0.13	0.00	0.27	-0.69	-0.31	-0.12	0.06	0.39
alpha[127]	-0.30	0.00	0.22	-0.76	-0.45	-0.29	-0.14	0.11
alpha[128]	0.04	0.00	0.30	-0.58	-0.17	0.04	0.25	0.60
alpha[129]	-0.19	0.00	0.19	-0.58	-0.32	-0.19	-0.06	0.16
alpha[130]	-0.12	0.00	0.21	-0.55	-0.26	-0.12	0.02	0.28
alpha[131]	0.05	0.00	0.30	-0.55	-0.15	0.06	0.25	0.61
alpha[132]	0.06	0.00	0.26	-0.48	-0.12	0.07	0.24	0.55
alpha[133]	0.06	0.00	0.25	-0.43	-0.10	0.06	0.23	0.54

alpha[134]	-0.04	0.00	0.27	-0.58	-0.22	-0.03	0.15	0.48
alpha[135]	-0.08	0.00	0.30	-0.68	-0.28	-0.07	0.14	0.49
alpha[136]	0.02	0.00	0.31	-0.60	-0.18	0.03	0.24	0.61
alpha[137]	-0.28	0.00	0.31	-0.92	-0.48	-0.27	-0.06	0.30
alpha[138]	0.31	0.00	0.25	-0.21	0.14	0.31	0.48	0.78
alpha[139]	0.07	0.00	0.24	-0.42	-0.08	0.08	0.24	0.53
alpha[140]	0.21	0.00	0.24	-0.28	0.05	0.22	0.38	0.66
alpha[141]	0.14	0.00	0.26	-0.39	-0.03	0.14	0.31	0.61
alpha[142]	0.23	0.00	0.30	-0.35	0.04	0.23	0.44	0.80
alpha[143]	-0.10	0.00	0.26	-0.63	-0.26	-0.09	0.08	0.40
alpha[144]	0.05	0.00	0.26	-0.50	-0.12	0.05	0.22	0.54
alpha[145]	0.33	0.00	0.24	-0.14	0.17	0.33	0.50	0.78
alpha[146]	0.04	0.00	0.25	-0.46	-0.12	0.05	0.22	0.51
alpha[147]	0.32	0.00	0.19	-0.07	0.20	0.33	0.45	0.68
alpha[148]	-0.09	0.00	0.25	-0.61	-0.26	-0.09	0.08	0.39
alpha[149]	0.59	0.00	0.23	0.11	0.44	0.59	0.74	1.02
alpha[150]	-0.49	0.00	0.13	-0.75	-0.57	-0.48	-0.40	-0.24
alpha[151]	-0.14	0.00	0.24	-0.63	-0.30	-0.14	0.02	0.31
alpha[152]	-0.07	0.00	0.20	-0.47	-0.21	-0.06	0.07	0.32
alpha[153]	0.37	0.00	0.25	-0.15	0.20	0.37	0.54	0.84
alpha[154]	0.32	0.00	0.24	-0.17	0.16	0.32	0.49	0.77
alpha[155]	0.06	0.00	0.22	-0.41	-0.08	0.07	0.21	0.49
alpha[156]	-0.12	0.00	0.22	-0.56	-0.27	-0.11	0.04	0.28
alpha[157]	-0.21	0.00	0.30	-0.84	-0.41	-0.20	-0.01	0.37
alpha[158]	-0.29	0.00	0.24	-0.77	-0.44	-0.28	-0.12	0.16
alpha[159]	0.23	0.00	0.22	-0.22	0.08	0.24	0.38	0.64
alpha[160]	-0.03	0.00	0.28	-0.57	-0.21	-0.02	0.17	0.49
alpha[161]	0.08	0.00	0.23	-0.39	-0.07	0.08	0.23	0.51
alpha[162]	0.01	0.00	0.22	-0.44	-0.13	0.02	0.16	0.42
alpha[163]	0.10	0.00	0.24	-0.38	-0.06	0.10	0.26	0.55
alpha[164]	0.06	0.00	0.26	-0.45	-0.10	0.07	0.24	0.54
alpha[165]	-0.12	0.00	0.22	-0.57	-0.26	-0.11	0.04	0.31
alpha[166]	-0.12	0.00	0.28	-0.70	-0.31	-0.12	0.06	0.41
alpha[167]	0.28	0.00	0.27	-0.26	0.09	0.28	0.47	0.79
alpha[168]	-0.06	0.00	0.25	-0.58	-0.22	-0.06	0.11	0.42
alpha[169]	-1.08	0.00	0.17	-1.44	-1.19	-1.07	-0.96	-0.75
alpha[170]	0.06	0.00	0.25	-0.45	-0.11	0.06	0.23	0.54
alpha[171]	-0.24	0.00	0.30	-0.86	-0.44	-0.23	-0.03	0.34
alpha[172]	0.14	0.00	0.24	-0.34	-0.01	0.15	0.31	0.61
alpha[173]	-0.08	0.00	0.27	-0.64	-0.26	-0.08	0.11	0.43
alpha[174]	0.01	0.00	0.24	-0.48	-0.16	0.01	0.18	0.46
alpha[175]	-0.10	0.00	0.23	-0.57	-0.25	-0.09	0.07	0.34
alpha[176]	-0.02	0.00	0.25	-0.54	-0.19	-0.01	0.16	0.45

alpha[177]	0.40	0.00	0.26	-0.13	0.23	0.40	0.57	0.89
alpha[178]	-0.43	0.00	0.16	-0.74	-0.53	-0.42	-0.32	-0.13
alpha[179]	-0.16	0.00	0.27	-0.71	-0.34	-0.16	0.03	0.36
alpha[180]	0.07	0.00	0.24	-0.43	-0.08	0.08	0.24	0.53
alpha[181]	0.02	0.00	0.26	-0.52	-0.15	0.02	0.20	0.51
alpha[182]	0.01	0.00	0.23	-0.46	-0.15	0.02	0.17	0.44
alpha[183]	0.13	0.00	0.24	-0.36	-0.03	0.13	0.29	0.60
alpha[184]	-0.46	0.00	0.31	-1.10	-0.67	-0.45	-0.24	0.13
alpha[185]	0.04	0.00	0.25	-0.48	-0.12	0.05	0.21	0.53
alpha[186]	-0.22	0.00	0.29	-0.82	-0.41	-0.22	-0.02	0.33
alpha[187]	-0.29	0.00	0.23	-0.76	-0.44	-0.28	-0.13	0.14
alpha[188]	0.24	0.00	0.25	-0.27	0.07	0.25	0.42	0.71
alpha[189]	0.20	0.00	0.25	-0.30	0.04	0.20	0.37	0.67
alpha[190]	-0.08	0.00	0.28	-0.63	-0.26	-0.08	0.11	0.44
alpha[191]	-0.02	0.00	0.29	-0.59	-0.22	-0.02	0.17	0.53
alpha[192]	-0.11	0.00	0.25	-0.61	-0.27	-0.10	0.06	0.36
alpha[193]	0.14	0.00	0.26	-0.39	-0.02	0.15	0.32	0.63
alpha[194]	-0.30	0.00	0.16	-0.62	-0.40	-0.29	-0.19	0.01
alpha[195]	-0.61	0.00	0.10	-0.81	-0.68	-0.61	-0.54	-0.42
beta	1.98	0.01	0.33	1.32	1.76	1.98	2.20	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	0.37	0.39	0.41	0.45
log_theta[1]	0.01	0.00	0.28	-0.56	-0.17	0.02	0.21	0.53
log_theta[2]	0.34	0.00	0.23	-0.13	0.19	0.35	0.50	0.77
log_theta[3]	0.80	0.00	0.21	0.37	0.66	0.80	0.94	1.19
log_theta[4]	0.12	0.00	0.27	-0.42	-0.06	0.13	0.31	0.64
log_theta[5]	0.65	0.00	0.25	0.15	0.48	0.65	0.83	1.13
log_theta[6]	-0.27	0.00	0.19	-0.65	-0.40	-0.27	-0.14	0.09
log_theta[7]	0.83	0.00	0.17	0.49	0.71	0.83	0.95	1.16
log_theta[8]	0.07	0.00	0.23	-0.39	-0.09	0.07	0.23	0.49
log_theta[9]	0.45	0.00	0.24	-0.03	0.30	0.45	0.61	0.90
log_theta[10]	0.65	0.00	0.21	0.23	0.51	0.65	0.79	1.05
log_theta[11]	0.16	0.00	0.30	-0.45	-0.03	0.17	0.37	0.73
log_theta[12]	0.83	0.00	0.26	0.29	0.66	0.83	1.00	1.33
log_theta[13]	0.15	0.00	0.24	-0.33	-0.01	0.16	0.32	0.61
log_theta[14]	0.68	0.00	0.20	0.28	0.55	0.68	0.81	1.05
log_theta[15]	0.34	0.00	0.24	-0.14	0.18	0.35	0.50	0.79
log_theta[16]	0.84	0.00	0.25	0.34	0.68	0.85	1.01	1.31
log_theta[17]	0.91	0.00	0.23	0.43	0.75	0.91	1.06	1.36
log_theta[18]	0.52	0.00	0.20	0.11	0.39	0.52	0.66	0.91
log_theta[19]	0.39	0.00	0.18	0.04	0.28	0.40	0.52	0.73
log_theta[20]	0.43	0.00	0.29	-0.17	0.24	0.43	0.63	1.00
log_theta[21]	0.93	0.00	0.26	0.42	0.75	0.94	1.11	1.41

log_theta[22]	1.06	0.00	0.22	0.63	0.91	1.06	1.21	1.47
log_theta[23]	0.55	0.00	0.24	0.06	0.40	0.55	0.71	1.02
log_theta[24]	0.13	0.00	0.29	-0.46	-0.07	0.13	0.33	0.69
log_theta[25]	0.61	0.00	0.21	0.18	0.47	0.61	0.75	1.01
log_theta[26]	0.69	0.00	0.22	0.25	0.55	0.70	0.85	1.12
log_theta[27]	0.66	0.00	0.24	0.18	0.50	0.66	0.82	1.12
log_theta[28]	0.84	0.00	0.22	0.41	0.69	0.85	1.00	1.27
log_theta[29]	0.39	0.00	0.32	-0.24	0.18	0.41	0.61	1.00
log_theta[30]	0.84	0.00	0.27	0.30	0.67	0.85	1.02	1.34
log_theta[31]	0.38	0.00	0.27	-0.19	0.20	0.39	0.56	0.91
log_theta[32]	0.15	0.00	0.30	-0.45	-0.05	0.15	0.36	0.71
log_theta[33]	0.42	0.00	0.25	-0.08	0.26	0.43	0.59	0.91
log_theta[34]	0.39	0.00	0.25	-0.10	0.23	0.40	0.57	0.86
log_theta[35]	0.23	0.00	0.27	-0.31	0.05	0.24	0.42	0.74
log_theta[36]	0.11	0.00	0.19	-0.28	-0.01	0.12	0.25	0.48
log_theta[37]	0.52	0.00	0.24	0.04	0.36	0.53	0.69	0.96
log_theta[38]	0.16	0.00	0.27	-0.37	-0.01	0.17	0.35	0.67
log_theta[39]	-0.20	0.00	0.25	-0.69	-0.36	-0.19	-0.03	0.26
log_theta[40]	0.58	0.00	0.26	0.06	0.41	0.59	0.77	1.08
log_theta[41]	-0.13	0.00	0.29	-0.72	-0.32	-0.12	0.07	0.41
log_theta[42]	-0.08	0.00	0.25	-0.59	-0.25	-0.08	0.09	0.39
log_theta[43]	0.24	0.00	0.24	-0.25	0.09	0.25	0.41	0.69
log_theta[44]	-0.02	0.00	0.22	-0.47	-0.17	-0.02	0.13	0.41
log_theta[45]	0.69	0.00	0.21	0.27	0.55	0.69	0.83	1.08
log_theta[46]	0.13	0.00	0.20	-0.28	0.01	0.14	0.26	0.50
log_theta[47]	0.17	0.00	0.24	-0.32	0.01	0.18	0.33	0.63
log_theta[48]	0.42	0.00	0.29	-0.16	0.22	0.42	0.62	0.97
log_theta[49]	0.25	0.00	0.23	-0.21	0.09	0.25	0.40	0.67
log_theta[50]	-0.03	0.00	0.24	-0.51	-0.18	-0.02	0.13	0.42
log_theta[51]	0.09	0.00	0.22	-0.36	-0.06	0.09	0.24	0.51
log_theta[52]	0.29	0.00	0.23	-0.16	0.14	0.30	0.45	0.71
log_theta[53]	-0.28	0.00	0.27	-0.83	-0.46	-0.28	-0.09	0.23
log_theta[54]	0.61	0.00	0.25	0.12	0.45	0.61	0.77	1.09
log_theta[55]	0.46	0.00	0.28	-0.11	0.27	0.46	0.64	0.99
log_theta[56]	0.08	0.00	0.20	-0.33	-0.05	0.09	0.22	0.47
log_theta[57]	0.49	0.00	0.25	-0.01	0.32	0.50	0.66	0.97
log_theta[58]	0.02	0.00	0.24	-0.46	-0.13	0.03	0.18	0.46
log_theta[59]	-0.20	0.00	0.28	-0.76	-0.38	-0.19	-0.01	0.31
log_theta[60]	0.14	0.00	0.29	-0.44	-0.06	0.14	0.33	0.68
log_theta[61]	0.01	0.00	0.26	-0.51	-0.16	0.02	0.19	0.52
log_theta[62]	-0.07	0.00	0.29	-0.63	-0.26	-0.07	0.12	0.48
log_theta[63]	0.00	0.00	0.20	-0.41	-0.13	0.00	0.14	0.38
log_theta[64]	-0.16	0.00	0.28	-0.73	-0.35	-0.16	0.04	0.37

log_theta[65]	0.03	0.00	0.29	-0.57	-0.16	0.04	0.24	0.58
log_theta[66]	-0.06	0.00	0.24	-0.54	-0.22	-0.05	0.10	0.39
log_theta[67]	-0.08	0.00	0.31	-0.71	-0.28	-0.08	0.13	0.51
log_theta[68]	0.15	0.00	0.29	-0.45	-0.04	0.16	0.36	0.69
log_theta[69]	0.11	0.00	0.20	-0.29	-0.02	0.12	0.25	0.49
log_theta[70]	-0.20	0.00	0.30	-0.80	-0.40	-0.20	0.01	0.38
log_theta[71]	-0.02	0.00	0.28	-0.58	-0.21	-0.02	0.16	0.50
log_theta[72]	-0.39	0.00	0.31	-1.02	-0.59	-0.38	-0.17	0.22
log_theta[73]	0.47	0.00	0.26	-0.06	0.30	0.48	0.65	0.95
log_theta[74]	-0.16	0.00	0.24	-0.65	-0.32	-0.15	0.00	0.29
log_theta[75]	0.21	0.00	0.30	-0.40	0.01	0.21	0.41	0.78
log_theta[76]	0.57	0.00	0.25	0.06	0.41	0.58	0.73	1.04
log_theta[77]	0.03	0.00	0.22	-0.42	-0.12	0.03	0.18	0.44
log_theta[78]	0.46	0.00	0.21	0.03	0.32	0.47	0.61	0.87
log_theta[79]	0.34	0.00	0.30	-0.27	0.14	0.34	0.54	0.92
log_theta[80]	0.46	0.00	0.31	-0.14	0.24	0.46	0.66	1.06
log_theta[81]	0.32	0.00	0.28	-0.22	0.13	0.32	0.51	0.83
log_theta[82]	0.45	0.00	0.25	-0.03	0.29	0.45	0.62	0.92
log_theta[83]	0.24	0.00	0.25	-0.27	0.08	0.25	0.41	0.70
log_theta[84]	0.79	0.00	0.22	0.34	0.64	0.80	0.94	1.21
log_theta[85]	0.43	0.00	0.26	-0.09	0.26	0.44	0.60	0.92
log_theta[86]	0.14	0.00	0.22	-0.32	0.00	0.15	0.29	0.57
log_theta[87]	0.21	0.00	0.22	-0.23	0.06	0.21	0.36	0.62
log_theta[88]	0.41	0.00	0.21	-0.01	0.27	0.41	0.56	0.79
log_theta[89]	0.34	0.00	0.32	-0.29	0.13	0.35	0.55	0.94
log_theta[90]	0.48	0.00	0.25	-0.03	0.31	0.49	0.65	0.97
log_theta[91]	-0.51	0.00	0.25	-1.03	-0.68	-0.51	-0.35	-0.03
log_theta[92]	0.31	0.00	0.26	-0.23	0.14	0.31	0.48	0.81
log_theta[93]	-0.16	0.00	0.16	-0.48	-0.27	-0.16	-0.05	0.15
log_theta[94]	0.43	0.00	0.23	-0.02	0.28	0.44	0.59	0.86
log_theta[95]	0.22	0.00	0.23	-0.25	0.07	0.23	0.39	0.66
log_theta[96]	0.29	0.00	0.22	-0.14	0.14	0.30	0.44	0.69
log_theta[97]	0.19	0.00	0.19	-0.19	0.07	0.19	0.32	0.54
log_theta[98]	0.06	0.00	0.23	-0.41	-0.09	0.06	0.21	0.50
log_theta[99]	-0.30	0.00	0.31	-0.92	-0.50	-0.29	-0.09	0.28
log_theta[100]	0.18	0.00	0.12	-0.06	0.10	0.18	0.26	0.39
log_theta[101]	0.26	0.00	0.23	-0.21	0.11	0.27	0.42	0.69
log_theta[102]	0.08	0.00	0.21	-0.35	-0.06	0.08	0.23	0.49
log_theta[103]	0.22	0.00	0.28	-0.34	0.03	0.23	0.40	0.75
log_theta[104]	-0.02	0.00	0.19	-0.41	-0.15	-0.02	0.11	0.34
log_theta[105]	-0.02	0.00	0.26	-0.53	-0.19	-0.02	0.15	0.46
log_theta[106]	-0.09	0.00	0.22	-0.54	-0.24	-0.09	0.06	0.34
log_theta[107]	0.53	0.00	0.27	0.00	0.35	0.54	0.72	1.02

log_theta[108]	-0.22	0.00	0.29	-0.80	-0.41	-0.21	-0.01	0.33
log_theta[109]	-0.02	0.00	0.24	-0.51	-0.17	-0.01	0.14	0.41
log_theta[110]	-0.20	0.00	0.30	-0.82	-0.41	-0.19	0.01	0.37
log_theta[111]	-0.03	0.00	0.24	-0.50	-0.20	-0.02	0.15	0.41
log_theta[112]	-0.04	0.00	0.23	-0.49	-0.19	-0.03	0.11	0.39
log_theta[113]	-0.15	0.00	0.23	-0.62	-0.30	-0.15	0.01	0.28
log_theta[114]	-0.16	0.00	0.23	-0.65	-0.32	-0.15	0.00	0.29
log_theta[115]	0.01	0.00	0.25	-0.50	-0.16	0.01	0.18	0.49
log_theta[116]	-0.19	0.00	0.28	-0.74	-0.38	-0.19	0.00	0.32
log_theta[117]	0.01	0.00	0.21	-0.42	-0.13	0.01	0.15	0.41
log_theta[118]	-0.69	0.00	0.21	-1.11	-0.83	-0.69	-0.55	-0.30
log_theta[119]	0.04	0.00	0.18	-0.33	-0.09	0.05	0.17	0.38
log_theta[120]	-0.03	0.00	0.28	-0.59	-0.22	-0.02	0.18	0.50
log_theta[121]	0.25	0.00	0.25	-0.25	0.09	0.25	0.42	0.72
log_theta[122]	-0.54	0.00	0.29	-1.14	-0.73	-0.53	-0.34	0.00
log_theta[123]	-0.12	0.00	0.23	-0.59	-0.28	-0.12	0.03	0.31
log_theta[124]	-0.38	0.00	0.24	-0.89	-0.54	-0.38	-0.23	0.06
log_theta[125]	0.14	0.00	0.24	-0.34	-0.02	0.15	0.31	0.59
log_theta[126]	-0.08	0.00	0.27	-0.64	-0.25	-0.07	0.11	0.44
log_theta[127]	-0.09	0.00	0.22	-0.55	-0.24	-0.09	0.06	0.32
log_theta[128]	0.00	0.00	0.30	-0.62	-0.20	0.00	0.21	0.57
log_theta[129]	-0.17	0.00	0.19	-0.55	-0.30	-0.17	-0.04	0.19
log_theta[130]	-0.10	0.00	0.21	-0.53	-0.24	-0.09	0.04	0.30
log_theta[131]	0.01	0.00	0.30	-0.58	-0.19	0.02	0.21	0.57
log_theta[132]	0.00	0.00	0.26	-0.54	-0.17	0.01	0.18	0.49
log_theta[133]	-0.11	0.00	0.25	-0.61	-0.27	-0.11	0.07	0.37
log_theta[134]	-0.24	0.00	0.27	-0.78	-0.42	-0.24	-0.06	0.27
log_theta[135]	-0.03	0.00	0.30	-0.63	-0.23	-0.02	0.19	0.54
log_theta[136]	-0.05	0.00	0.31	-0.67	-0.25	-0.04	0.17	0.55
log_theta[137]	-0.40	0.00	0.31	-1.04	-0.60	-0.39	-0.19	0.18
log_theta[138]	0.11	0.00	0.25	-0.39	-0.05	0.11	0.29	0.59
log_theta[139]	-0.06	0.00	0.24	-0.55	-0.21	-0.05	0.10	0.40
log_theta[140]	0.17	0.00	0.24	-0.32	0.01	0.18	0.33	0.62
log_theta[141]	-0.12	0.00	0.25	-0.65	-0.29	-0.12	0.05	0.35
log_theta[142]	-0.02	0.00	0.30	-0.60	-0.21	-0.02	0.18	0.55
log_theta[143]	-0.15	0.00	0.26	-0.68	-0.32	-0.14	0.02	0.34
log_theta[144]	-0.19	0.00	0.26	-0.72	-0.36	-0.18	-0.01	0.30
log_theta[145]	0.10	0.00	0.24	-0.36	-0.06	0.11	0.28	0.56
log_theta[146]	-0.16	0.00	0.25	-0.66	-0.32	-0.15	0.01	0.30
log_theta[147]	0.19	0.00	0.19	-0.19	0.07	0.20	0.32	0.55
log_theta[148]	-0.26	0.00	0.25	-0.77	-0.43	-0.25	-0.08	0.22
log_theta[149]	0.55	0.00	0.23	0.07	0.40	0.55	0.70	0.98
log_theta[150]	-0.63	0.00	0.13	-0.89	-0.71	-0.63	-0.54	-0.38

log_theta[151]	-0.33	0.00	0.24	-0.80	-0.48	-0.32	-0.16	0.14
log_theta[152]	0.18	0.00	0.20	-0.22	0.05	0.19	0.32	0.56
log_theta[153]	0.49	0.00	0.25	-0.02	0.33	0.49	0.66	0.95
log_theta[154]	0.26	0.00	0.24	-0.22	0.10	0.26	0.42	0.71
log_theta[155]	-0.09	0.00	0.22	-0.57	-0.23	-0.08	0.06	0.33
log_theta[156]	-0.20	0.00	0.22	-0.64	-0.35	-0.20	-0.05	0.19
log_theta[157]	-0.19	0.00	0.30	-0.82	-0.39	-0.18	0.01	0.39
log_theta[158]	-0.49	0.00	0.24	-0.98	-0.65	-0.49	-0.33	-0.04
log_theta[159]	0.04	0.00	0.22	-0.40	-0.10	0.05	0.20	0.47
log_theta[160]	-0.16	0.00	0.28	-0.70	-0.34	-0.15	0.03	0.35
log_theta[161]	-0.14	0.00	0.23	-0.59	-0.29	-0.13	0.02	0.29
log_theta[162]	-0.18	0.00	0.22	-0.63	-0.32	-0.17	-0.03	0.24
log_theta[163]	-0.10	0.00	0.24	-0.58	-0.26	-0.10	0.05	0.34
log_theta[164]	0.07	0.00	0.26	-0.45	-0.10	0.07	0.24	0.55
log_theta[165]	-0.21	0.00	0.22	-0.67	-0.36	-0.20	-0.05	0.21
log_theta[166]	-0.10	0.00	0.28	-0.68	-0.29	-0.10	0.08	0.43
log_theta[167]	0.27	0.00	0.27	-0.27	0.09	0.27	0.46	0.78
log_theta[168]	-0.12	0.00	0.25	-0.64	-0.29	-0.12	0.05	0.36
log_theta[169]	-1.24	0.00	0.17	-1.59	-1.36	-1.24	-1.12	-0.92
log_theta[170]	0.16	0.00	0.25	-0.35	-0.01	0.16	0.33	0.65
log_theta[171]	-0.24	0.00	0.30	-0.86	-0.44	-0.23	-0.03	0.34
log_theta[172]	0.21	0.00	0.24	-0.27	0.05	0.22	0.38	0.68
log_theta[173]	-0.15	0.00	0.27	-0.70	-0.33	-0.15	0.04	0.36
log_theta[174]	-0.22	0.00	0.24	-0.70	-0.38	-0.22	-0.05	0.24
log_theta[175]	-0.37	0.00	0.23	-0.84	-0.52	-0.36	-0.21	0.06
log_theta[176]	-0.27	0.00	0.25	-0.78	-0.44	-0.26	-0.10	0.19
log_theta[177]	0.39	0.00	0.26	-0.14	0.22	0.39	0.56	0.88
log_theta[178]	-0.61	0.00	0.15	-0.92	-0.71	-0.61	-0.50	-0.32
log_theta[179]	-0.29	0.00	0.28	-0.85	-0.47	-0.29	-0.10	0.23
log_theta[180]	-0.11	0.00	0.24	-0.61	-0.26	-0.10	0.06	0.34
log_theta[181]	-0.20	0.00	0.26	-0.74	-0.37	-0.19	-0.02	0.30
log_theta[182]	-0.22	0.00	0.23	-0.69	-0.37	-0.21	-0.07	0.21
log_theta[183]	0.00	0.00	0.24	-0.49	-0.16	0.00	0.15	0.47
log_theta[184]	-0.70	0.00	0.31	-1.34	-0.92	-0.70	-0.49	-0.12
log_theta[185]	-0.12	0.00	0.25	-0.64	-0.28	-0.12	0.04	0.37
log_theta[186]	-0.33	0.00	0.29	-0.92	-0.52	-0.33	-0.13	0.23
log_theta[187]	-0.17	0.00	0.23	-0.65	-0.32	-0.17	-0.01	0.26
log_theta[188]	0.00	0.00	0.25	-0.50	-0.17	0.01	0.18	0.47
log_theta[189]	0.14	0.00	0.25	-0.35	-0.01	0.15	0.31	0.61
log_theta[190]	-0.35	0.00	0.27	-0.91	-0.53	-0.35	-0.16	0.16
log_theta[191]	-0.28	0.00	0.29	-0.85	-0.47	-0.28	-0.09	0.27
log_theta[192]	-0.30	0.00	0.25	-0.81	-0.46	-0.29	-0.13	0.16
log_theta[193]	-0.06	0.00	0.26	-0.60	-0.23	-0.06	0.11	0.42

```
log_theta[194]   -0.44    0.00  0.16   -0.76   -0.54   -0.44   -0.34   -0.14
log_theta[195]   -0.92    0.00  0.09   -1.10   -0.98   -0.92   -0.86   -0.75
lp__           4013.68    0.38 12.07 3989.16 4005.80 4013.89 4021.73 4036.57
               n_eff Rhat
alpha[1]        9089    1
alpha[2]        9232    1
alpha[3]        7250    1
alpha[4]       10045    1
alpha[5]        7614    1
alpha[6]        8265    1
alpha[7]        6381    1
alpha[8]        6620    1
alpha[9]        8898    1
alpha[10]       9502    1
alpha[11]       9556    1
alpha[12]       8976    1
alpha[13]       8154    1
alpha[14]       9520    1
alpha[15]       9354    1
alpha[16]       7398    1
alpha[17]       9208    1
alpha[18]       8734    1
alpha[19]       6734    1
alpha[20]       7610    1
alpha[21]       7553    1
alpha[22]       6364    1
alpha[23]       6820    1
alpha[24]       9710    1
alpha[25]       8117    1
alpha[26]       8025    1
alpha[27]       9102    1
alpha[28]       7809    1
alpha[29]       9627    1
alpha[30]       8451    1
alpha[31]       8508    1
alpha[32]       9258    1
alpha[33]       8213    1
alpha[34]      10195    1
alpha[35]       8347    1
alpha[36]       6719    1
alpha[37]       7864    1
alpha[38]       7684    1
alpha[39]       9347    1
```

```
alpha[40]       7412    1
alpha[41]       8205    1
alpha[42]      10264    1
alpha[43]       8428    1
alpha[44]      10050    1
alpha[45]       8249    1
alpha[46]       8217    1
alpha[47]       8604    1
alpha[48]       9504    1
alpha[49]       9297    1
alpha[50]       8791    1
alpha[51]       7422    1
alpha[52]       9949    1
alpha[53]       8510    1
alpha[54]      10241    1
alpha[55]       8406    1
alpha[56]      10078    1
alpha[57]       9488    1
alpha[58]       8551    1
alpha[59]      10053    1
alpha[60]       9308    1
alpha[61]       9361    1
alpha[62]       9632    1
alpha[63]       9467    1
alpha[64]       8483    1
alpha[65]       9308    1
alpha[66]       8499    1
alpha[67]       9061    1
alpha[68]       8494    1
alpha[69]       8180    1
alpha[70]       8238    1
alpha[71]       8615    1
alpha[72]       9131    1
alpha[73]       7197    1
alpha[74]       6632    1
alpha[75]       9045    1
alpha[76]       8196    1
alpha[77]       8734    1
alpha[78]       9812    1
alpha[79]      10315    1
alpha[80]      10531    1
alpha[81]       8271    1
alpha[82]      10480    1
```

```
alpha[83]       8771    1
alpha[84]       8155    1
alpha[85]       9412    1
alpha[86]       7741    1
alpha[87]      10029    1
alpha[88]      10688    1
alpha[89]       8132    1
alpha[90]       7738    1
alpha[91]      10180    1
alpha[92]       9296    1
alpha[93]       8747    1
alpha[94]       9003    1
alpha[95]       9229    1
alpha[96]       8158    1
alpha[97]       7671    1
alpha[98]       8268    1
alpha[99]       8668    1
alpha[100]      7336    1
alpha[101]      8537    1
alpha[102]      9223    1
alpha[103]     10105    1
alpha[104]      7452    1
alpha[105]      8970    1
alpha[106]      8755    1
alpha[107]     10859    1
alpha[108]      8529    1
alpha[109]      8828    1
alpha[110]      8593    1
alpha[111]     10868    1
alpha[112]      8559    1
alpha[113]      7361    1
alpha[114]      8408    1
alpha[115]      8675    1
alpha[116]      9013    1
alpha[117]      8286    1
alpha[118]      7827    1
alpha[119]      9343    1
alpha[120]      8876    1
alpha[121]      7678    1
alpha[122]      6912    1
alpha[123]      7064    1
alpha[124]      8916    1
alpha[125]      9075    1
```

```
alpha[126]      9490    1
alpha[127]      8565    1
alpha[128]      9512    1
alpha[129]      9050    1
alpha[130]     10061    1
alpha[131]      9958    1
alpha[132]     11586    1
alpha[133]      8879    1
alpha[134]      9534    1
alpha[135]      9639    1
alpha[136]     10636    1
alpha[137]      8460    1
alpha[138]      8787    1
alpha[139]      8108    1
alpha[140]     10589    1
alpha[141]      9723    1
alpha[142]      8256    1
alpha[143]      8906    1
alpha[144]      8765    1
alpha[145]      9760    1
alpha[146]      9305    1
alpha[147]      8963    1
alpha[148]      8362    1
alpha[149]      9186    1
alpha[150]      9395    1
alpha[151]      7493    1
alpha[152]      7258    1
alpha[153]      8145    1
alpha[154]      8016    1
alpha[155]      8366    1
alpha[156]      9358    1
alpha[157]      8087    1
alpha[158]      8490    1
alpha[159]      9698    1
alpha[160]      8341    1
alpha[161]      9130    1
alpha[162]      9432    1
alpha[163]      9602    1
alpha[164]      9869    1
alpha[165]      8949    1
alpha[166]      9581    1
alpha[167]     12424    1
alpha[168]      9709    1
```

```
alpha[169]      7696    1
alpha[170]     11274    1
alpha[171]      7674    1
alpha[172]      9918    1
alpha[173]      9165    1
alpha[174]      8252    1
alpha[175]      8075    1
alpha[176]      8859    1
alpha[177]      7781    1
alpha[178]      7422    1
alpha[179]      9954    1
alpha[180]      8413    1
alpha[181]     10040    1
alpha[182]      8314    1
alpha[183]     10916    1
alpha[184]      7537    1
alpha[185]     10101    1
alpha[186]      7649    1
alpha[187]      8719    1
alpha[188]      8771    1
alpha[189]      9738    1
alpha[190]      7773    1
alpha[191]      8876    1
alpha[192]      9877    1
alpha[193]      9717    1
alpha[194]      9200    1
alpha[195]      5106    1
beta            3342    1
mu              5076    1
sigma           2261    1
log_theta[1]    9111    1
log_theta[2]    9359    1
log_theta[3]    7966    1
log_theta[4]   10293    1
log_theta[5]    8070    1
log_theta[6]    8541    1
log_theta[7]    7740    1
log_theta[8]    6599    1
log_theta[9]    8983    1
log_theta[10]   9507    1
log_theta[11]   9471    1
log_theta[12]   9405    1
log_theta[13]   8074    1
```

```
log_theta[14]   9916    1
log_theta[15]   9241    1
log_theta[16]   7309    1
log_theta[17]   9382    1
log_theta[18]   8786    1
log_theta[19]   8634    1
log_theta[20]   7441    1
log_theta[21]   7940    1
log_theta[22]   7092    1
log_theta[23]   7070    1
log_theta[24]   9994    1
log_theta[25]   9215    1
log_theta[26]   8111    1
log_theta[27]   9014    1
log_theta[28]   7875    1
log_theta[29]   9956    1
log_theta[30]   9638    1
log_theta[31]   8436    1
log_theta[32]   8453    1
log_theta[33]   8154    1
log_theta[34]  10066    1
log_theta[35]   8386    1
log_theta[36]   7949    1
log_theta[37]   7963    1
log_theta[38]   7295    1
log_theta[39]   9956    1
log_theta[40]   7960    1
log_theta[41]   8194    1
log_theta[42]  10284    1
log_theta[43]   8407    1
log_theta[44]   9987    1
log_theta[45]   8250    1
log_theta[46]   8883    1
log_theta[47]   8647    1
log_theta[48]   9460    1
log_theta[49]   9120    1
log_theta[50]   8883    1
log_theta[51]   8001    1
log_theta[52]  10070    1
log_theta[53]   8556    1
log_theta[54]   9883    1
log_theta[55]   8465    1
log_theta[56]  10422    1
```

```
log_theta[57]   9795    1
log_theta[58]   8281    1
log_theta[59]  10240    1
log_theta[60]   8788    1
log_theta[61]   9362    1
log_theta[62]   9794    1
log_theta[63]   9477    1
log_theta[64]   8481    1
log_theta[65]   9138    1
log_theta[66]   8798    1
log_theta[67]   8813    1
log_theta[68]   8465    1
log_theta[69]   9190    1
log_theta[70]   8074    1
log_theta[71]   8719    1
log_theta[72]   9307    1
log_theta[73]   7088    1
log_theta[74]   6677    1
log_theta[75]   9049    1
log_theta[76]   8605    1
log_theta[77]   8863    1
log_theta[78]   9854    1
log_theta[79]  10276    1
log_theta[80]  10491    1
log_theta[81]   7886    1
log_theta[82]  10438    1
log_theta[83]   8680    1
log_theta[84]   8869    1
log_theta[85]   9070    1
log_theta[86]   7944    1
log_theta[87]   9981    1
log_theta[88]  10670    1
log_theta[89]   8071    1
log_theta[90]   7679    1
log_theta[91]  10850    1
log_theta[92]   9122    1
log_theta[93]   9381    1
log_theta[94]   8950    1
log_theta[95]   9134    1
log_theta[96]   8099    1
log_theta[97]   8304    1
log_theta[98]   8384    1
log_theta[99]   8688    1
```

```
log_theta[100]  9243    1
log_theta[101]  8462    1
log_theta[102]  9137    1
log_theta[103] 10113    1
log_theta[104]  7952    1
log_theta[105]  8937    1
log_theta[106]  9106    1
log_theta[107] 10881    1
log_theta[108]  8611    1
log_theta[109]  8830    1
log_theta[110]  8665    1
log_theta[111] 10275    1
log_theta[112]  9041    1
log_theta[113]  7488    1
log_theta[114]  8579    1
log_theta[115]  8708    1
log_theta[116]  9052    1
log_theta[117]  8583    1
log_theta[118]  8063    1
log_theta[119] 10477    1
log_theta[120]  8842    1
log_theta[121]  7967    1
log_theta[122]  6963    1
log_theta[123]  7142    1
log_theta[124]  9173    1
log_theta[125]  9097    1
log_theta[126]  9617    1
log_theta[127]  8853    1
log_theta[128]  9581    1
log_theta[129]  9027    1
log_theta[130] 10076    1
log_theta[131] 10003    1
log_theta[132] 11585    1
log_theta[133]  8837    1
log_theta[134] 10168    1
log_theta[135]  9622    1
log_theta[136] 10528    1
log_theta[137]  8516    1
log_theta[138]  8939    1
log_theta[139]  8150    1
log_theta[140] 10517    1
log_theta[141]  9990    1
log_theta[142]  8496    1
```

```
log_theta[143]  9145    1
log_theta[144]  8583    1
log_theta[145]  9908    1
log_theta[146]  9983    1
log_theta[147]  9187    1
log_theta[148]  7982    1
log_theta[149]  9148    1
log_theta[150]  9161    1
log_theta[151]  7823    1
log_theta[152]  7833    1
log_theta[153]  8097    1
log_theta[154]  8168    1
log_theta[155]  8576    1
log_theta[156]  9502    1
log_theta[157]  8074    1
log_theta[158]  8775    1
log_theta[159] 10061    1
log_theta[160]  8418    1
log_theta[161]  9746    1
log_theta[162]  9723    1
log_theta[163]  9416    1
log_theta[164]  9870    1
log_theta[165]  9098    1
log_theta[166]  9563    1
log_theta[167] 12428    1
log_theta[168]  9653    1
log_theta[169]  8662    1
log_theta[170] 11288    1
log_theta[171]  7676    1
log_theta[172]  9982    1
log_theta[173]  9249    1
log_theta[174]  8710    1
log_theta[175]  8224    1
log_theta[176]  9005    1
log_theta[177]  7777    1
log_theta[178]  7564    1
log_theta[179] 10208    1
log_theta[180]  8610    1
log_theta[181] 10028    1
log_theta[182]  9015    1
log_theta[183] 10949    1
log_theta[184]  7557    1
log_theta[185] 10081    1
```

```
log_theta[186]  7958    1
log_theta[187]  8837    1
log_theta[188]  9122    1
log_theta[189]  9689    1
log_theta[190]  8069    1
log_theta[191]  9543    1
log_theta[192] 10023    1
log_theta[193]  9564    1
log_theta[194]  9001    1
log_theta[195]  6184    1
lp__            1033    1

Samples were drawn using NUTS(diag_e) at Wed Mar 15 17:51:23 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.

```
library(tidybayes)
resmod1 <- mod1lab9 %>%
  gather_draws(log_theta[i]) %>%
  median_qi() %>%
  rename(median_mod1 = .value,
         lower_mod1 = .lower,
         upper_mod1 = .upper) %>%
  dplyr::select(i,median_mod1:upper_mod1)

resmod2 <- mod2lab9 %>%
  gather_draws(log_theta[i]) %>%
  median_qi() %>%
  rename(median_mod2 = .value,
         lower_mod2 = .lower,
         upper_mod2 = .upper) %>%
  dplyr::select(i,median_mod2:upper_mod2)

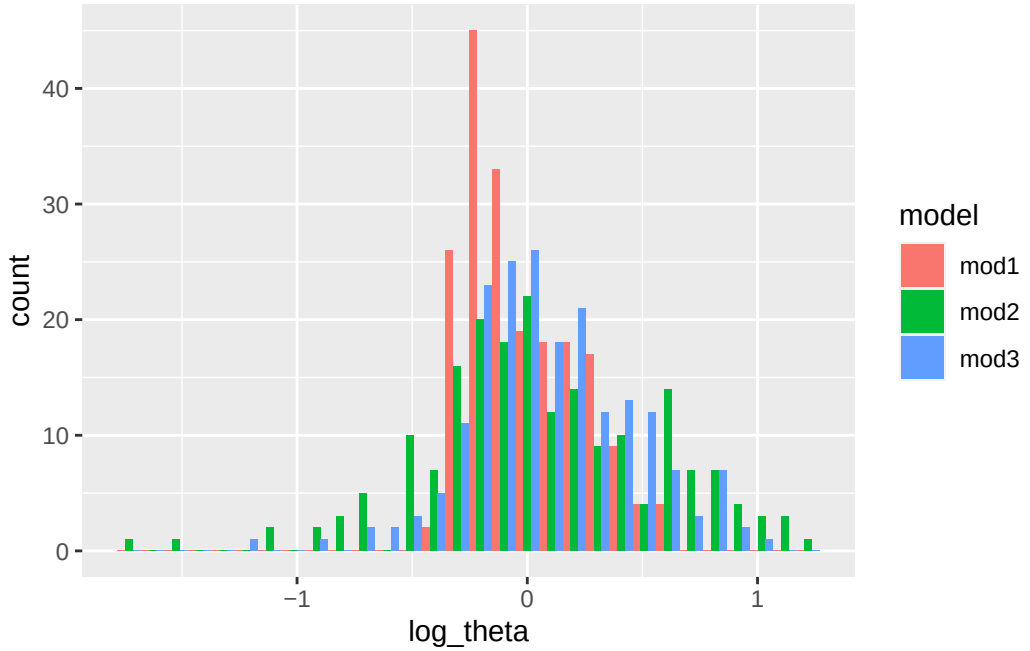
resmod3 <- mod3lab9 %>%
  gather_draws(log_theta[i]) %>%
```

```
  median_qi() %>%
  rename(median_mod3 = .value,
         lower_mod3 = .lower,
         upper_mod3 = .upper) %>%
  dplyr::select(i,median_mod3:upper_mod3)
```

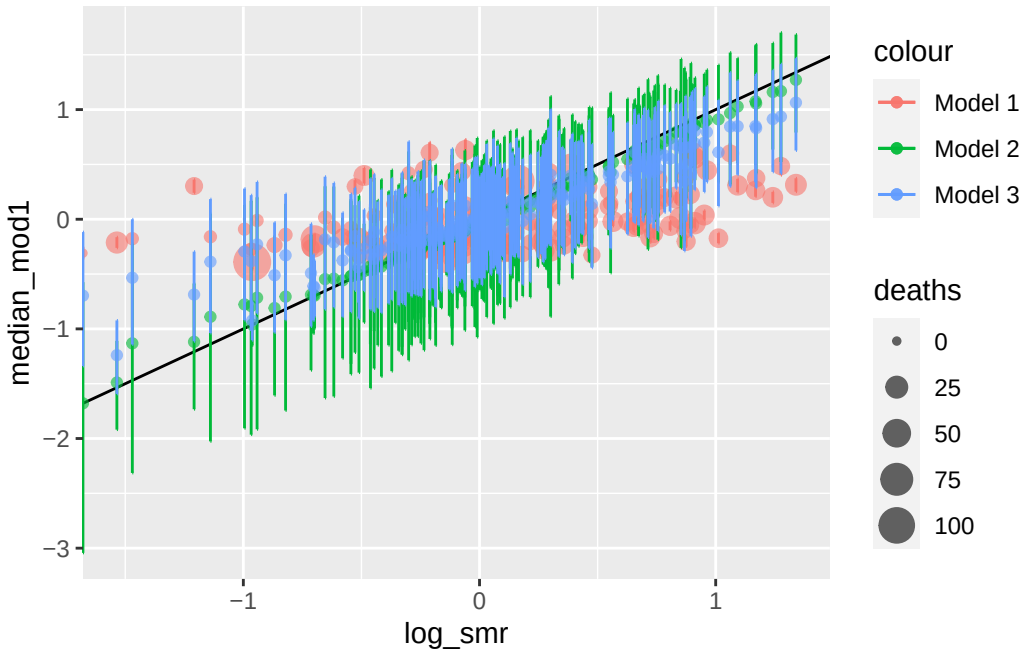
```
res <- resmod1 %>%
  left_join(resmod2) %>%
  left_join(resmod3)
res
```

```
# A tibble: 195 x 10
       i media~1 lower~2 upper~3 media~4 lower~5 upper~6 media~7 lower~8 upper~9
   <int>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>
 1     1  0.173   0.123   0.220   -0.193  -1.09   0.536   0.0231 -0.560   0.533
 2     2  0.147   0.0990  0.193    0.381  -0.218  0.867   0.346  -0.130   0.765
 3     3  0.558   0.465   0.647    0.861   0.356  1.29    0.805   0.370   1.19
 4     4  0.309   0.247   0.368   -0.108  -0.978  0.587   0.127  -0.419   0.643
 5     5  0.379   0.309   0.445    0.787   0.111  1.34    0.653   0.147   1.13
 6     6  0.399   0.326   0.467   -0.474  -0.941 -0.0412 -0.269  -0.653   0.0882
 7     7  0.595   0.497   0.687    0.874   0.485  1.23    0.828   0.486   1.16
 8     8  0.607   0.508   0.702   -0.185  -0.816  0.371   0.0696 -0.394   0.489
 9     9 -0.166  -0.212  -0.121    0.654   0.103  1.12    0.455  -0.0298  0.898
10    10  0.0109 -0.0294  0.0510   0.800   0.379  1.17    0.651   0.233   1.05
# ... with 185 more rows, and abbreviated variable names 1: median_mod1,
#   2: lower_mod1, 3: upper_mod1, 4: median_mod2, 5: lower_mod2, 6: upper_mod2,
#   7: median_mod3, 8: lower_mod3, 9: upper_mod3
```

```
library(ggplot2)
res %>%
  dplyr::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")
```




```
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")) +
  geom_abline(slope = 1, intercept = 0) +
  geom_point(aes(log_smr, median_mod2, color = "Model 2"), alpha = 0.6) +
  geom_errorbar(aes(ymin = lower_mod2, ymax = upper_mod2, color = "Model 2")) +
  geom_point(aes(log_smr, median_mod3, color = "Model 3"), alpha = 0.6) +
  geom_errorbar(aes(ymin = lower_mod3, ymax = upper_mod3, color = "Model 3"))
```


median_mod1
log_smr
1
0
−1
−2
−3
−1
0
1
colour
Model 1
Model 2
Model 3
deaths
0
25
50
75
100