STT 810

Homework 4

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Contents

Question 1

```
func_1 <- function(x) x[1]**2 - 3*x[1] +
  x[2]**4 -3*x[2] + x[3]**2 + 10*x[3] + cos(x[1]*x[2]*x[3])

paste(optim( c(0,0,0),func_1))
```

```
## [1] "c(0.958613145696839, 0.734856786194304, -4.8938218733315)"
## [2] "-29.812179241302"
## [3] "c(`function` = 250, gradient = NA)"
## [4] "0"
## [5] "NULL"
```

```
paste(optim(c(6,7,12),func_1))
```

```
## [1] "c(1.8068473614052, 1.0075966999892, -5.10858154237778)"
## [2] "-30.1284033902556"
## [3] "c(`function` = 139, gradient = NA)"
## [4] "0"
## [5] "NULL"
```

```
paste(optim(c(-6,19,32),func_1))
```

```
## [1] "c(1.83566693680597, 0.991365837529994, -5.11892659962607)"
## [2] "-30.125410039339"
## [3] "c(`function` = 163, gradient = NA)"
## [4] "0"
## [5] "NULL"
```

```
paste(optim(c(-124,197,382),func_1))
```

```
## [1] "c(2.44433348505634, 0.818796355873763, -5.49718066951175)"
## [2] "-28.1114162715162"
## [3] "c(`function` = 130, gradient = NA)"
## [4] "0"
## [5] "NULL"
```

We can observe different local minimum in our function and its hard to establish a global minimum, but as per our findings the global minimum occurs at value x = 1.8, y = 1, z = 5.1

Question 2

```
x <- c(2,3,2.5,3,1.6,1.4,1.3,1.8, 1.9, 2.4, 4.6)
f <- function (alpha) length(x)*log(alpha) - (alpha+1)*sum(log(x))
a = optimize(f,c(1,3),maximum=TRUE)
paste(a)
```

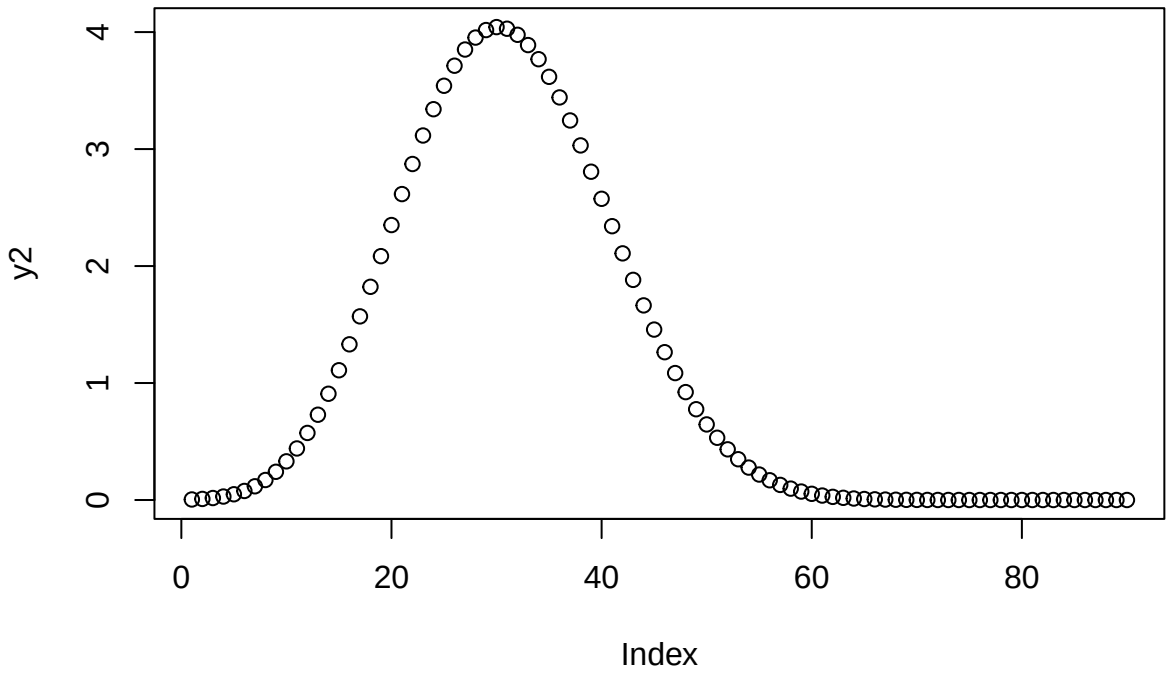
```
## [1] "1.29310853373677"  "-16.6791740775447"
```

Question 3

```
betadata = read.csv('betasample.csv', header = TRUE)
y <- betadata$x
f <- function (x) -1*sum(log(dbeta(y,x[1],x[2])))

a = optim(par = c(2,4),fn = f)

paste(a)
```

```
## [1] "c(10.0010394834202, 14.9946478615332)"
## [2] "-92710.5720237346"
## [3] "c(‘function‘ = 69, gradient = NA)"
## [4] "0"
## [5] "NULL"
```

```
y2 <- dbeta(seq(0.1,0.99,0.01), a$par[1],a$par[2])

plot(y2)
```



Question 4

```
penguins = read.csv('penguins.csv', header = TRUE)

mn <- mean(penguins$body_mass_g)
sdev <- sd(penguins$body_mass_g)
n <- length(penguins$body_mass_g)
serror <- sdev/sqrt(n)
CI <- mn + serror*qt(c(0.005,0.995), length(penguins$body_mass_g) - 1)
print(CI)
```

```
## [1] 4089.426 4314.083
```

```
mn_spe <- aggregate(penguins$body_mass_g, list(penguins$species), FUN = mean)
sdev_spe <- aggregate(penguins$body_mass_g, list(penguins$species), FUN = sd)
n_spe <- aggregate(penguins$body_mass_g, list(penguins$species), FUN = length)
serror_spe <- sdev_spe$x/sqrt(n_spe$x)

for (x in c(1:3)) {
  CI <- mn_spe$x[x] + serror_spe[x]*qt(c(0.005,0.995),n_spe$x[x] - 1)
  print(CI)
}
```

```
## [1] 3603.301 3798.024
## [1] 3609.522 3856.655
## [1] 4957.074 5194.959
```