Multiple Comparisons: Homework - 2

Submitted by:

Eyal Bar-Natan - 207630658

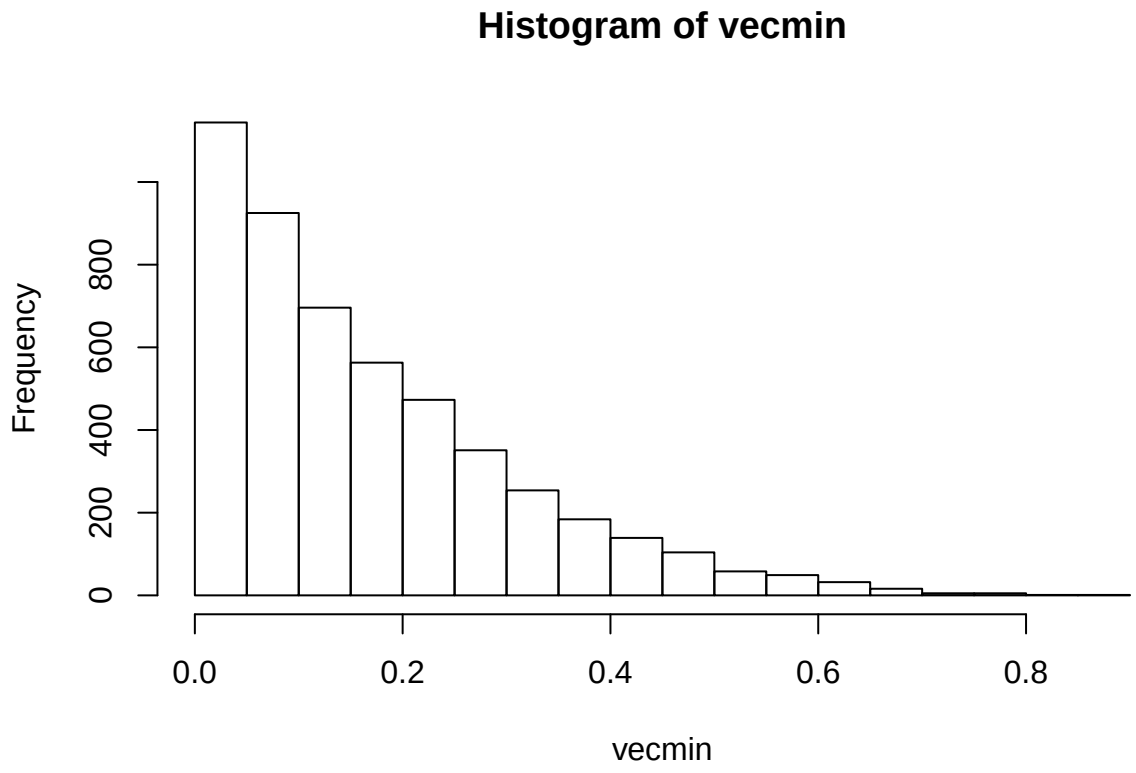
Omer Shubi - 312236219

Question 1

Part A

1.

```
iterations <- 5000
m <- 5
mat <- replicate(iterations, runif(m,0, 1))
vecmin <- apply(mat, 2, min)
hist(vecmin)
```




```
length(vecmin[vecmin<0.05])/iterations
```

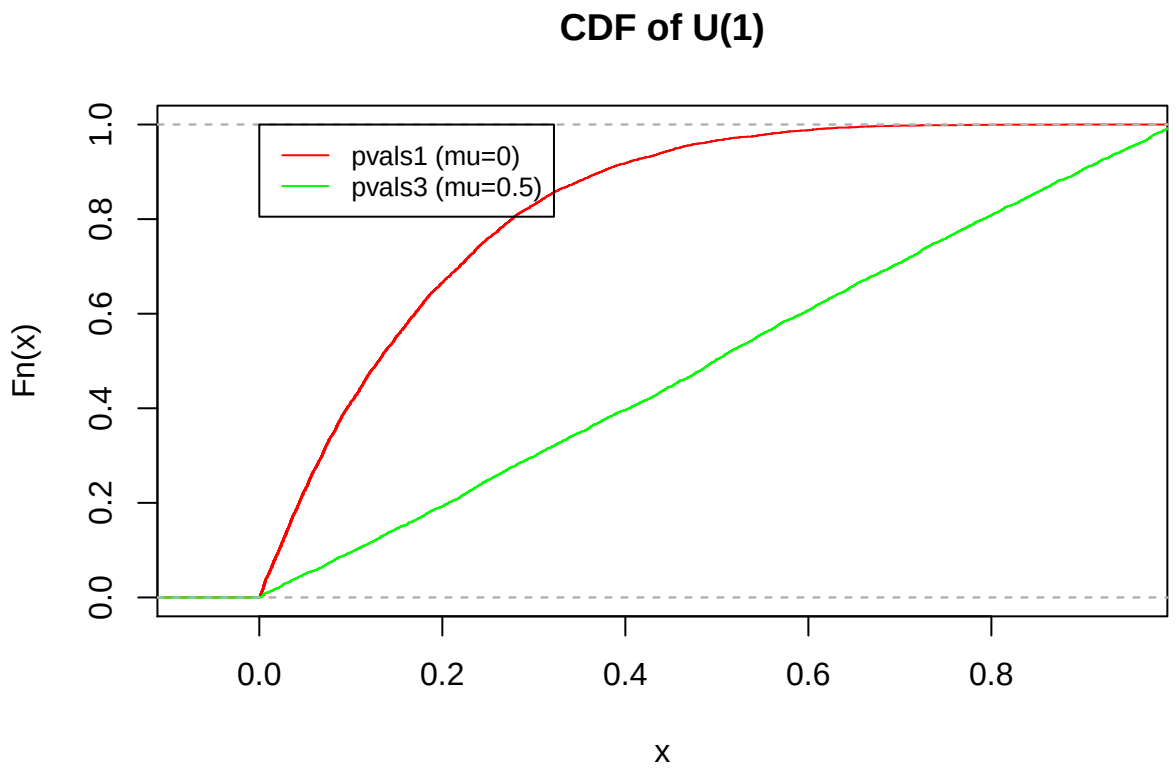
```
## [1] 0.2288
```

Exactly like taking the minimum p_value, becuase p-value$\sim$ Uni[0,1] in $\aleph$

2.

By running the ecdf function we can visual the cdf of both functions clearly.

```
plot(ecdf(vecmin),col='red', main='CDF of U(1)')
lines(ecdf(mat[1,]),col='green')
legend(0, 1, legend=c('pvals1 (mu=0)', 'pvals3 (mu=0.5)'), col=c("red", "green"), lty=1, cex=0.8)
```

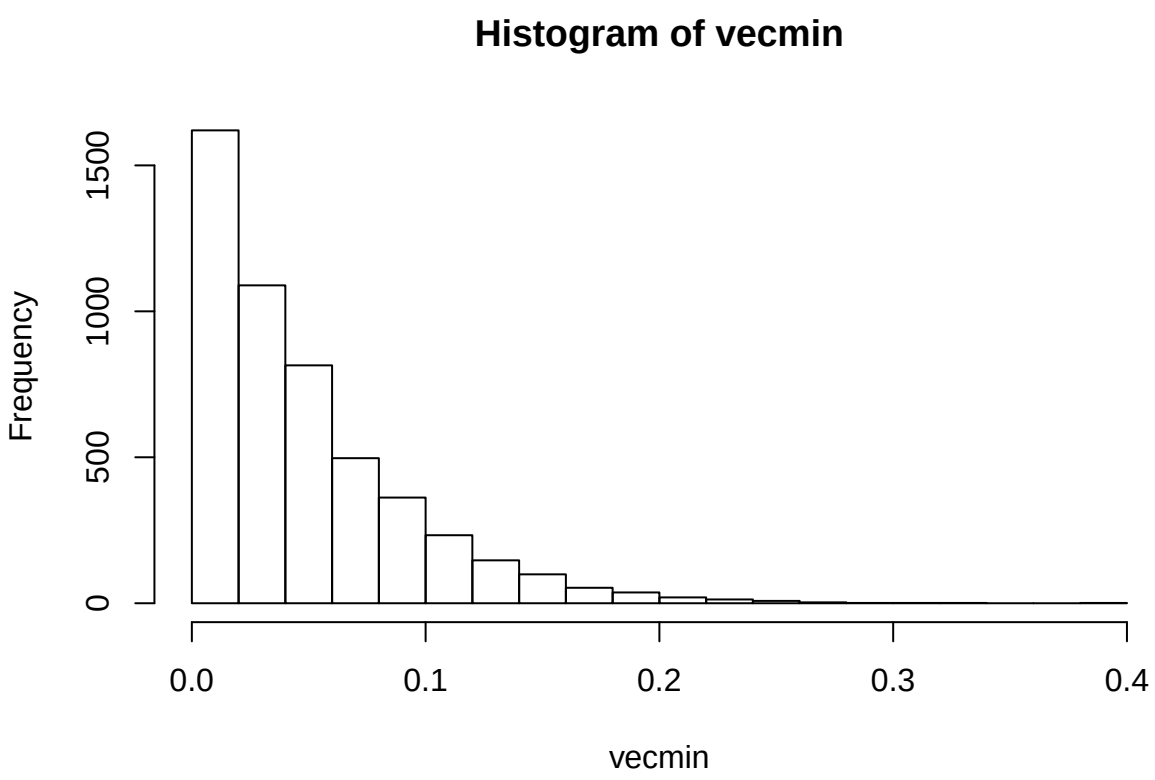



```
# TODO update legend
# TODO update vecmin names
```

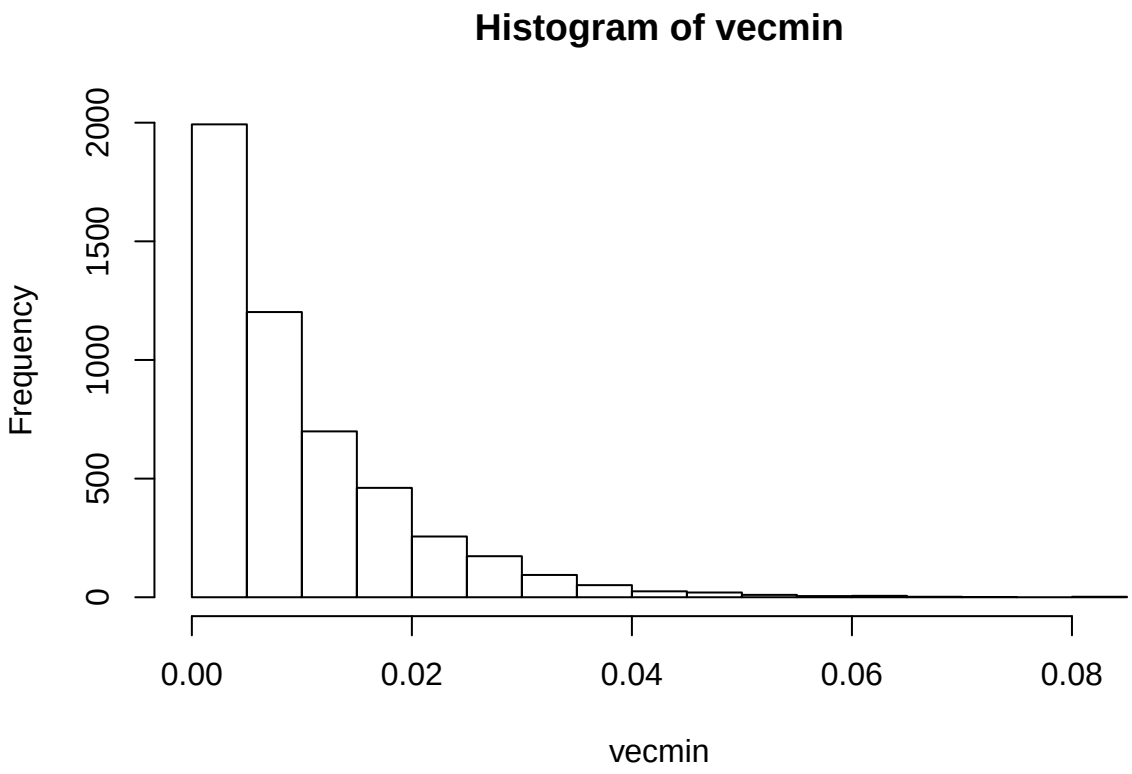
It is clear that $U_{(1)}$ is stochastically smaller ($\prec$) than $Uni[0,1]$

3.

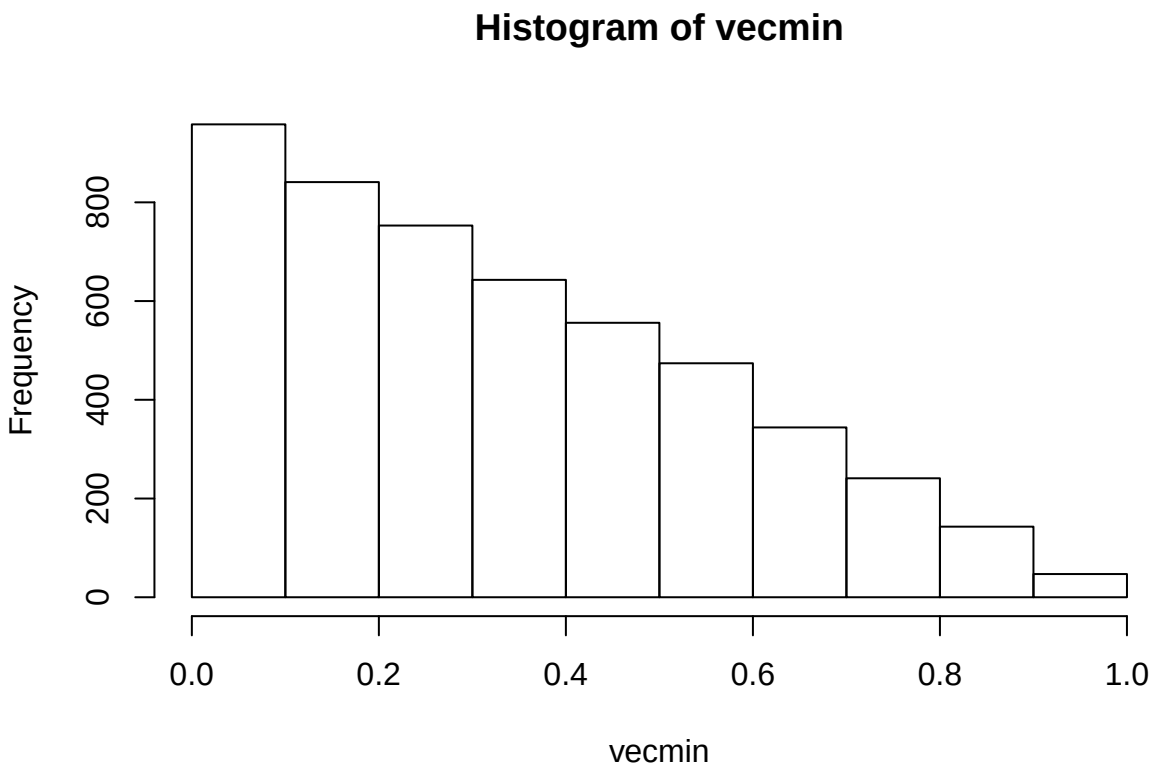
```
iterations <- 5000
m <- 20
mat <- replicate(iterations, runif(m,0, 1))
vecmin <- apply(mat, 2, min)
hist(vecmin)
```



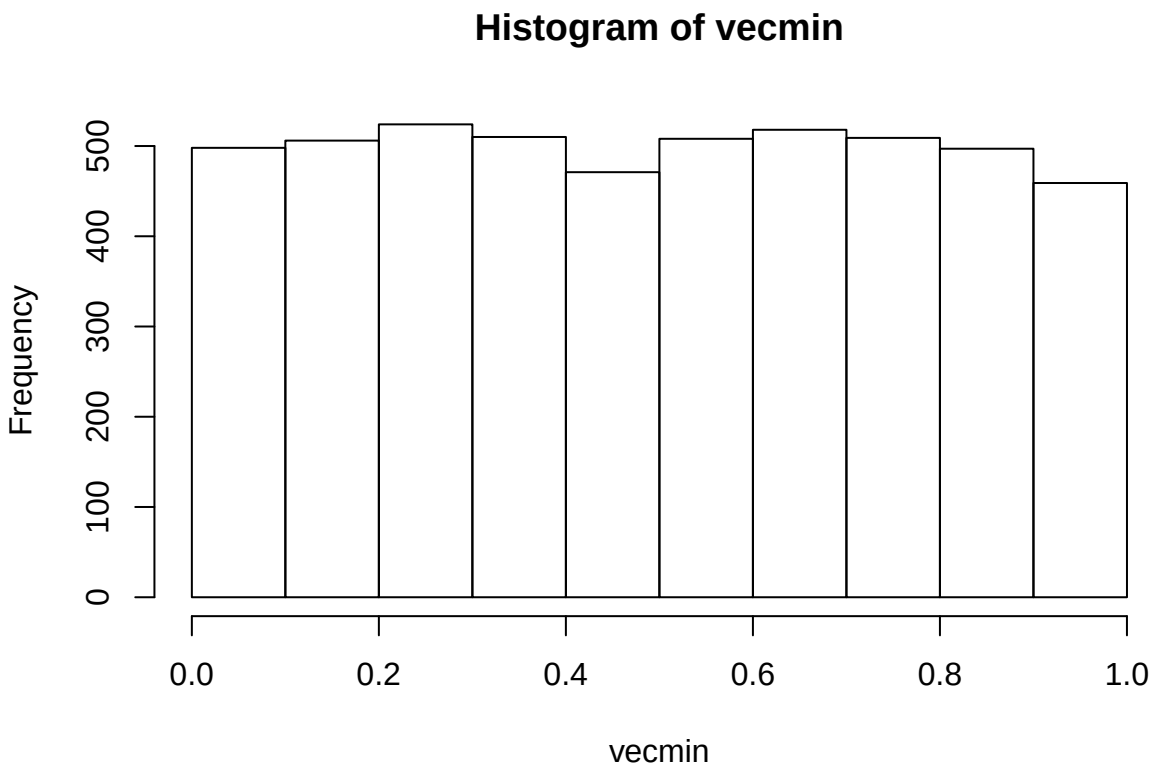

```
iterations <- 5000
m <- 100
mat <- replicate(iterations, runif(m,0, 1))
vecmin <- apply(mat, 2, min)
hist(vecmin)
```




```
iterations <- 5000
m <- 2
mat <- replicate(iterations, runif(m,0, 1))
vecmin <- apply(mat, 2, min)
hist(vecmin)
```




```
iterations <- 5000
m <- 1
vecmin <- replicate(iterations, runif(m,0, 1))
hist(vecmin)
```



if $m > m'$ then $U_{(1)} \prec U'_{(1)}$

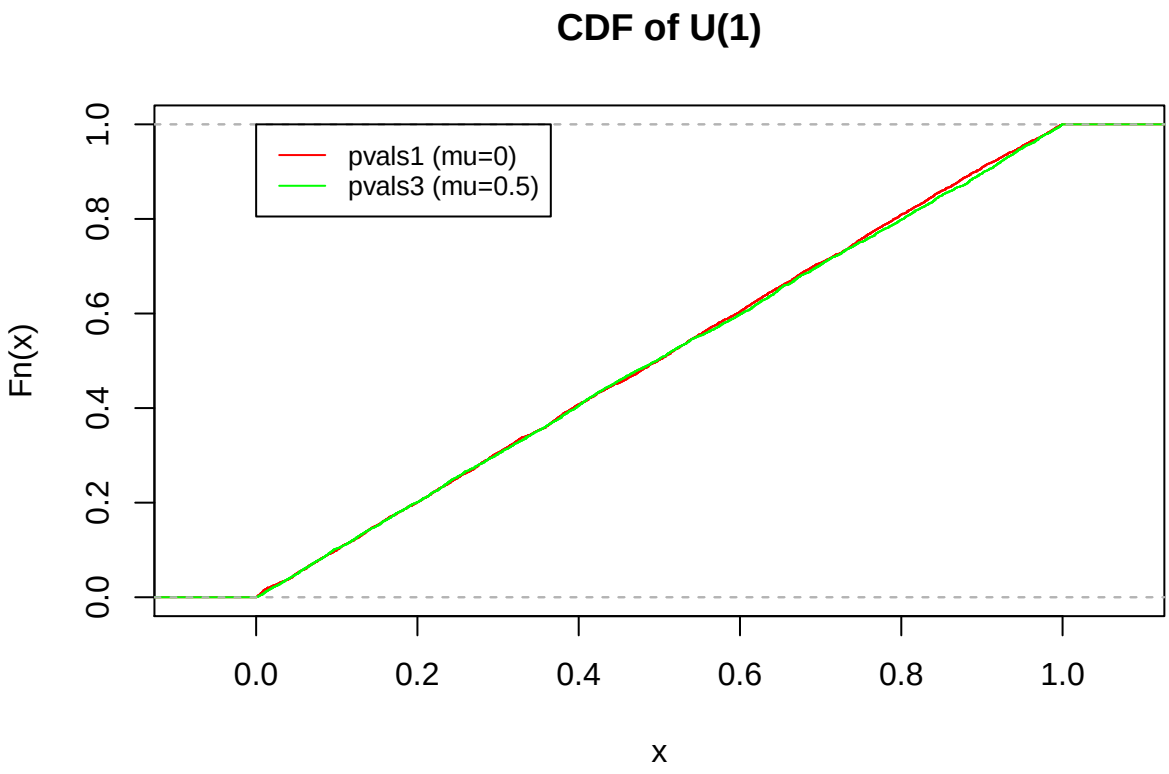
if $m < m'$ then $U_{(1)} \succ U'_{(1)}$

Part B.

```
# TODO add proof from Eyal of 2 & 3
z <- 1
z
```

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

```
plot(ecdf(vecmin),col='red', main='CDF of U(1)')
lines(ecdf(mat[1,]),col='green')
legend(0, 1, legend=c('pvals1 (mu=0)', 'pvals3 (mu=0.5)'), col=c("red", "green"), lty=1, cex=0.8)
```

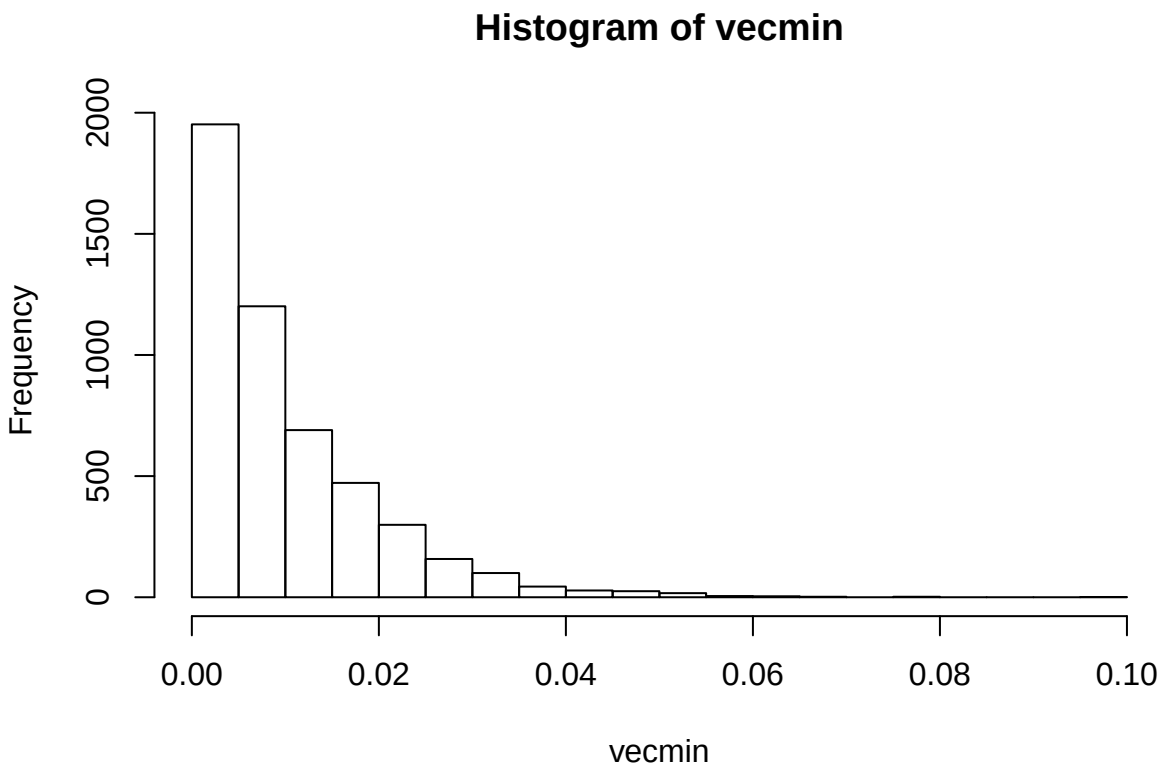



```
# TODO update legend
# TODO update vecmin names
```

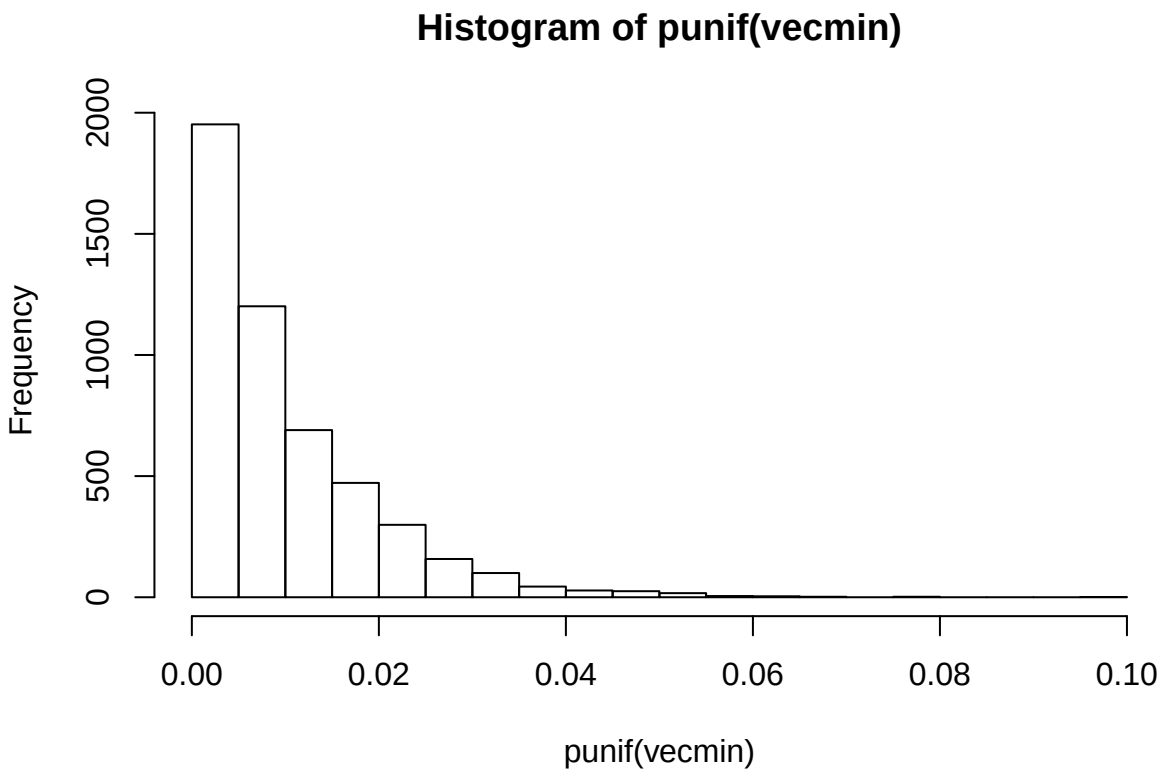
$U_{(1)} \sim Beta(1, m)$ therefore has the same cdf of Beta(1,m).

Part C.

```
iterations <- 5000
m <- 100
mat <- replicate(iterations, runif(m,0, 1))
vecmin <- apply(mat, 2, min)
hist(vecmin)
```




```
hist(punif(vecmin))
```


Histogram of punif(vecmin)
Frequency
0
500
1000
1500
2000
0.00
0.02
0.04
0.06
0.08
0.10
punif(vecmin)