Problem4

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Problem 4: Modelling Insurance Claims

```
library(MASS)

gaussian <- function(vec){

  b0 <- vec[1]
  b1 <- vec[2]
  sigma <- vec[3]

  loglikely <-  0

  for (i in 1:nrow(Insurance)){

    avg <- b0 + b1*Insurance$Holders[i]
    loglikely <- loglikely + dnorm(Insurance$Claims[i],
                                   mean=avg, sd=sigma, log=TRUE)

  }
  return(-1*loglikely)
}

bic <- function(mle, parameters, data){
  N <- length(data)
  return((length(parameters))*log(N)-2*(mle$value))
}

gaussian.estimate <- optim(c(0,1/5,1), gaussian)
gaussian.bic <- bic(gaussian.estimate, gaussian.estimate$par, Insurance)

cat("The Gaussian BIC is:", gaussian.bic)
```

```
## The Gaussian BIC is: -493.4548
```

```
##############################################################################

loglaplace <- function(x, mu, b){

  numerator <- exp(-abs(x-mu)/b)
  denominator <- 2*b
```

```
  laplace <- numerator/denominator

  return(log(laplace))

}

laplacian <- function(vec){

  b0 <- vec[1]
  b1 <- vec[2]
  sigma <- vec[3]

  loglikely <-  0

  for (i in 1:nrow(Insurance)){

    avg <- b0 + b1*Insurance$Holders[i]
    loglikely <- loglikely + loglaplace(Insurance$Claims[i],
                                        mu=avg, b=sigma)

  }
  return(-1*loglikely)

}

laplacian.estimate <- optim(c(0, 0, 1), laplacian)

laplacian.bic <- bic(laplacian.estimate, laplacian.estimate$par, Insurance)

cat("The Laplacian BIC is:", laplacian.bic)
```

```
## The Laplacian BIC is: -481.3824
```

```
#############################################################################

lognormal <- function(vec){

  b0 <- vec[1]
  b1 <- vec[2]
  sigma <- vec[3]

  loglikely <-  0

  for (i in 1:nrow(Insurance)){

    if (Insurance$Claims[i] > 0){
      avg <- b0 + b1*Insurance$Holders[i]
      loglikely <- loglikely + dlnorm(Insurance$Claims[i],
                                      meanlog=avg, sdlog=sigma, log=TRUE)
    }

  }
  return(-1*loglikely)
```

```
}

lognormal.estimate <- optim(c(0, 0, 1), lognormal)

lognormal.bic <- bic(lognormal.estimate, lognormal.estimate$par, Insurance)

cat("The Lognormal BIC is:", lognormal.bic)
```

```
## The Lognormal BIC is: -550.7147
```

```
################################################################################

gamma.model <- function(vec){

  b0 <- vec[1]
  b1 <- vec[2]
  sigma <- vec[3]

  loglikely <-  0

  for (i in 1:nrow(Insurance)){

    if (Insurance$Claims[i] > 0){
      avg <- b0 + b1*Insurance$Holders[i]
      loglikely <- loglikely + dgamma(Insurance$Claims[i],
                                      shape=avg, scale=sigma, log=TRUE)
    }

  }
  return(-1*loglikely)
}

gamma.estimate <- optim(c(0,1/5,1), gamma.model)

gamma.bic <- bic(gamma.estimate, gamma.estimate$par, Insurance)

cat("The Gamma BIC is:", gamma.bic)
```

```
## The Gamma BIC is: -432.7574
```