

Homework3a

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Homework 3a

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a) stan program

The result is not identical (I have tried not to use the prior first, but the result is very bad).

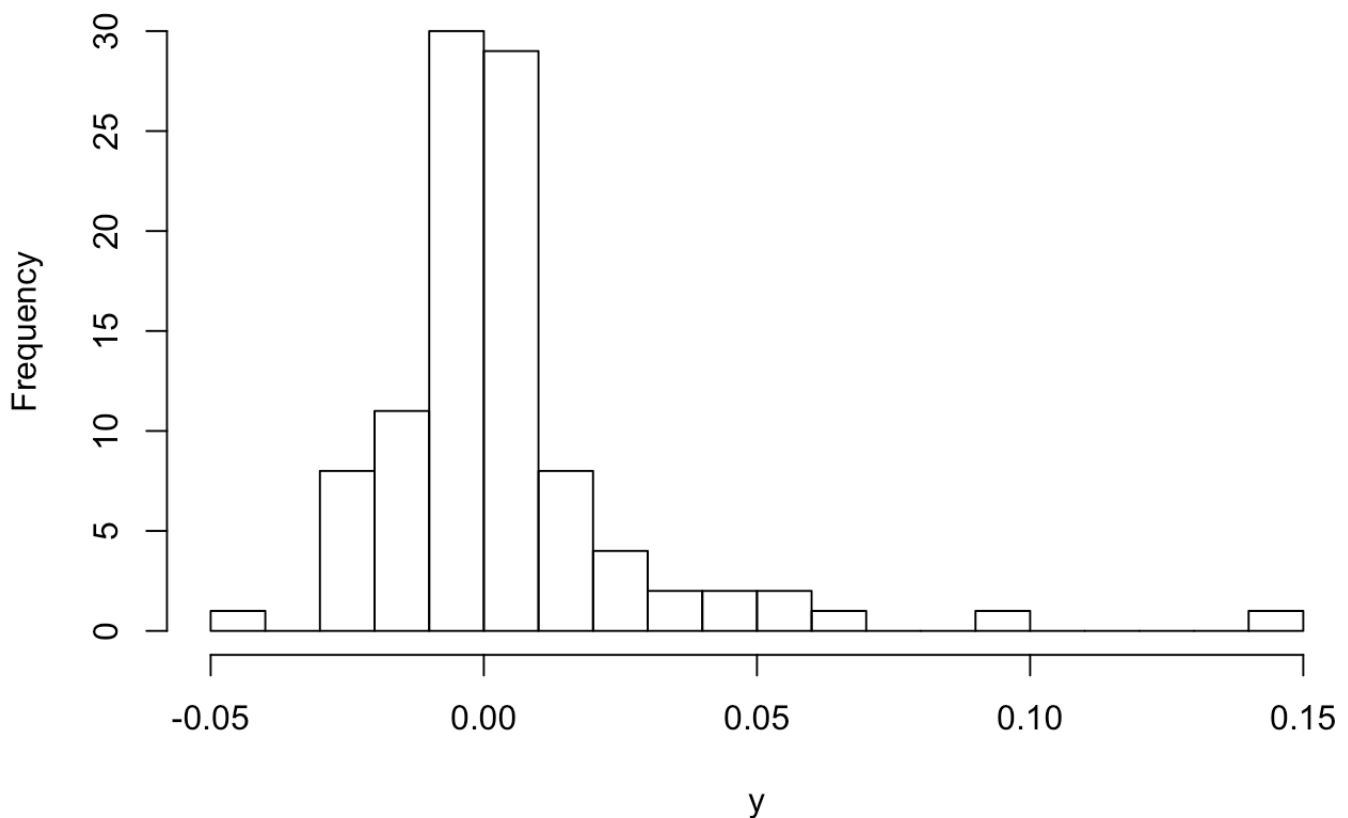
Thus, we should use some prior information. I choose to use the cauchy distribution since it is not so strong and usually give a more robust result.

```
data{
  int<lower=0> N;
  vector[N] x;
  vector[N] y;
}
parameters{
  real<lower=0> a;
  real<lower=0> b;
  real<lower=0> sigma;
}
model{
  a ~ cauchy(2,1);
  b ~ cauchy(3,1);
  y ~ normal(0,sigma ./ (a+b*x));
}
```

b) simulate the fake data

```
N <- 100
x <- runif(N,0,10)
a <- 2
b <- 3
sigma <- 0.2
error <- rnorm(N,0,sigma)
y <- (1/(a+b*x)) * error
data <- list(N=N,x=x,y=y)
hist(y,breaks = 20)
```

Histogram of y



c) fit the stan model with simulated data

```
library(rstan)
options(mc.cores = parallel::detectCores())
rstan_options(auto_write = TRUE)
fit <- stan('./homework_3a.stan', data=data)
```

```
## In file included from file5e666f93392e.cpp:8:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/st
an/model/model_header.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/core.hpp:12:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/core/gevv_vvv_vari.hpp:5:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/core/var.hpp:7:
## In file included from /usr/local/lib/R/3.5/site-library/BH/include/boost/math/tool
s/config.hpp:13:
## In file included from /usr/local/lib/R/3.5/site-library/BH/include/boost/config.hp
p:39:
## /usr/local/lib/R/3.5/site-library/BH/include/boost/config/compiler/clang.hpp:200:1
1: warning: 'BOOST_NO_CXX11_RVALUE_REFERENCES' macro redefined [-Wmacro-redefined]
## # define BOOST_NO_CXX11_RVALUE_REFERENCES
##      ^
## <command line>:6:9: note: previous definition is here
## #define BOOST_NO_CXX11_RVALUE_REFERENCES 1
##      ^
## In file included from file5e666f93392e.cpp:8:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/st
an/model/model_header.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/core.hpp:14:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/core/matrix_vari.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat/fun/Eigen_NumTraits.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/prim/mat/fun/Eigen.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/De
nse:1:
```

```

## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Core:531:
## /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/src/Core/util/ReenableStupidWarnings.h:10:30: warning: pragma diagnostic pop could not pop, no matching push [-Wunknown-pragmas]
##      #pragma clang diagnostic pop
##      ^
## In file included from file5e666f93392e.cpp:8:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/stan/model/model_header.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/rev/mat.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/rev/core.hpp:14:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/rev/core/matrix_vari.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/rev/mat/fun/Eigen_NumTraits.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/prim/mat/fun/Eigen.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Dense:2:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/LU:47:
## /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/src/Core/util/ReenableStupidWarnings.h:10:30: warning: pragma diagnostic pop could not pop, no matching push [-Wunknown-pragmas]
##      #pragma clang diagnostic pop
##      ^
## In file included from file5e666f93392e.cpp:8:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/stan/model/model_header.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/rev/mat.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/rev/core.hpp:14:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/rev/core/matrix_vari.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/rev/mat/fun/Eigen_NumTraits.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/prim/mat/fun/Eigen.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Dense:2:

```

```

nse:3:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Ch
olesky:12:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Ja
cobi:29:
## /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/src/Core/util/ReenableSt
upidWarnings.h:10:30: warning: pragma diagnostic pop could not pop, no matching push
[-Wunknown-pragmas]
##      #pragma clang diagnostic pop
##      ^
## In file included from file5e666f93392e.cpp:8:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/st
an/model/model_header.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/core.hpp:14:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/core/matrix_vari.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat/fun/Eigen_NumTraits.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/prim/mat/fun/Eigen.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/De
nse:3:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Ch
olesky:43:
## /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/src/Core/util/ReenableSt
upidWarnings.h:10:30: warning: pragma diagnostic pop could not pop, no matching push
[-Wunknown-pragmas]
##      #pragma clang diagnostic pop
##      ^
## In file included from file5e666f93392e.cpp:8:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/st
an/model/model_header.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/core.hpp:14:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/core/matrix_vari.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat/fun/Eigen_NumTraits.hpp:4:

```

```

## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/prim/mat/fun/Eigen.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/De
nse:4:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/QR
:17:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Ho
useholder:27:
## /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/src/Core/util/ReenableSt
upidWarnings.h:10:30: warning: pragma diagnostic pop could not pop, no matching push
[-Wunknown-pragmas]
##      #pragma clang diagnostic pop
##                                     ^
## In file included from file5e666f93392e.cpp:8:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/st
an/model/model_header.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/core.hpp:14:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/core/matrix_vari.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat/fun/Eigen_NumTraits.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/prim/mat/fun/Eigen.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/De
nse:5:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/SV
D:48:
## /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/src/Core/util/ReenableSt
upidWarnings.h:10:30: warning: pragma diagnostic pop could not pop, no matching push
[-Wunknown-pragmas]
##      #pragma clang diagnostic pop
##                                     ^
## In file included from file5e666f93392e.cpp:8:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/st
an/model/model_header.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/core.hpp:14:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m

```

```

ath/rev/core/matrix_vari.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat/fun/Eigen_NumTraits.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/prim/mat/fun/Eigen.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/De
nse:6:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Ge
ometry:58:
## /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/src/Core/util/ReenableSt
upidWarnings.h:10:30: warning: pragma diagnostic pop could not pop, no matching push
[-Wunknown-pragmas]
##      #pragma clang diagnostic pop
##      ^
## In file included from file5e666f93392e.cpp:8:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/st
an/model/model_header.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/core.hpp:14:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/core/matrix_vari.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat/fun/Eigen_NumTraits.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/prim/mat/fun/Eigen.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/De
nse:7:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Ei
genvalues:58:
## /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/src/Core/util/ReenableSt
upidWarnings.h:10:30: warning: pragma diagnostic pop could not pop, no matching push
[-Wunknown-pragmas]
##      #pragma clang diagnostic pop
##      ^
## In file included from file5e666f93392e.cpp:8:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/st
an/model/model_header.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/core.hpp:36:

```

```

## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/rev/core/operator_unary_plus.hpp:7:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/prim/scal/fun/constants.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/BH/include/boost/math/constants/constants.hpp:13:
## In file included from /usr/local/lib/R/3.5/site-library/BH/include/boost/math/tools/convert_from_string.hpp:15:
## In file included from /usr/local/lib/R/3.5/site-library/BH/include/boost/lexical_cast.hpp:32:
## In file included from /usr/local/lib/R/3.5/site-library/BH/include/boost/lexical_cast/try_lexical_convert.hpp:42:
## In file included from /usr/local/lib/R/3.5/site-library/BH/include/boost/lexical_cast/detail/converter_lexical.hpp:52:
## In file included from /usr/local/lib/R/3.5/site-library/BH/include/boost/container/container_fwd.hpp:61:
## /usr/local/lib/R/3.5/site-library/BH/include/boost/container/detail/std_fwd.hpp:27:1: warning: inline namespaces are a C++11 feature [-Wc++11-inline-namespace]
## BOOST_MOVE_STD_NS_BEG
## ^
## /usr/local/lib/R/3.5/site-library/BH/include/boost/move/detail/std_ns_begin.hpp:18:34: note: expanded from macro 'BOOST_MOVE_STD_NS_BEG'
##     #define BOOST_MOVE_STD_NS_BEG _LIBCPP_BEGIN_NAMESPACE_STD
##                                     ^
## /Library/Developer/CommandLineTools/usr/include/c++/v1/__config:445:52: note: expanded from macro '_LIBCPP_BEGIN_NAMESPACE_STD'
## #define _LIBCPP_BEGIN_NAMESPACE_STD namespace std {inline namespace _LIBCPP_NAMESPACE {
##                                     ^
## In file included from file5e666f93392e.cpp:8:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/stan/model/model_header.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/rev/mat.hpp:12:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/prim/mat.hpp:83:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/prim/mat/fun/csr_extract_u.hpp:6:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Sparse:26:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/SparseCore:66:
## /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/src/Core/util/ReenableStackWarnings.h:10:30: warning: pragma diagnostic pop could not pop, no matching push [-Wunknown-pragmas]

```



```

##      #pragma clang diagnostic pop
##      ^
##
## In file included from file5e666f93392e.cpp:8:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/st
an/model/model_header.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat.hpp:12:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/prim/mat.hpp:83:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/prim/mat/fun/csr_extract_u.hpp:6:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Sp
arse:27:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Or
deringMethods:71:
## /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/src/Core/util/ReenableSt
upidWarnings.h:10:30: warning: pragma diagnostic pop could not pop, no matching push
[-Wunknown-pragmas]
##      #pragma clang diagnostic pop
##      ^
##
## In file included from file5e666f93392e.cpp:8:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/st
an/model/model_header.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/rev/mat.hpp:12:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/prim/mat.hpp:83:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath/prim/mat/fun/csr_extract_u.hpp:6:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Sp
arse:29:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Sp
arseCholesky:43:
## /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/src/Core/util/ReenableSt
upidWarnings.h:10:30: warning: pragma diagnostic pop could not pop, no matching push
[-Wunknown-pragmas]
##      #pragma clang diagnostic pop
##      ^
##
## In file included from file5e666f93392e.cpp:8:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/st
an/model/model_header.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/m
ath.hpp:4:

```

```

## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/rev/mat.hpp:12:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/prim/mat.hpp:83:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/prim/mat/fun/csr_extract_u.hpp:6:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Sparse:32:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/SparseQR:35:
## /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/src/Core/util/ReenableStackWarnings.h:10:30: warning: pragma diagnostic pop could not pop, no matching push [-Wunknown-pragmas]
##      #pragma clang diagnostic pop
##      ^
## In file included from file5e666f93392e.cpp:8:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/stan/model/model_header.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math.hpp:4:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/rev/mat.hpp:12:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/prim/mat.hpp:83:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/stan/math/prim/mat/fun/csr_extract_u.hpp:6:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/Sparse:33:
## In file included from /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/IterativeLinearSolvers:46:
## /usr/local/lib/R/3.5/site-library/RcppEigen/include/Eigen/src/Core/util/ReenableStackWarnings.h:10:30: warning: pragma diagnostic pop could not pop, no matching push [-Wunknown-pragmas]
##      #pragma clang diagnostic pop
##      ^
## In file included from file5e666f93392e.cpp:413:
## In file included from /usr/local/lib/R/3.5/site-library/rstan/include/rstan/rstanc.hpp:3:
## In file included from /usr/local/lib/R/3.5/site-library/rstan/include/rstan/stan_fit.hpp:36:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/stan/services/optimize/bfgs.hpp:11:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/stan/optimization/bfgs.hpp:9:
## In file included from /usr/local/lib/R/3.5/site-library/StanHeaders/include/src/stan/optimization/lbfgs_update.hpp:6:
## In file included from /usr/local/lib/R/3.5/site-library/BH/include/boost/circular_

```

```

buffer.hpp:54:
## In file included from /usr/local/lib/R/3.5/site-library/BH/include/boost/circular_
buffer/details.hpp:20:
## In file included from /usr/local/lib/R/3.5/site-library/BH/include/boost/move/move
.hpp:30:
## In file included from /usr/local/lib/R/3.5/site-library/BH/include/boost/move/iter
ator.hpp:27:
## /usr/local/lib/R/3.5/site-library/BH/include/boost/move/detail/iterator_traits.hpp
:29:1: warning: inline namespaces are a C++11 feature [-Wc++11-inline-namespace]
## BOOST_MOVE_STD_NS_BEG
## ^
## /usr/local/lib/R/3.5/site-library/BH/include/boost/move/detail/std_ns_begin.hpp:18
:34: note: expanded from macro 'BOOST_MOVE_STD_NS_BEG'
##      #define BOOST_MOVE_STD_NS_BEG _LIBCPP_BEGIN_NAMESPACE_STD
##      ^
## /Library/Developer/CommandLineTools/usr/include/c++/v1/__config:445:52: note: expa
nded from macro '_LIBCPP_BEGIN_NAMESPACE_STD'
## #define _LIBCPP_BEGIN_NAMESPACE_STD namespace std {inline namespace _LIBCPP_NAMESP
ACE {
##      ^
## 16 warnings generated.
## ld: warning: text-based stub file /System/Library/Frameworks/CoreFoundation.frame
work/CoreFoundation.tbd and library file /System/Library/Frameworks/CoreFoundation.f
ramework/CoreFoundation are out of sync. Falling back to library file for linking.

```

```
print(fit)
```

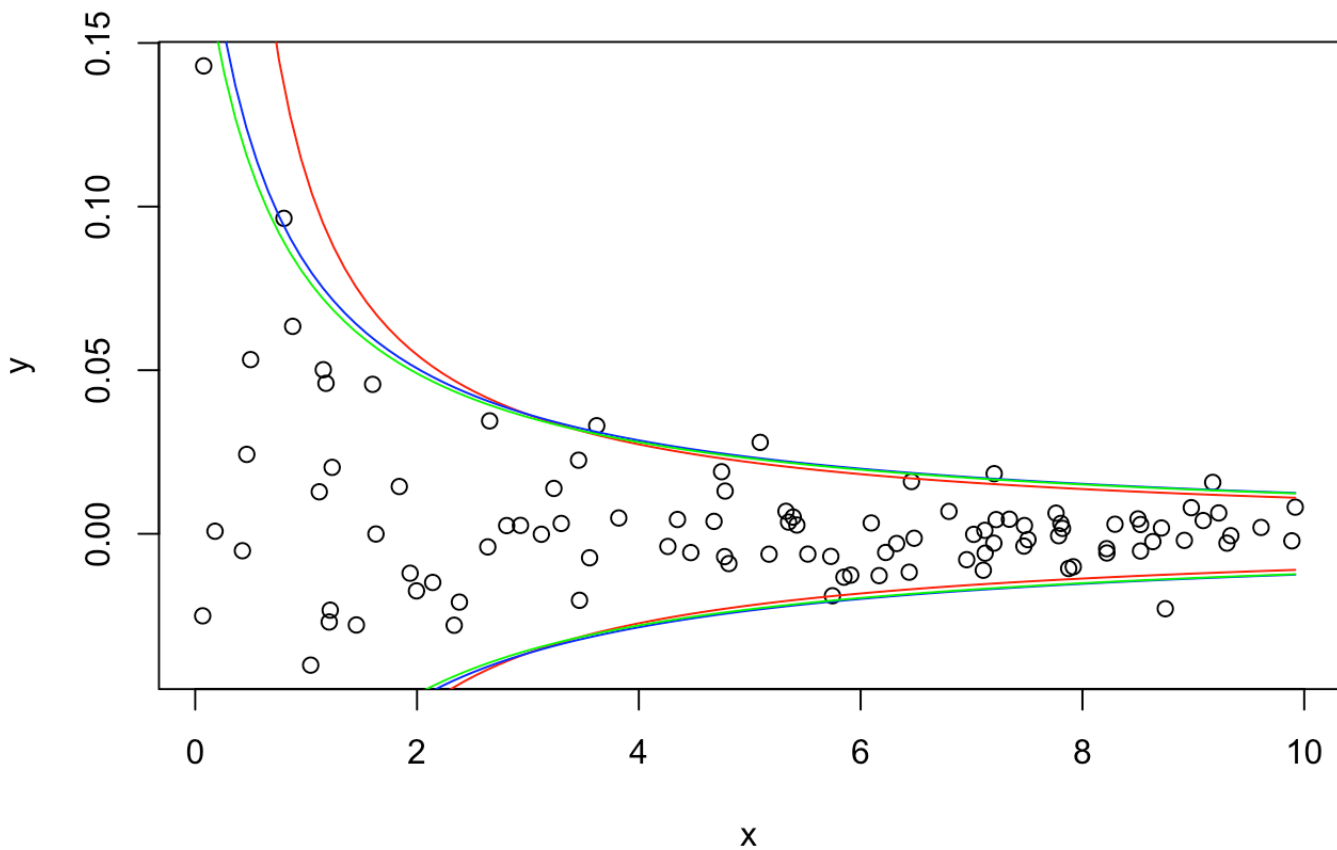
```
## Inference for Stan model: homework_3a.
## 4 chains, each with iter=2000; warmup=1000; thin=1;
## post-warmup draws per chain=1000, total post-warmup draws=4000.
##
##               mean          se_mean          sd    2.5%    25%    50%
## a      3.350000e+00  5.100000e-01  1.403000e+01   0.78    1.78    2.29
## b      7.786096e+149  3.247887e+149  2.054144e+151   1.81    2.99    3.84
## sigma  4.345633e+148  4.299081e+148  1.155547e+150   0.12    0.20    0.26
## lp__    3.777600e+02  1.390000e+00  3.440000e+00 369.05 377.13 379.10
##               75%          97.5% n_eff Rhat
## a      2.96  8.660000e+00    769 1.00
## b      6.54  1.126570e+143   4000 1.00
## sigma  0.42  6.438095e+141    722 1.00
## lp__   380.10  3.808700e+02      6 1.84
##
## Samples were drawn using NUTS(diag_e) at Thu Sep 20 13:55:42 2018.
## 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).
```

Note

1. If I do not use any prior information in this model the result is very poor. The estimation cannot coverage the true value.
2. Then I try the prior information about the a and b, as we can see from the result, the posterior median this time can coverage the true value. But sometime the posterior mean cannot estimate the result very well. And we can see that the r hat is almost 1 which means the result is reliable.

d) draw the praph

```
## if we fit the model with mean
results <- extract(fit)
plot(x,y)
a_mean <- mean(results$a)
b_mean <- mean(results$b)
sigma_mean <- mean(results$sigma)
a_median <- median(results$a)
b_median <- median(results$b)
sigma_median <- median(results$sigma)
## red lines are the posterior mean
curve(1.96*(1/(a_mean+b_mean*x))*sigma_mean,add = T,col='red')
curve(-1.96*(1/(a_mean+b_mean*x))*sigma_mean,add = T,col='red')
# blue lines are the posterior median
curve(1.96*(1/(a_median+b_median*x))*sigma_median,add = T,col='blue')
curve(-1.96*(1/(a_median+b_median*x))*sigma_median,add = T,col='blue')
# green lines are the true value
curve(1.96*(1/(2+3*x))*0.2,add=T,col='green')
curve(-1.96*(1/(2+3*x))*0.2,add=T,col='green')
```



Note

In this plot I draw the 95% upper bound and lower bound for the true value, posterior mean and posterior median for a , b and σ .

The red line is based on posterior mean, the blue line is based on posterior median and the green line is the true value.

As we can see, almost all points are in this range and these three line overlap with each other.

e)

In this problem there are sever things that I think is very important:

1. The prior information is need. Otherwise, given such a small sample size, it is impossible to get a good estimation.
2. In this problem, we are not care about the mean of distribution anymore. All the parameters are related to variance.