Statistics Lab1

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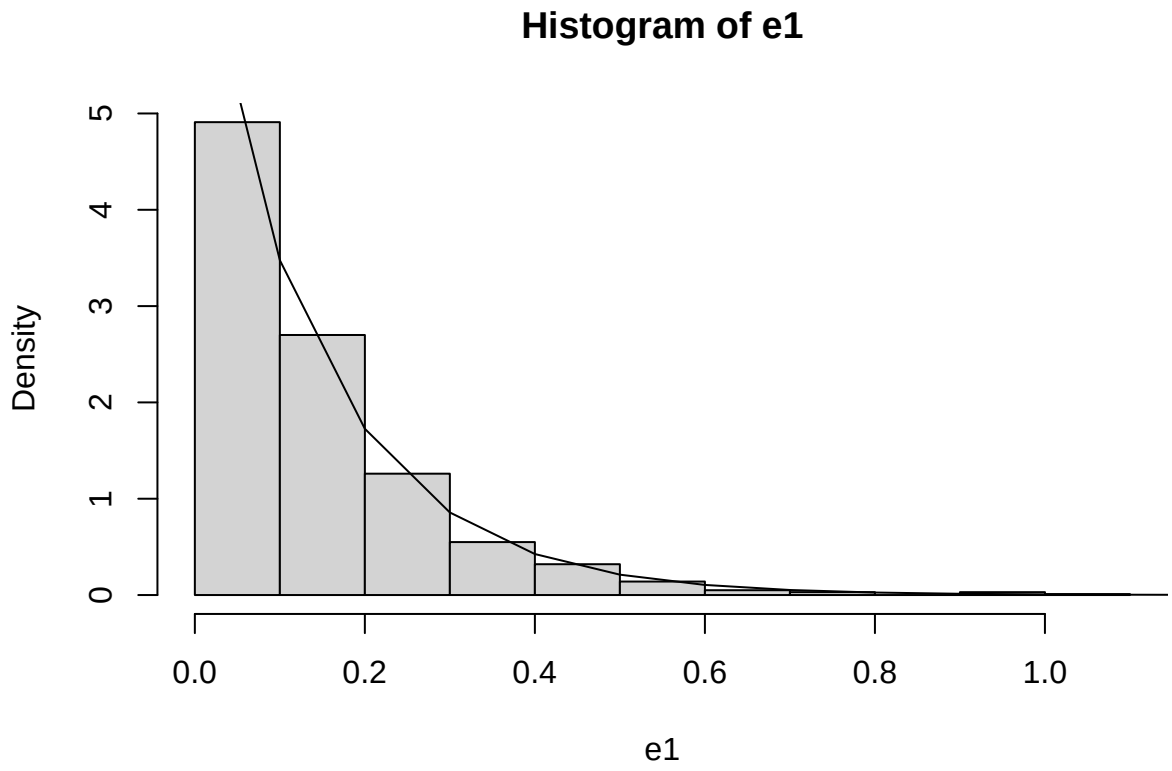
student number = 9813007
So we have `r=7`:

```
set.seed(66)
n <- 1000 # sample size
r <- 7 #rate of exponential random variable
u <- runif(n)
u1 <- 1-u
e1 <- -(1/r)*log(u1)
hist(e1,probability =T) # Use option probability =T to plot relative frequency histogram
x <- seq(0,10,0.1)
lines(x,dexp(x,r))
```



As we can see, `mean_of_population` and `mean(e1)` are close numbers:

```r
#mean of random variable u is : 1/r and r is 7 here
mean_of_population <- 1/r
mean_of_population
```

```
## [1] 0.1428571
```

```r
#mean of generated random numbers
mean(e1)
```

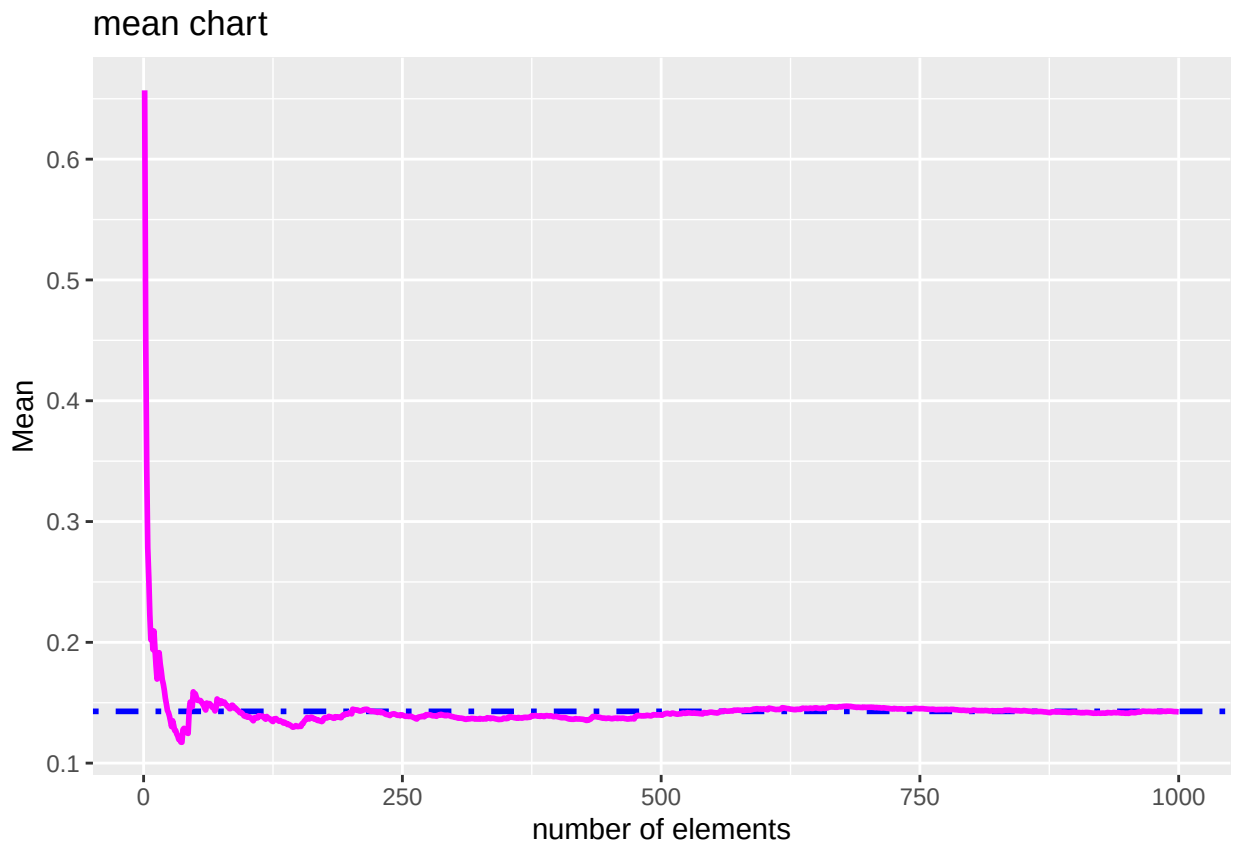
```
## [1] 0.1424633
```

mean convergence

Baesd on `mean chart`, we can observe convergence after `x = 500`.

```r
library(ggplot2)
x <- 1:1000
y <- e1[1]
for(i in 2:1000){
  y <- append(y,mean(e1[1:i]))
}

ggplot(data = data.frame(x,y),
       aes(x = x, y = y)) +
   geom_hline(yintercept = (1/r), linetype = "dotdash",
              color = "blue" , size = 1) +
  geom_line(color = "magenta",size = 1) +
  xlab("number of elements") +
  ylab("Mean") +
  ggtitle("mean chart")
```



Variance convergence

```
#variance is = 1/(r)^2
variance_of_population <- 1/((r)^2)
variance_of_population
```

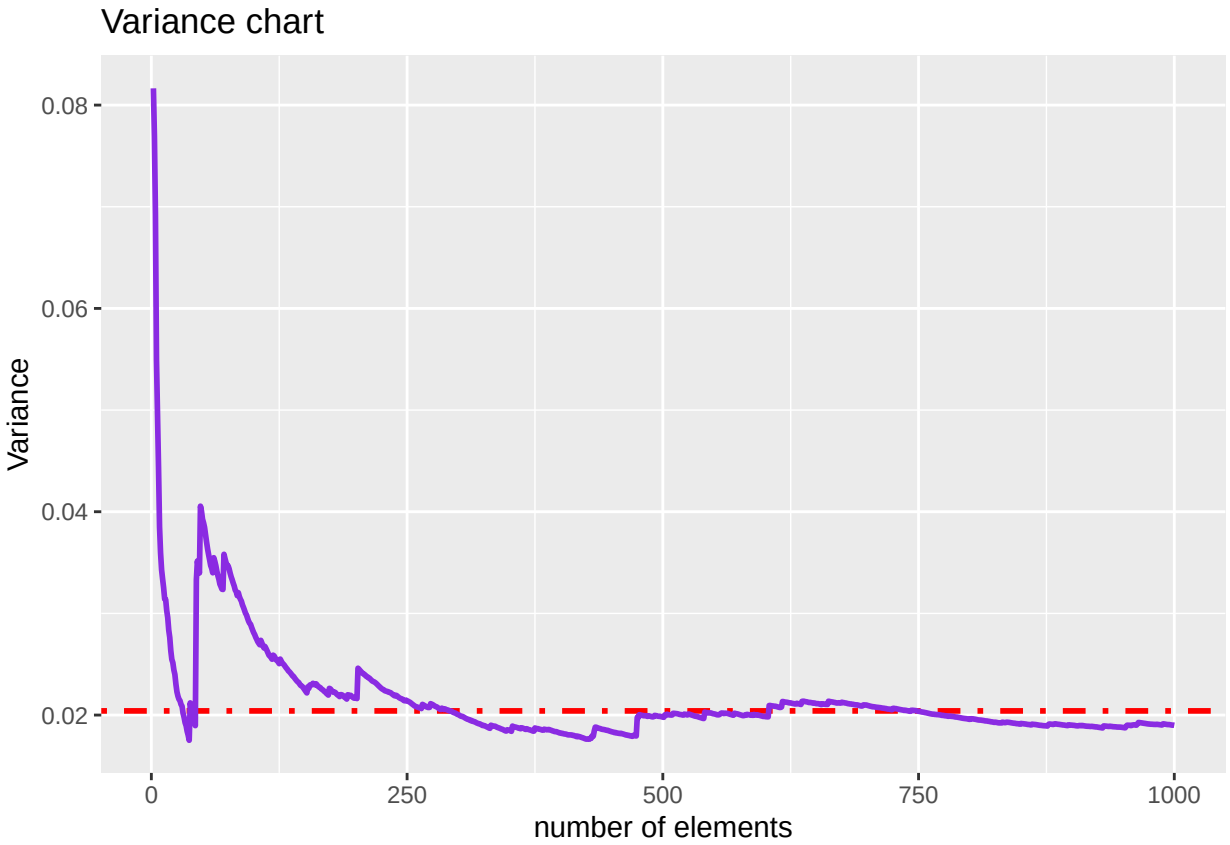
```
## [1] 0.02040816
```

```
#variance of generated random numbers
var(e1)
```

```
## [1] 0.01899049
```

```
#variance of population is : 1/(1)^2=1
v <- c(var(e1[1]))
for(i in 2:1000){
  v <- append(v,var(e1[1:i]))
}

ggplot(data = data.frame(x,v),
       aes(x = x, y = v)) +
  geom_hline(yintercept = 1/((r)^2), linetype = "dotdash",
             color = "red" , size = 1) +
  geom_line(color = "Blue Violet",size = 1) +
  xlab("number of elements") +
  ylab("Variance") +
  ggtitle("Variance chart")
```


Variance chart
0.08
0.06
0.04
0.02
Variance
0
250
500
750
1000
number of elements