EXERCISE 04

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1.- Two unpaired samples

- **What is the probability that the mean bp of patients with diabetes is greater than the mean of patients without.**

```r
#Read file
data <- read.csv("~/exercise_4/ex2.csv", stringsAsFactors = FALSE)
#Seed
set.seed(1234)
#Install package
install.packages("BEST")
library(BEST)

#Separate data by people who have diabetes and people who do not have
diabetes
si_diabetes <- data$bp[data$type=="Yes"]
no_diabetes <- data$bp[data$type=="No"]

#BEST
BESTout <- BESTmcmc(si_diabetes, no_diabetes, parallel=FALSE)
BESTout
#Plot
plot(BESTout)
```

```
#MCMC fit results for BEST analysis:
#100002 simulations saved.
#       mean       sd median  HDIlo HDIup  Rhat n.eff
#mu1   74.60  1.4136  74.60 71.843 77.38 1.000 61642
#mu2   69.46  0.9630  69.46 67.587 71.37 1.000 61777
#nu    28.58 24.4306  20.65  3.664 77.21 1.001 12708
#sigma1 11.07 1.1496  11.01  8.849 13.34 1.000 37734
#sigma2 10.52 0.8044  10.51  8.960 12.13 1.000 32370
#
#'HDIlo' and 'HDIup' are the limits of a 95% HDI credible interval.
```

```
#'Rhat' is the potential scale reduction factor (at convergence,
Rhat=1).
#'n.eff' is a crude measure of effective sample size.
```


Difference of Means

mean = 5.13

0.1% < 0 < 99.9%

95% HDI

1.73   8.43

$\mu_1 - \mu_2$
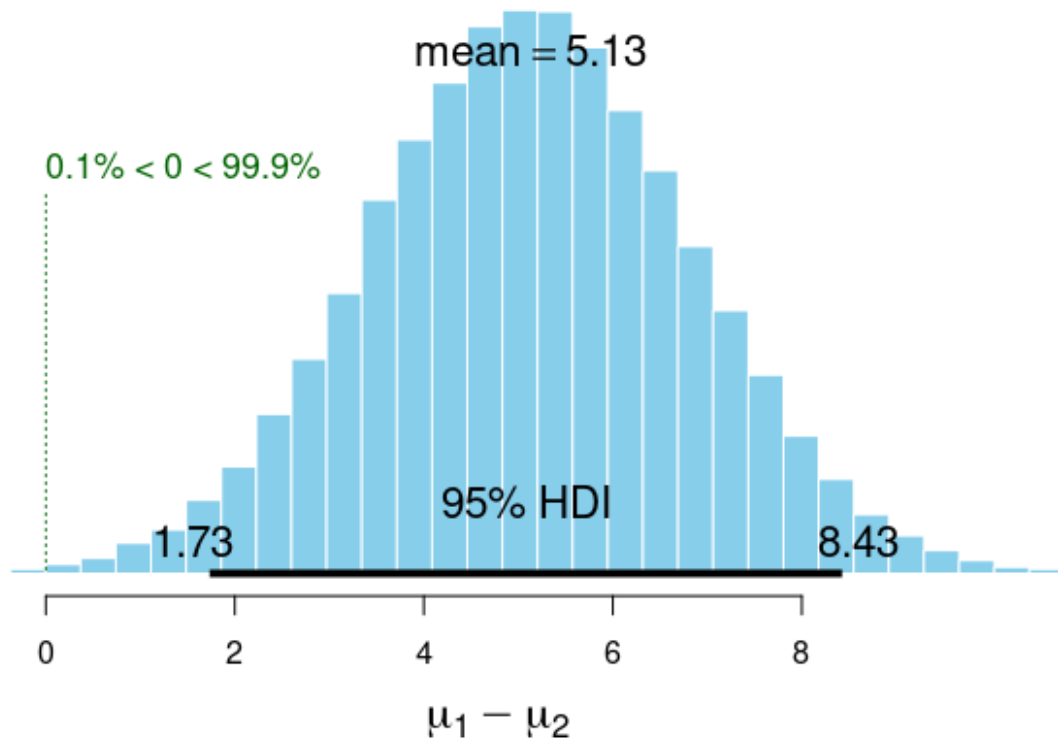
```
meanDiff <- (BESTout$mu1 - BESTout$mu2)
meanDiffGTzero <- mean(meanDiff > 0)
meanDiffGTzero
```

```
[1] 0.99876
```

- **Assume a ROPE of -4 to 4, meaning a difference in mean less than 4 is considered irrelevant. How likely is it that there is no practical difference between the blood pressure of patients with and without diabetes. (I don't know what is considered an irrelevant difference for blood pressure - this value of 4 is just for illustration).**

```
plot(BESTout, ROPE=c(-4,4))
```

Difference of Means

mean = 5.13

0.1% < 0 < 99.9%

25% in ROPE

1.73   95% HDI   8.43

$\mu_1 - \mu_2$
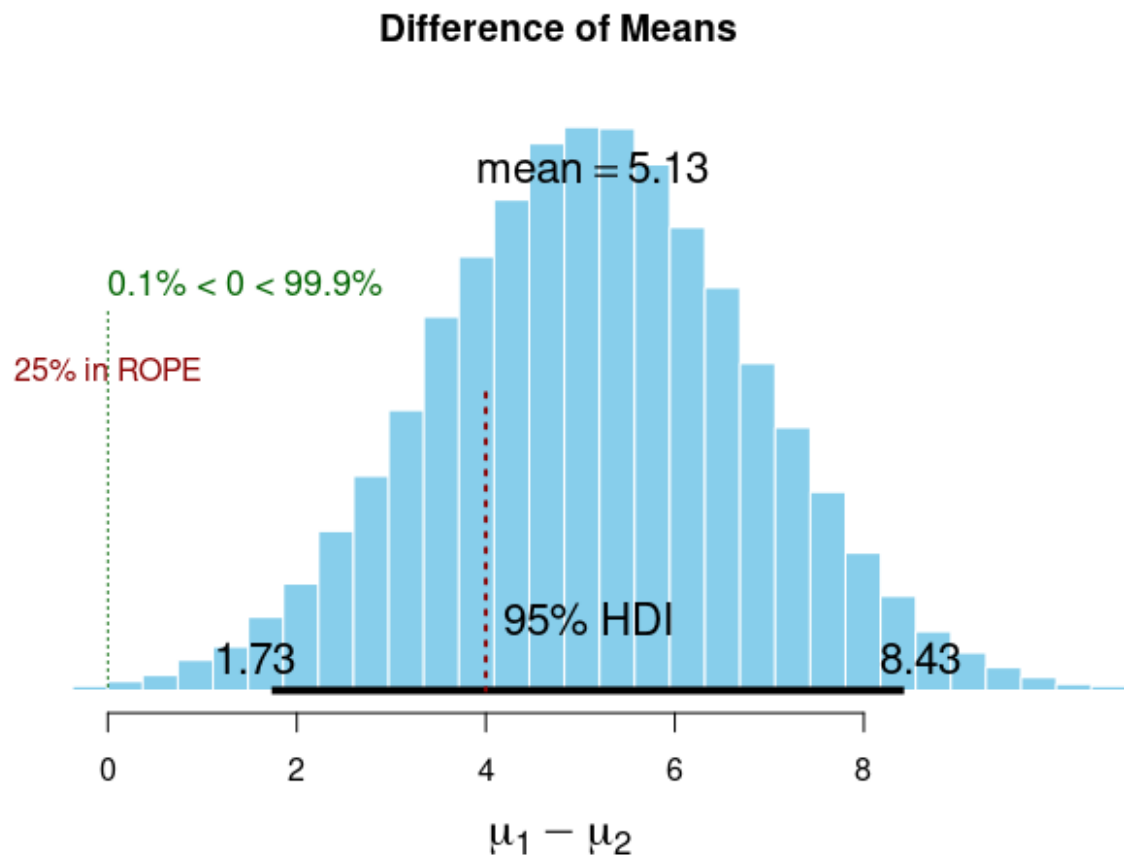
2.- Two paired samples

- **What is the probability that the average for the month of November is greater than the average for the month of August.**

BAYES.T.TES

```
#Read file
data2 <- read.csv("~/exercise_4/ex2-paired.csv", stringsAsFactors =
FALSE)

#Seed
set.seed(1234)

#Install package
install.packages("devtools")
devtools::install_github("rasmusab/bayesian_first_aid")
library(BayesianFirstAid)

resultbayes <- bayes.t.test(data2$November, data2$August, paired = T)
resultbayes
```

```
#       Bayesian estimation supersedes the t test (BEST) - paired samples
#
#data: data2$November and data2$August, n = 13
#
#   Estimates [95% credible interval]
#mean paired difference: 4.5 [-0.27, 9.3]
#sd of the paired differences: 7.6 [4.1, 12]
#
#The mean difference is more than 0 by a probability of 0.973
#and less than 0 by a probability of 0.027
```
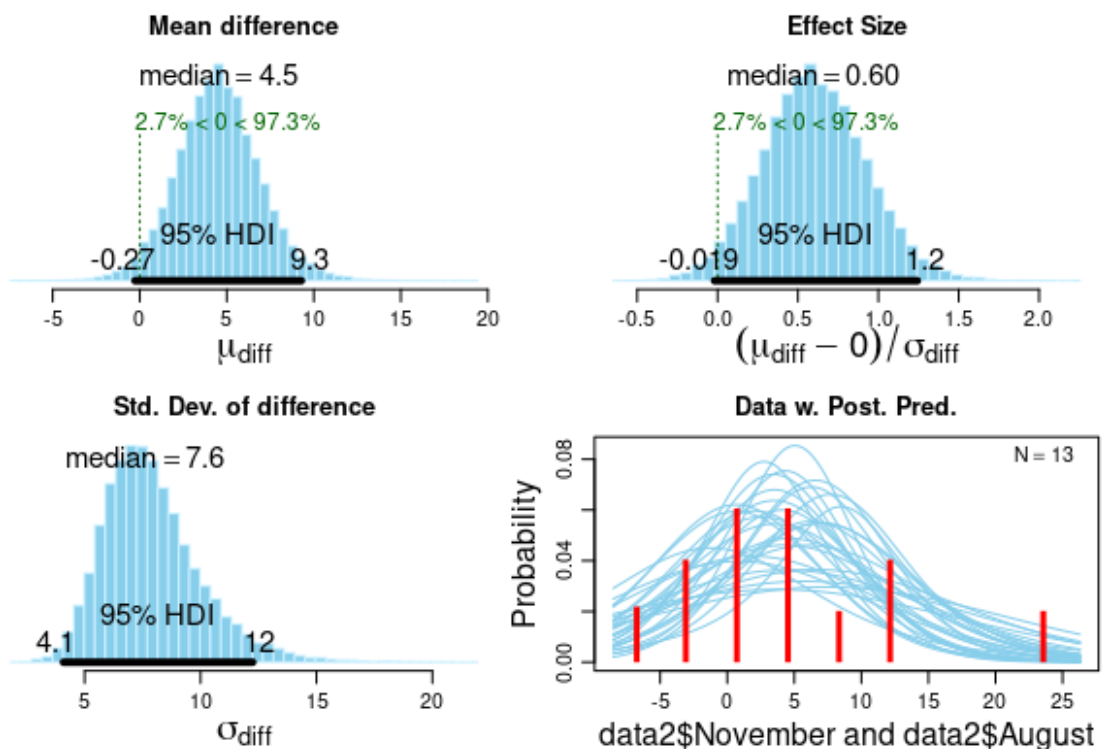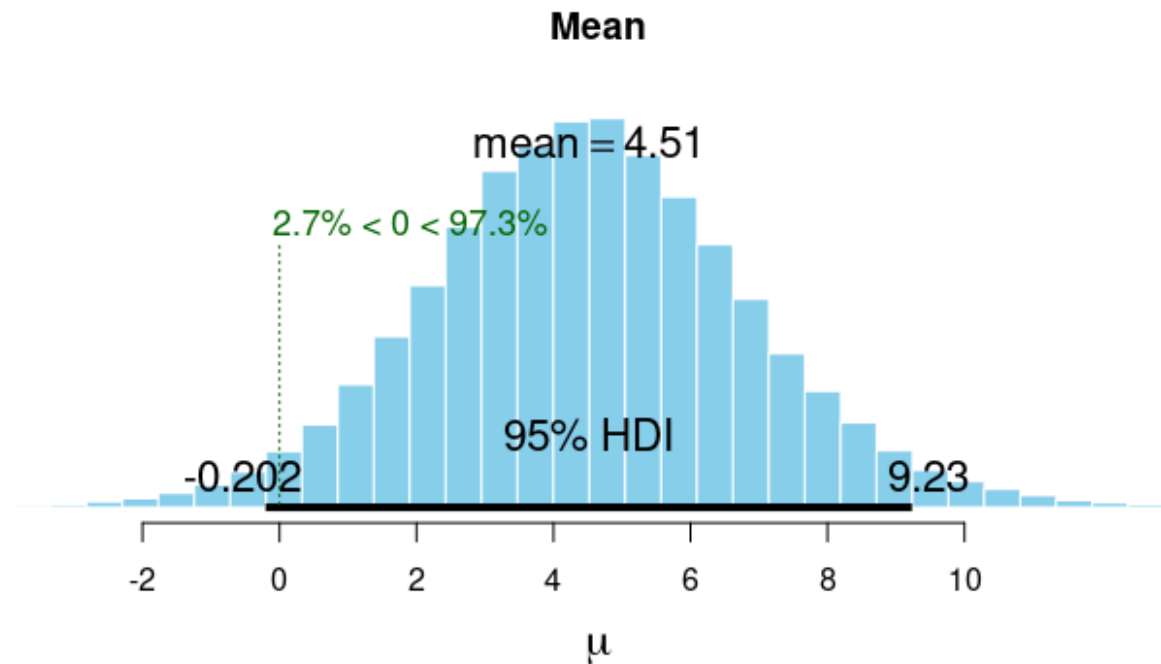

BEST

```
#BEST
library(BEST)
resultBest <- BESTmcmc(data2$November-data2$August, parallel=FALSE)
resultBest
```

```
#MCMC fit results for BEST analysis:
#100002 simulations saved.
#      mean    sd median   HDIlo   HDIup  Rhat  n.eff
#mu    4.513  2.384  4.477  -0.2022  9.234 1.000 53989
#nu   29.305 27.820 20.625   1.0005 85.767 1.000 18609
#sigma 7.875  2.149  7.580   4.1118 12.311 1.001 27316
```

```
#
#'HDIlo' and 'HDIup' are the limits of a 95% HDI credible interval.
#'Rhat' is the potential scale reduction factor (at convergence,
Rhat=1).
#'n.eff' is a crude measure of effective sample size.
```

Mean

- **Assumindo um ROPE de -3.5 a 3.5, qual a probabilidade da diferença não reja relevante.**

```
plot(resultBest, ROPE=c(-3.5,3.5))
```

Mean

mean = 4.51

2.7% < 0 < 97.3%

33% in ROPE

95% HDI

-0.202

9.23

μ