# Homework 2

Jaeho, Chang

March 21, 2019

## Bisection ; steps

For a gamma density $f$ with $\alpha = 2$ and $\beta = 2$,

1. Solve $G(\lambda) = F(b_\lambda) - F(a_\lambda) - \alpha = 0$ and

$g(b_\lambda) = g(a_\lambda) = 0$ where $g(x) = f(x) - \lambda$.

2. Set $a$, $b$ and $c = \frac{a+b}{2}$.
3. If $sign\{g(b) - g(a)\}g(c) < 0$ then $a \leftarrow c$, else $b \leftarrow c$.

```r
rm(list = ls())
# Function for solving g(x) = 0
solveg <- function(g, a, b, l, iter.max = 100, eps = 1e-7) {
  for (i in 1:iter.max) {
    c <- (a + b)/2
    if (sign(g(b, l)-g(a, l))*g(c, l) < 0) {
      a <- c
    } else {
      b <- c
    }
    if (abs(b - a) < eps) {
      break
    }
  }
```

```
  return(a)
}
g <- function(x, l) dgamma(x, 2, 1/2) - l
print(x0 <- solveg(g, 0, 2, .1))
```

```
## [1] 0.5183422
```

```
dgamma(x0, 2, 1/2) # Equals lambda!
```

```
## [1] 0.1
```

```
out.f <- function(alp = 0.9, iter.max = 100, eps = 1e-10) {
  a <- 1e-10 ; b <- dgamma(2, 2, 1/2) - 1e-10
  # a, b <- minimum and maximum of lambda.
  for (i in 1:iter.max) {
    c <- (a + b)/2
    a.lam <- solveg(g, 0, 2, c)
    b.lam <- solveg(g, 2, 1e7, c)
    if (pgamma(b.lam, 2, 1/2) - pgamma(a.lam, 2, 1/2) - alp
      b <- c
    } else {
      a <- c
    }
    if (abs(b - a) < eps) break
  }
  return(c(a.lam, b.lam))
}
dgamma(out.f(), 2, 1/2) # lambda
```

```
## [1] 0.0385381 0.0385381
```

```
pgamma(out.f()[2], 2, 1/2) - pgamma(out.f()[1], 2, 1/2) # al
```

```
## [1] 0.9
```