Computer Lab 3

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Question 2

1.

$$DE(\mu, \alpha) = \frac{\alpha}{2} e^{-\alpha|x-\mu|}$$

- μ - location parameter
- $b > 0$ - scale parameter

inverse CDF of DE:

Source - https://en.wikipedia.org/wiki/Laplace_distribution

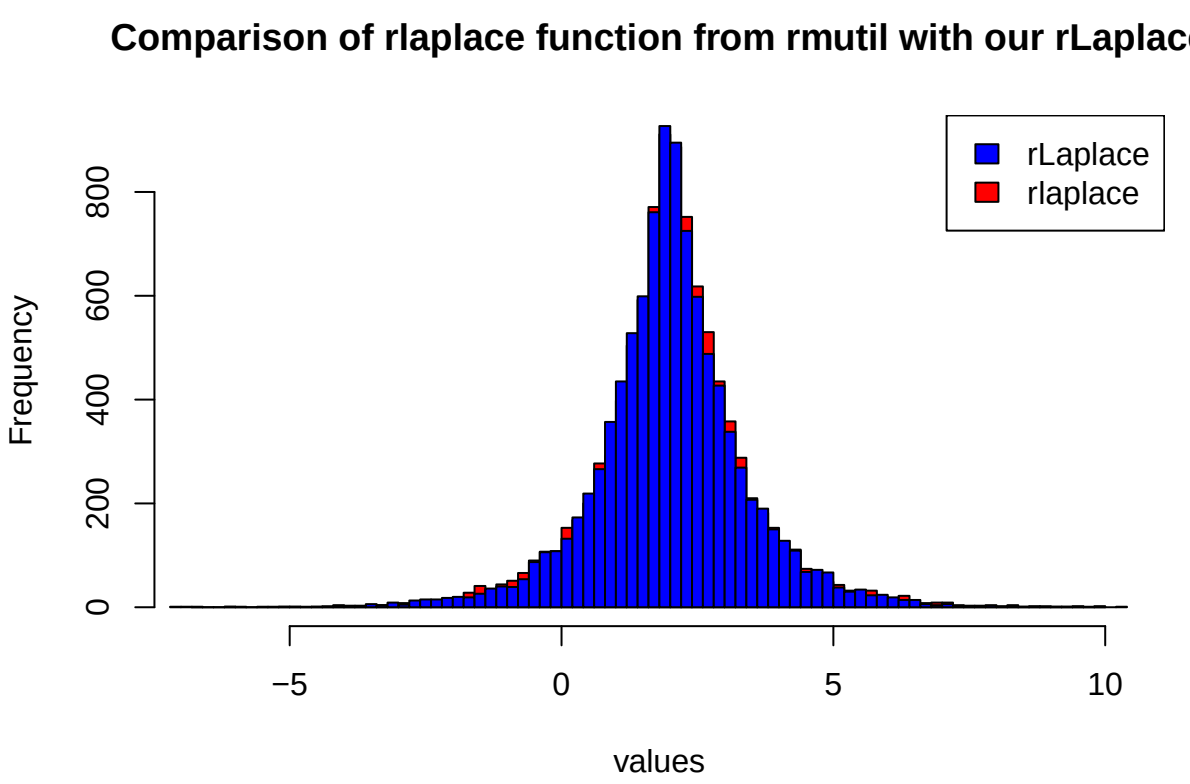
$$F^{-1}(p) = \mu - bsgn(p - 0.5)ln(1 - 2|p - 0.5|)$$

where $b = \frac{1}{\alpha}$

```
rLaplace <- function(n, mean = 0, alpha = 1){
  b <- 1/alpha
  u <- runif(n)
  res <- mean - (b*sign(u-0.5) * log(1-(2*abs(u-0.5))))
  return(res)
}
```

meaning:

1. calculate b.
2. take n random variables from uniform distribution [0,1]
3. calculate random numbers from inverse CDF of laplace distribution where x is a random variable from uniform distribution



2.

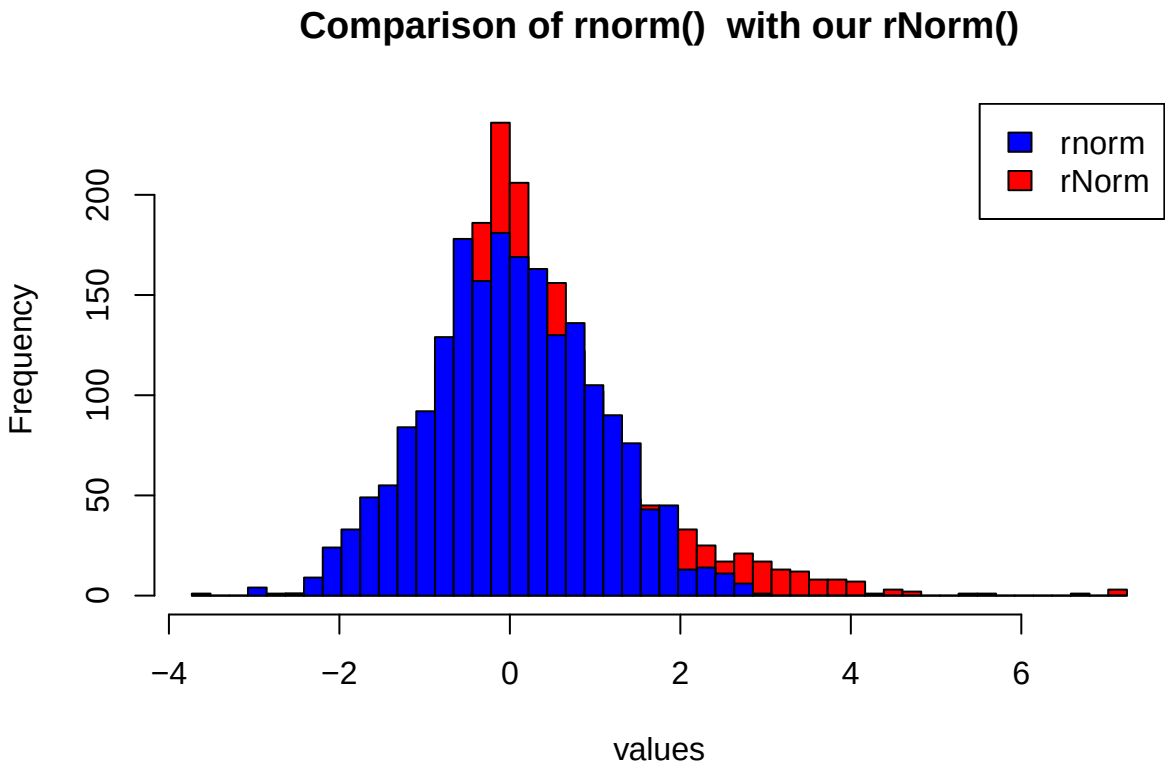
```
DE <- function(x, mean = 0,alpha = 1){
  return((0.5*alpha)*exp((-alpha)*abs(x-mean)))
}

genNorm <- function(c, rej){
  z <- TRUE
  res <- 0
  while (z == TRUE) {
    y <- rLaplace(1)
    u <- runif(1)
    if(u <= pnorm(y) / (c*DE(y))){
      res <- y
      z <- FALSE
    }
    if(rej){
    rejected <<- rejected + 1
    }
  }
  return(res)
}

rNorm <- function(n,c,rej = FALSE){
 return(replicate(n, genNorm(c, rej)))
```

```
}
```

algorithm:

1. write Laplace probability function
2. assign 0 to result value res
3. generate random number y from rLaplace function
4. generate random number u from uniform distribution
5. check if u is less or equal to probability y in normal distribution / c * probability of y in laplace distribution
   a) if yes, return u
   b) repeat steps from 3

Estimated optimal c using `optim( method = "Brent",lower = 0, upper = 2)` - 1.0296387



rejection rate: 1.1265

	mean	variance
rNorm()	0.3000746	1.3615132
rnorm()	0.0258128	0.9932653