

# The `lstbayes` package

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## 1 Introduction

This package provides language drivers for the `listings` package for the several Bayesian modeling languages: BUGS, JAGS, and Stan.

## 2 Usage

See the documentation of the `listings` package.

## 3 Implementation

```
1 \RequirePackage{listings}
```

### 3.1 BUGS

Language driver for BUGS, including WinBUGS and OpenBUGS. The driver is based on OpenBUGS v. 3.2.3.

```
2 \lstdefinlanguage{BUGS}{
3   morekeywords={1}{for,in,model,T,I,C},%
4   morecomment={1}{\#},%
5   sensitive=true,%
6   alsoletter={.},%
7   otherkeywords={<-,~},%
8   literate={<-}{\leftarrow}1 {~}{\sim}1%
9 }
10 \lstalias[] {OpenBUGS} [] {BUGS}
11 \lstalias[] {WinBUGS} [] {BUGS}
```

### 3.2 JAGS

Language driver for JAGS. The driver is based on JAGS version 3.4.0 (Sept 4, 2013).

```
12 \lstdefinlanguage[] {JAGS} [] {BUGS}{
```

```

13 morekeywords=[1]{data,var,const},%
14 morecomment=[n]{/*}{*/}%
15 }

```

### 3.3 Stan

Language driver for Stan. The driver is based on Stan modeling language version 2.10.0.

```

16 \lstdefinlanguage{Stan}{
17   morekeywords=[1]{functions,data,parameters,transformed,model,generated,quantities,%
18     for,in,while,print,if,else,lower,upper,increment_log_prob,T,return,%
19     reject,integrate_ode,integrate_ode_bdf,integrate_ode_rk45,target},%
20   morekeywords=[2]{int,real,vector,%
21     ordered,positive_ordered,simplex,unit_vector,%
22     row_vector,matrix,%
23     cholesky_factor_corr,cholesky_factor_cov,%
24     cor_matrix,cov_matrix,%
25     void},%
26   morekeywords=[3]{%
27     Phi,%
28     Phi_approx,%
29     abs,%
30     acos,%
31     acosh,%
32     append_col,%
33     append_row,%
34     asin,%
35     asinh,%
36     atan,%
37     atan2,%
38     atanh,%
39     bernoulli_ccdf_log,%
40     bernoulli_cdf,%
41     bernoulli_cdf_log,%
42     bernoulli_lccdf,%
43     bernoulli_lcdf,%
44     bernoulli_log,%
45     bernoulli_logit_log,%
46     bernoulli_logit_lpmf,%
47     bernoulli_logit_lpmf,%
48     bernoulli_lpmf,%
49     bernoulli_lpmf,%
50     bernoulli_rng,%
51     bessel_first_kind,%
52     bessel_second_kind,%
53     beta_binomial_ccdf_log,%
54     beta_binomial_cdf,%
55     beta_binomial_cdf_log,%
56     beta_binomial_lccdf,%

```

```

57     beta_binomial_lcdf,%
58     beta_binomial_log,%
59     beta_binomial_lpmf,%
60     beta_binomial_lpmf,%
61     beta_binomial_rng,%
62     beta_ccdf_log,%
63     beta_cdf,%
64     beta_cdf_log,%
65     beta_lccdf,%
66     beta_lcdf,%
67     beta_log,%
68     beta_lpdf,%
69     beta_lpdf,%
70     beta_rng,%
71     binary_log_loss,%
72     binomial_ccdf_log,%
73     binomial_cdf,%
74     binomial_cdf_log,%
75     binomial_coefficient_log,%
76     binomial_lccdf,%
77     binomial_lcdf,%
78     binomial_log,%
79     binomial_logit_log,%
80     binomial_logit_lpmf,%
81     binomial_logit_lpmf,%
82     binomial_lpmf,%
83     binomial_lpmf,%
84     binomial_rng,%
85     block,%
86     categorical_log,%
87     categorical_logit_log,%
88     categorical_logit_lpmf,%
89     categorical_logit_lpmf,%
90     categorical_lpmf,%
91     categorical_lpmf,%
92     categorical_rng,%
93     cauchy_ccdf_log,%
94     cauchy_cdf,%
95     cauchy_cdf_log,%
96     cauchy_lccdf,%
97     cauchy_lcdf,%
98     cauchy_log,%
99     cauchy_lpdf,%
100    cauchy_lpdf,%
101    cauchy_rng,%
102    cbrt,%
103    ceil,%
104    chi_square_ccdf_log,%
105    chi_square_cdf,%
106    chi_square_cdf_log,%

```

```

107     chi_square_lccdf,%
108     chi_square_lcdf,%
109     chi_square_log,%
110     chi_square_lpdf,%
111     chi_square_lpdf,%
112     chi_square_rng,%
113     cholesky_decompose,%
114     col,%
115     cols,%
116     columns_dot_product,%
117     columns_dot_self,%
118     cos,%
119     cosh,%
120     crossprod,%
121     csr_extract_u,%
122     csr_extract_v,%
123     csr_extract_w,%
124     csr_matrix_times_vector,%
125     csr_to_dense_matrix,%
126     cumulative_sum,%
127     determinant,%
128     diag_matrix,%
129     diag_post_multiply,%
130     diag_pre_multiply,%
131     diagonal,%
132     digamma,%
133     dims,%
134     dirichlet_log,%
135     dirichlet_lpdf,%
136     dirichlet_lpdf,%
137     dirichlet_rng,%
138     distance,%
139     dot_product,%
140     dot_self,%
141     double_exponential_ccdf_log,%
142     double_exponential_cdf,%
143     double_exponential_cdf_log,%
144     double_exponential_lccdf,%
145     double_exponential_lcdf,%
146     double_exponential_log,%
147     double_exponential_lpdf,%
148     double_exponential_lpdf,%
149     double_exponential_rng,%
150     e,%
151     eigenvalues_sym,%
152     eigenvectors_sym,%
153     erf,%
154     erfc,%
155     exp,%
156     exp2,%

```

```

157     exp_mod_normal_ccdf_log,%
158     exp_mod_normal_cdf,%
159     exp_mod_normal_cdf_log,%
160     exp_mod_normal_lccdf,%
161     exp_mod_normal_lcdf,%
162     exp_mod_normal_log,%
163     exp_mod_normal_lpdf,%
164     exp_mod_normal_lpdf,%
165     exp_mod_normal_rng,%
166     expm1,%
167     exponential_ccdf_log,%
168     exponential_cdf,%
169     exponential_cdf_log,%
170     exponential_lccdf,%
171     exponential_lcdf,%
172     exponential_log,%
173     exponential_lpdf,%
174     exponential_lpdf,%
175     exponential_rng,%
176     fabs,%
177     falling_factorial,%
178     fdim,%
179     floor,%
180     fma,%
181     fmax,%
182     fmin,%
183     fmod,%
184     frechet_ccdf_log,%
185     frechet_cdf,%
186     frechet_cdf_log,%
187     frechet_lccdf,%
188     frechet_lcdf,%
189     frechet_log,%
190     frechet_lpdf,%
191     frechet_lpdf,%
192     frechet_rng,%
193     gamma_ccdf_log,%
194     gamma_cdf,%
195     gamma_cdf_log,%
196     gamma_lccdf,%
197     gamma_lcdf,%
198     gamma_log,%
199     gamma_lpdf,%
200     gamma_lpdf,%
201     gamma_p,%
202     gamma_q,%
203     gamma_rng,%
204     gaussian_dlm_obs_log,%
205     gaussian_dlm_obs_lpdf,%
206     gaussian_dlm_obs_lpdf,%

```

```

207     get_lp,%
208     gumbel_ccdf_log,%
209     gumbel_cdf,%
210     gumbel_cdf_log,%
211     gumbel_lccdf,%
212     gumbel_lcdf,%
213     gumbel_log,%
214     gumbel_lpdf,%
215     gumbel_lpdf,%
216     gumbel_rng,%
217     head,%
218     hypergeometric_log,%
219     hypergeometric_lpmf,%
220     hypergeometric_lpmf,%
221     hypergeometric_rng,%
222     hypot,%
223     if_else,%
224     inc_beta,%
225     int_step,%
226     inv,%
227     inv_chi_square_ccdf_log,%
228     inv_chi_square_cdf,%
229     inv_chi_square_cdf_log,%
230     inv_chi_square_lccdf,%
231     inv_chi_square_lcdf,%
232     inv_chi_square_log,%
233     inv_chi_square_lpdf,%
234     inv_chi_square_lpdf,%
235     inv_chi_square_rng,%
236     inv_cloglog,%
237     inv_gamma_ccdf_log,%
238     inv_gamma_cdf,%
239     inv_gamma_cdf_log,%
240     inv_gamma_lccdf,%
241     inv_gamma_lcdf,%
242     inv_gamma_log,%
243     inv_gamma_lpdf,%
244     inv_gamma_lpdf,%
245     inv_gamma_rng,%
246     inv_logit,%
247     inv_phi,%
248     inv_sqrt,%
249     inv_square,%
250     inv_wishart_log,%
251     inv_wishart_lpdf,%
252     inv_wishart_lpdf,%
253     inv_wishart_rng,%
254     inverse,%
255     inverse_spd,%
256     is_inf,%

```

```

257     is_nan,%
258     lbeta,%
259     lchoose,%
260     lgamma,%
261     lkj_corr_cholesky_log,%
262     lkj_corr_cholesky_lpdf,%
263     lkj_corr_cholesky_lpdf,%
264     lkj_corr_cholesky_rng,%
265     lkj_corr_log,%
266     lkj_corr_lpdf,%
267     lkj_corr_lpdf,%
268     lkj_corr_rng,%
269     lmgamma,%
270     lmultiply,%
271     log,%
272     log10,%
273     log1m,%
274     log1m_exp,%
275     log1m_inv_logit,%
276     log1p,%
277     log1p_exp,%
278     log2,%
279     log_determinant,%
280     log_diff_exp,%
281     log_falling_factorial,%
282     log_inv_logit,%
283     log_mix,%
284     log_rising_factorial,%
285     log_softmax,%
286     log_sum_exp,%
287     logistic_ccdf_log,%
288     logistic_cdf,%
289     logistic_cdf_log,%
290     logistic_lccdf,%
291     logistic_lcdf,%
292     logistic_log,%
293     logistic_lpdf,%
294     logistic_lpdf,%
295     logistic_rng,%
296     logit,%
297     lognormal_ccdf_log,%
298     lognormal_cdf,%
299     lognormal_cdf_log,%
300     lognormal_lccdf,%
301     lognormal_lcdf,%
302     lognormal_log,%
303     lognormal_lpdf,%
304     lognormal_lpdf,%
305     lognormal_rng,%
306     machine_precision,%

```

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307     max,%
308     mdivide_left_tri_low,%
309     mdivide_right_tri_low,%
310     mean,%
311     min,%
312     modified_bessel_first_kind,%
313     modified_bessel_second_kind,%
314     multi_gp_cholesky_log,%
315     multi_gp_cholesky_lpdf,%
316     multi_gp_cholesky_lpdf,%
317     multi_gp_log,%
318     multi_gp_lpdf,%
319     multi_gp_lpdf,%
320     multi_normal_cholesky_log,%
321     multi_normal_cholesky_lpdf,%
322     multi_normal_cholesky_lpdf,%
323     multi_normal_cholesky_rng,%
324     multi_normal_log,%
325     multi_normal_lpdf,%
326     multi_normal_lpdf,%
327     multi_normal_prec_log,%
328     multi_normal_prec_lpdf,%
329     multi_normal_prec_lpdf,%
330     multi_normal_rng,%
331     multi_student_t_log,%
332     multi_student_t_lpdf,%
333     multi_student_t_lpdf,%
334     multi_student_t_rng,%
335     multinomial_log,%
336     multinomial_lpmf,%
337     multinomial_lpmf,%
338     multinomial_rng,%
339     multiply_log,%
340     multiply_lower_tri_self_transpose,%
341     neg_binomial_2_ccdf_log,%
342     neg_binomial_2_cdf,%
343     neg_binomial_2_cdf_log,%
344     neg_binomial_2_lccdf,%
345     neg_binomial_2_lcdf,%
346     neg_binomial_2_log,%
347     neg_binomial_2_log_log,%
348     neg_binomial_2_log_lpmf,%
349     neg_binomial_2_log_lpmf,%
350     neg_binomial_2_log_rng,%
351     neg_binomial_2_lpmf,%
352     neg_binomial_2_lpmf,%
353     neg_binomial_2_rng,%
354     neg_binomial_ccdf_log,%
355     neg_binomial_cdf,%
356     neg_binomial_cdf_log,%

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357     neg_binomial_lccdf,%
358     neg_binomial_lcdf,%
359     neg_binomial_log,%
360     neg_binomial_lpmf,%
361     neg_binomial_lpmf,%
362     neg_binomial_rng,%
363     negative_infinity,%
364     normal_ccdf_log,%
365     normal_cdf,%
366     normal_cdf_log,%
367     normal_lccdf,%
368     normal_lcdf,%
369     normal_log,%
370     normal_lpdf,%
371     normal_lpdf,%
372     normal_rng,%
373     not_a_number,%
374     num_elements,%
375     ordered_logistic_log,%
376     ordered_logistic_lpmf,%
377     ordered_logistic_lpmf,%
378     ordered_logistic_rng,%
379     owens_t,%
380     pareto_ccdf_log,%
381     pareto_cdf,%
382     pareto_cdf_log,%
383     pareto_lccdf,%
384     pareto_lcdf,%
385     pareto_log,%
386     pareto_lpdf,%
387     pareto_lpdf,%
388     pareto_rng,%
389     pareto_type_2_ccdf_log,%
390     pareto_type_2_cdf,%
391     pareto_type_2_cdf_log,%
392     pareto_type_2_lccdf,%
393     pareto_type_2_lcdf,%
394     pareto_type_2_log,%
395     pareto_type_2_lpdf,%
396     pareto_type_2_lpdf,%
397     pareto_type_2_rng,%
398     pi,%
399     poisson_ccdf_log,%
400     poisson_cdf,%
401     poisson_cdf_log,%
402     poisson_lccdf,%
403     poisson_lcdf,%
404     poisson_log,%
405     poisson_log_log,%
406     poisson_log_lpmf,%

```

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407 poisson_log_lpmf,%
408 poisson_log_rng,%
409 poisson_lpmf,%
410 poisson_lpmf,%
411 poisson_rng,%
412 positive_infinity,%
413 pow,%
414 prod,%
415 qr_Q,%
416 qr_R,%
417 quad_form,%
418 quad_form_diag,%
419 quad_form_sym,%
420 rank,%
421 rayleigh_ccdf_log,%
422 rayleigh_cdf,%
423 rayleigh_cdf_log,%
424 rayleigh_lccdf,%
425 rayleigh_lcdf,%
426 rayleigh_log,%
427 rayleigh_lpdf,%
428 rayleigh_lpdf,%
429 rayleigh_rng,%
430 rep_array,%
431 rep_matrix,%
432 rep_row_vector,%
433 rep_vector,%
434 rising_factorial,%
435 round,%
436 row,%
437 rows,%
438 rows_dot_product,%
439 rows_dot_self,%
440 scaled_inv_chi_square_ccdf_log,%
441 scaled_inv_chi_square_cdf,%
442 scaled_inv_chi_square_cdf_log,%
443 scaled_inv_chi_square_lccdf,%
444 scaled_inv_chi_square_lcdf,%
445 scaled_inv_chi_square_log,%
446 scaled_inv_chi_square_lpdf,%
447 scaled_inv_chi_square_lpdf,%
448 scaled_inv_chi_square_rng,%
449 sd,%
450 segment,%
451 sin,%
452 singular_values,%
453 sinh,%
454 size,%
455 skew_normal_ccdf_log,%
456 skew_normal_cdf,%

```

```

457     skew_normal_cdf_log,%
458     skew_normal_lccdf,%
459     skew_normal_lcdf,%
460     skew_normal_log,%
461     skew_normal_lpdf,%
462     skew_normal_lpdf,%
463     skew_normal_rng,%
464     softmax,%
465     sort_asc,%
466     sort_desc,%
467     sort_indices_asc,%
468     sort_indices_desc,%
469     sqrt,%
470     sqrt2,%
471     square,%
472     squared_distance,%
473     step,%
474     student_t_ccdf_log,%
475     student_t_cdf,%
476     student_t_cdf_log,%
477     student_t_lccdf,%
478     student_t_lcdf,%
479     student_t_log,%
480     student_t_lpdf,%
481     student_t_lpdf,%
482     student_t_rng,%
483     sub_col,%
484     sub_row,%
485     sum,%
486     tail,%
487     tan,%
488     tanh,%
489     tcrossprod,%
490     tgamma,%
491     to_array_1d,%
492     to_array_2d,%
493     to_matrix,%
494     to_row_vector,%
495     to_vector,%
496     trace,%
497     trace_gen_quad_form,%
498     trace_quad_form,%
499     trigamma,%
500     trunc,%
501     uniform_ccdf_log,%
502     uniform_cdf,%
503     uniform_cdf_log,%
504     uniform_lccdf,%
505     uniform_lcdf,%
506     uniform_log,%

```

```

507     uniform_lpdf,%
508     uniform_lpdf,%
509     uniform_rng,%
510     variance,%
511     von_mises_log,%
512     von_mises_lpdf,%
513     von_mises_lpdf,%
514     von_mises_rng,%
515     weibull_ccdf_log,%
516     weibull_cdf,%
517     weibull_cdf_log,%
518     weibull_lccdf,%
519     weibull_lcdf,%
520     weibull_log,%
521     weibull_lpdf,%
522     weibull_lpdf,%
523     weibull_rng,%
524     wiener_log,%
525     wiener_lpdf,%
526     wiener_lpdf,%
527     wishart_log,%
528     wishart_lpdf,%
529     wishart_lpdf,%
530     wishart_rng
531 },%
532 otherkeywords={<-,~,+=,=},%
533 sensitive=true,%
534 morecomment=[l]{\#},%
535 morecomment=[l]{//},%
536 morecomment=[n]{/*}{*/},%
537 string=[d]"%,
538 literate={<-}{\leftarrow$}1 {~}{\sim$}1%
539 }

```

## Change History

2015-09-26	General: Converted to DTX file . . . 1	2015-09-28	General: Fix README. Add key-words for all built-in functions that are in Stan v2.8.0. . . . . 1
2015-09-27	General: Fix README . . . . . 1		

## Index

Numbers written in *italic* refer to the page where the corresponding entry is described; numbers underlined refer to the code line of the definition; numbers in *roman* refer to the code lines where the entry is used.

### Symbols

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<b>L</b>	..... 2, 12, 16	<b>S</b>
<code>\leftarrow</code> .....	8, 538	<code>\sim</code> .....
<code>\lalias</code> .....	10, 11	
<code>\lstdefinlanguage</code> .	<b>R</b>	
	<code>\RequirePackage</code> .....	1