Laboratory 3

Basics of generating random variables cd.

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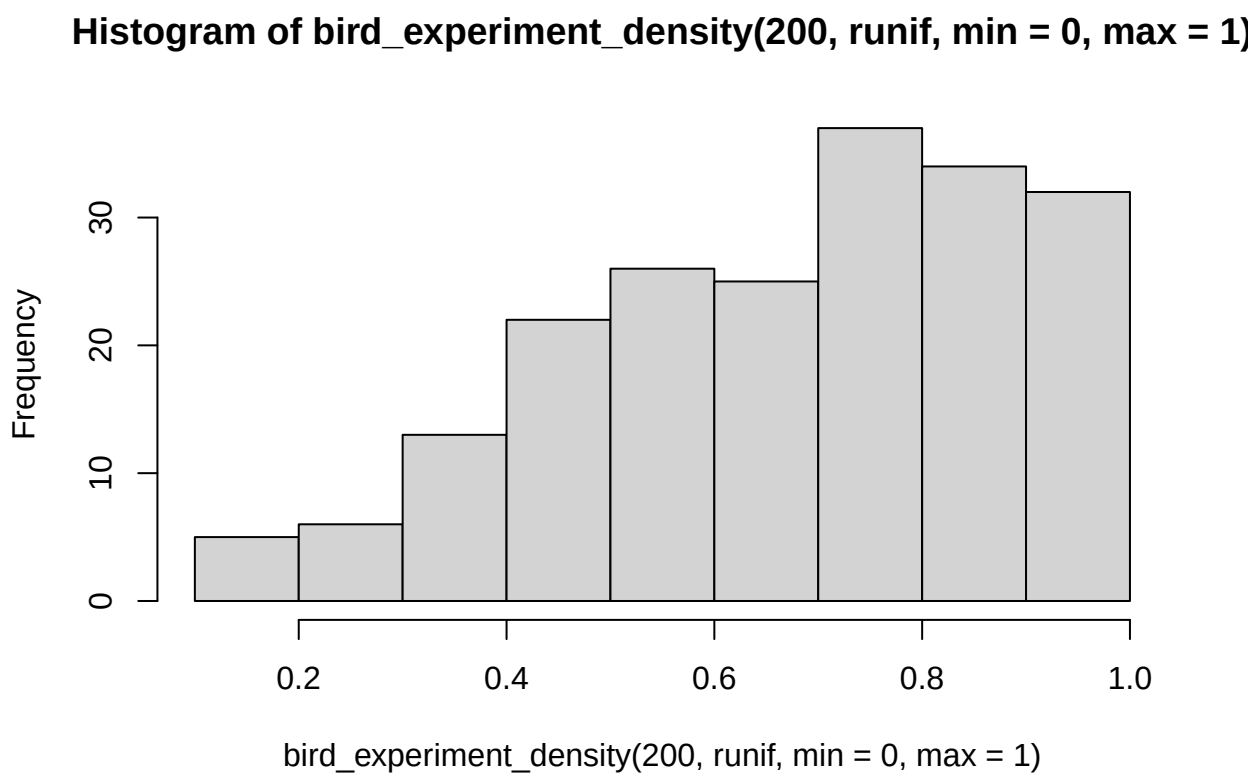
We are doing exercise 1.18 from lecture notes.

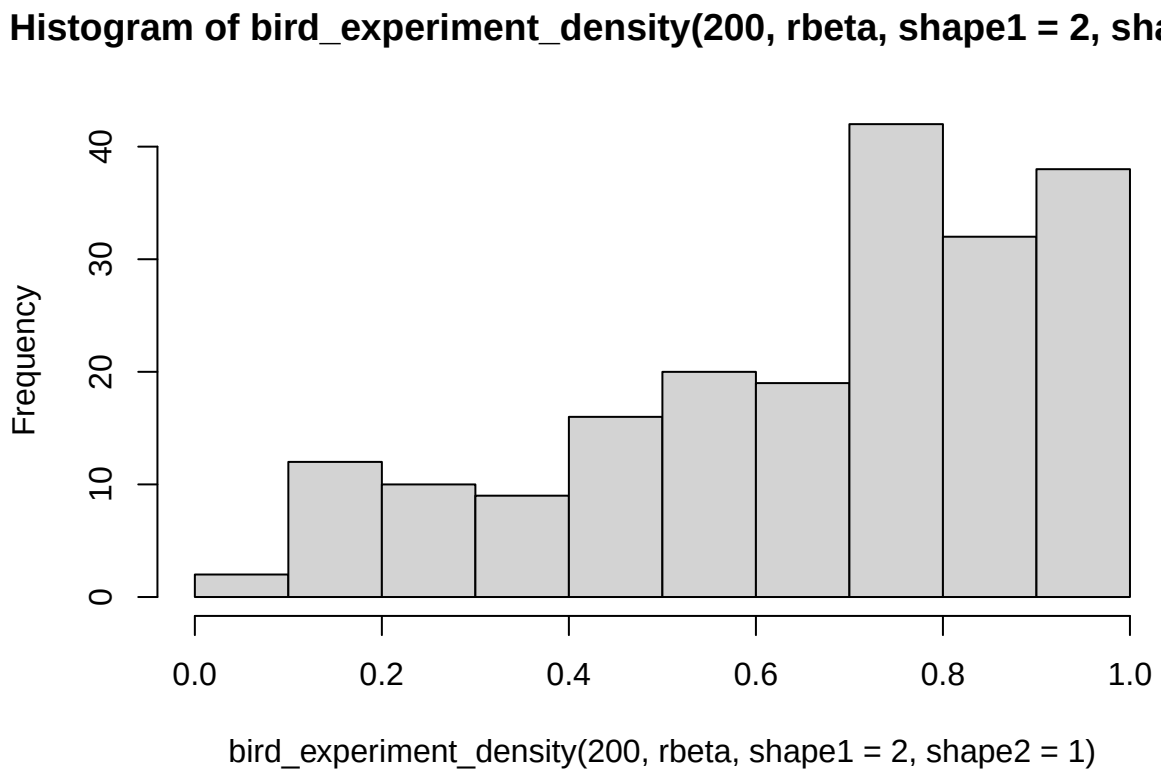
```
bird_experiment_density <- function(n, distribution, ...){
theta <- distribution(n, ...)
V <- distribution(n, ...)
observed <- ifelse(V < theta, theta,  1 - theta)

return(observed)
}

hist(bird_experiment_density(200, runif, min = 0, max = 1))
```



```r
hist(bird_experiment_density(200, rbeta, shape1 = 2, shape2 = 1))
```

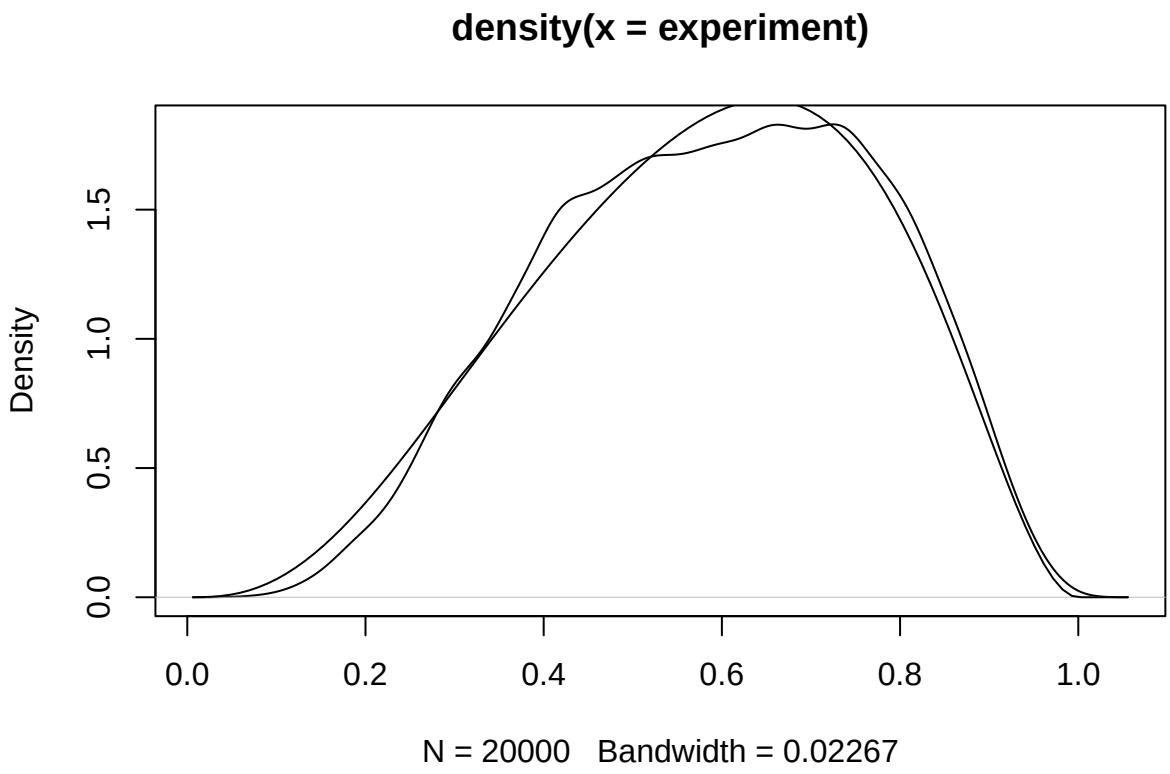



```r
ks.test(bird_experiment_density(200, rbeta, shape1 = 2, shape2 = 1), "pbeta", shape1 = 2, shape2 = 1)
```

```
##
##  Asymptotic one-sample Kolmogorov-Smirnov test
##
## data:  bird_experiment_density(200, rbeta, shape1 = 2, shape2 = 1)
## D = 0.16283, p-value = 4.956e-05
## alternative hypothesis: two-sided
```

```r
experiment <- bird_experiment_density(20000, rbeta, shape1 = 3, shape2 = 5)

{
plot(density(experiment))
curve(x*(dbeta(x, 3, 5) + dbeta(1 - x, 3, 5)), add = TRUE)
}
```



Investigating other algorithm for generating normal distribution.

```
n <- 200000

V1 <- runif(n, -1, 1)
V2 <- runif(n, -1, 1)
R2 <- V1 * V1 + V2 * V2

V1 <- V1[R2 < 1]
V2 <- V2[R2 < 1]
R2 <- R2[R2 < 1]

R2 <- sqrt(-2*log(R2) / R2)
Z1 <- V1 * R2
Z2 <- V2 * R2

ks.test(Z2, "pnorm")
```

```
##
##  Asymptotic one-sample Kolmogorov-Smirnov test
##
## data:  Z2
## D = 0.0038795, p-value = 0.01754
## alternative hypothesis: two-sided
```

```r
cov(Z1, Z2)
```

```
## [1] 0.001997183
```

```r
cov(cbind(Z1, Z2))
```

```
##             Z1          Z2
## Z1 0.999342980 0.001997183
## Z2 0.001997183 1.000330715
```

```r
n <- 20000

X <- runif(n)
U <- runif(n)

U <- U[U < X]
X <- X[U < X]
```

```
## Warning in U < X: długość dłuszego obiektu nie jest wielokrotnością długości
## krótszego obiektu
```

```r
hist(X)
```