

STAT 447: Exercise 6

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Question 1

$$\mu_e \sim \text{Unif}(0, 1)$$

$$\lambda_e \sim \text{Exp}(0.01)$$

$$\mu_p \sim \text{BetaMP}(0.1, 15)$$

$$\lambda_p \sim \text{Exp}(0.01)$$

$$e_{Pfizer}, e_{Moderna} | \mu_e, \lambda_e \sim \text{BetaMP}(\mu_e, \lambda_e)$$

$$p_{Pfizer}, p_{Moderna} | \mu_p, \lambda_p \sim \text{BetaMP}(\mu_p, \lambda_p)$$

$$n_c | p \sim \text{Binom}(t_c, p)$$

$$n_v | e, p \sim \text{Binom}(t_v, p(1 - e))$$

Question 2

```
# this is where your R code goes
source("../simple.R")

BetaMP = function(mean, precision){
  Beta(mean*precision, (1-mean)*precision)
}

model = function() {
  mu_e = simulate(Unif(0,1))
  lambda_e = simulate(Exp(0.01))

  mu_p = simulate(BetaMP(0.1, 15))
  lambda_p = simulate(Exp(0.01))

  eff = list()
  inc = list()

  eff[["Pfizer-BioNTech"]] = simulate(BetaMP(mu_e, lambda_e))
  inc[["Pfizer-BioNTech"]] = simulate(BetaMP(mu_p, lambda_p))

  eff[["Moderna-NIH"]] = simulate(BetaMP(mu_e, lambda_e))
  inc[["Moderna-NIH"]] = simulate(BetaMP(mu_p, lambda_p))
}
```

```

for (i in seq_along(vaccines)) {
  vaccine = vaccines$trials[i]
  arm = vaccines$arms[i]
  size = vaccines$groupSizes[i]
  cases = vaccines$numberOfCases[i]

  if (arm == "control") {
    observe(cases, Binom(size, inc[[vaccine]]))
  } else {
    observe(cases, Binom(size, inc[[vaccine]] * (1 - eff[[vaccine]])))
  }
}

return(eff[["Moderna-NIH"]] > eff[["Pfizer-BioNTech"]])
}

```

Question 3

```

# this is where your R code goes
vaccines = read.csv("vaccines.csv")
vaccines$groupSizes = as.double(vaccines$groupSizes) # needed due to bug in Binom code

```

Question 4

```

# this is where your R code goes
set.seed(2)
prob = posterior(model, 10000)
print(prob)

```

```
## [1] 0.9854687
```

I am not sure if it is reliable because for the code above, when I set the seed to 1, it would fail for some reason. If this wasn't the case, I would say SNIS is reliable.