Exponential Distro

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title: the exponential distribution and the sampling distribution of its mean

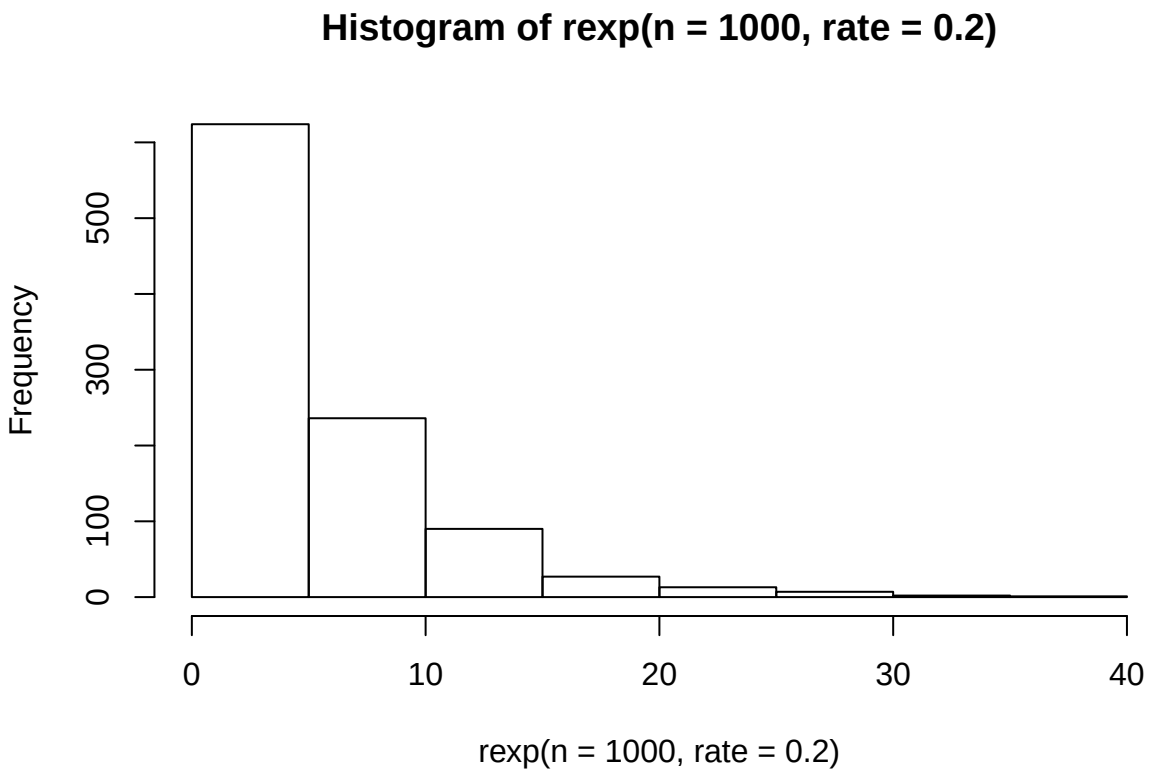
summary

I am going to show you the exponential distribution
Then I will show you the sampling distribution of the mean for the exp distro

exponential distribution

this is a histogram of 1000 random values from the exponential distribution with rate = 0.2

```
hist(rexp(n=1000,rate = .2))
```

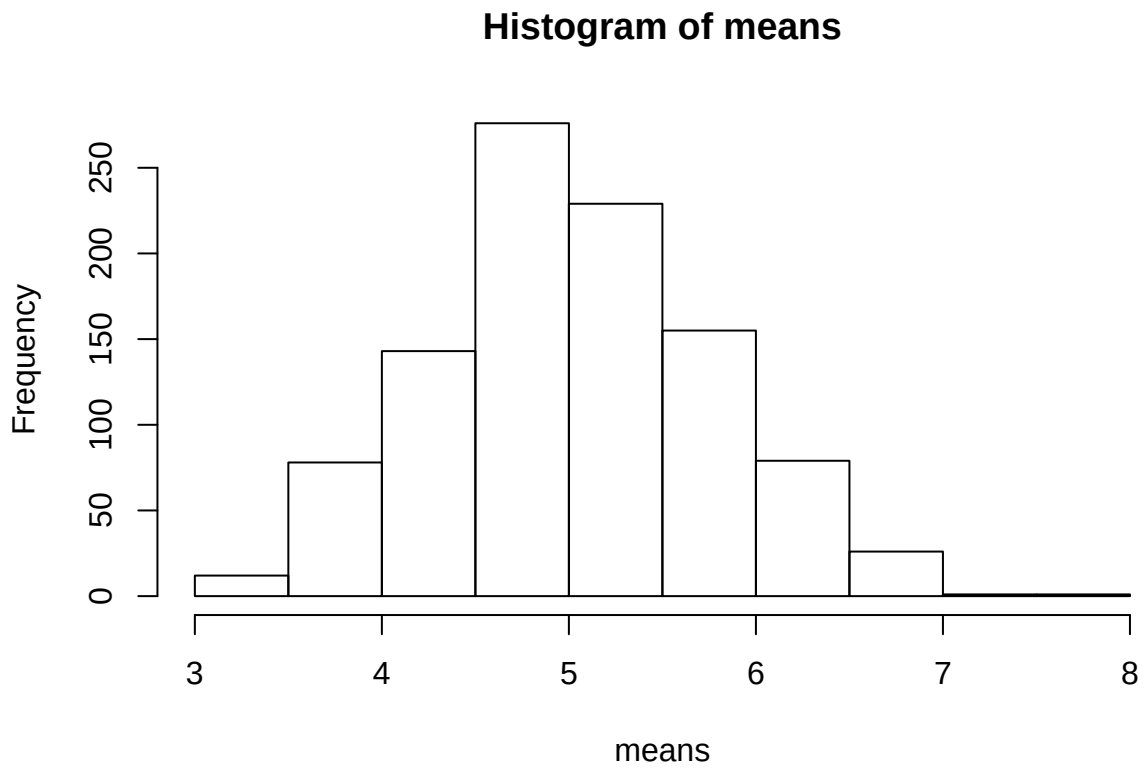


sampling distibution of the mean

```
means <- NULL
for(i in 1:1000){
        the_mean <- mean(rexp(n=40, rate = .2))
        means <- c(means, the_mean)
}
```

this is a histogram the means of 1000 size 40 samples taken from the exponential distribution with rate = 0.2

```
hist(means)
```



mean

```
sam_mean <- mean(means)
```

the theoretical mean of a sampling distribution of the mean is equal to the mean of the distribution from which the samples were drawn
the theoretical mean of an exponential distro is 1/rate
so the expected mean of our sampling distro is 1/.2, which equals 5
our observed mean of the sampling distro is 5.0193141

variance

the theoretical variance of the exponential distribution is 1/rate = 1/.2 = 5
and for the sampling distribution...

the law of large numbers say that as sample size increases, the mean of the samples approaches the population mean
therefore the variance of the sampling distro decreases as sample size increases
to be exact, the theoretical variance of the sampling distribution of the mean equals:
(Population_Standard_Deviation / sqrt(Sample_Size)) ^ 2

```
theo_var <- (5/sqrt(40))^2
```

in our case the theoretical variance of the sampling distro is 0.625

```
sam_var <- var(means)*(40/39)
```

the observed variance of our sampling distro was 0.5718714

normality

normal distributions follow the 68-95-99 rule
about 68% of values should fall within one standard deviation of the mean, etc.

```
sam_sd <- sqrt(sam_var)
one_sd <- mean(means > sam_mean - sam_sd & means < sam_mean + sam_sd)
two_sd <- mean(means > sam_mean - 2*sam_sd & means < sam_mean + 2*sam_sd)
three_sd <- mean(means > sam_mean - 3*sam_sd & means < sam_mean + 3*sam_sd)
```

in our case
1. 68.8% of values fall within one standard deviation of the mean
2. 96% of values fall within two standard deviations of the mean
3. 99.9% of values fall within three standard deviations of the mean

so the sampling distro is approximately normal, as expected