Analysis of exponential distribution

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Overview:

This assignment aims to analyze a small sample of exponentials to determine its distribution. Primarily, computer simulation and resampling techniques are utilized to determine and compare the characterstics with normal distribution.

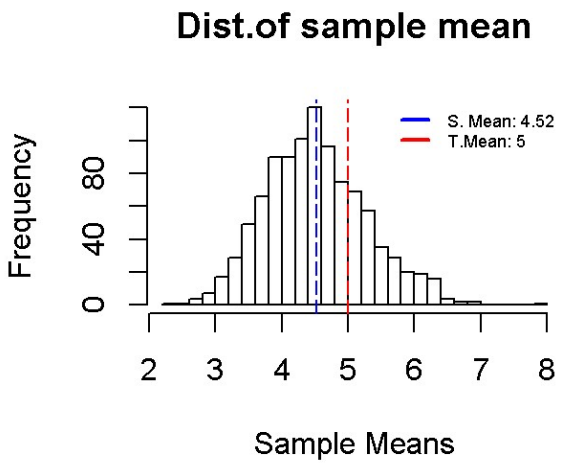
Simulations:

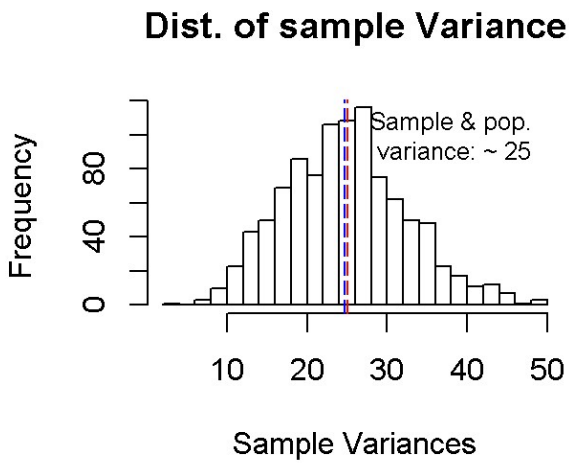
- Step 1: Generate sample data of exponential distribution
- Step 2: Examine the distribution of the sample data

```
n<-40;lambda<-0.2;set.seed(1000)
x<-rexp(n,lambda)
ms<-mean(x); sds<-sd(x); vars<-var(x)
# hist(x,breaks = 10,
#      main="Distribution of 40 exponetials (sample)")
# text(x=10,y=10,paste("Sample mean:",round(ms,2),"\nStandard Deviation:",round(sds,
2)))
```

- Step 3: Generate simulation data (1000 simulations, 40 exponentials)
    - Calculate mean and variance for each simulation
    - Plot histogram for mean and variance

```
sim<-1000
simData<-matrix(sample(x,n*sim,replace=T),sim,n)
means<-apply(simData,1,mean); vars<-apply(simData,1,var); sds<-apply(simData,1,sd)
par(mfrow=c(1,2))
hist(means,breaks = 20,
     main=paste("Dist.of sample mean"),
     xlab="Sample Means")
abline(v=mean(means),lty=5,col="blue")
abline(v=1/lambda,lty=5,col="red")
legend("topright", c(paste("S. Mean:",round(mean(means),2)),paste("T.Mean:",1/lambd
a)),
       cex=0.55, col=c("blue","red"), lty=5, lwd=2, bty="n");
hist(vars,breaks = 20,xlab="Sample Variances",
     main=paste("Dist. of sample Variance"))
abline(v=mean(vars),lty=5,col="blue")
text(38,100,cex=.8, paste("Sample & pop.\n variance: ~",round(mean(vars),0)))
abline(v=(1/lambda)^2,lty=5,col="red")
```

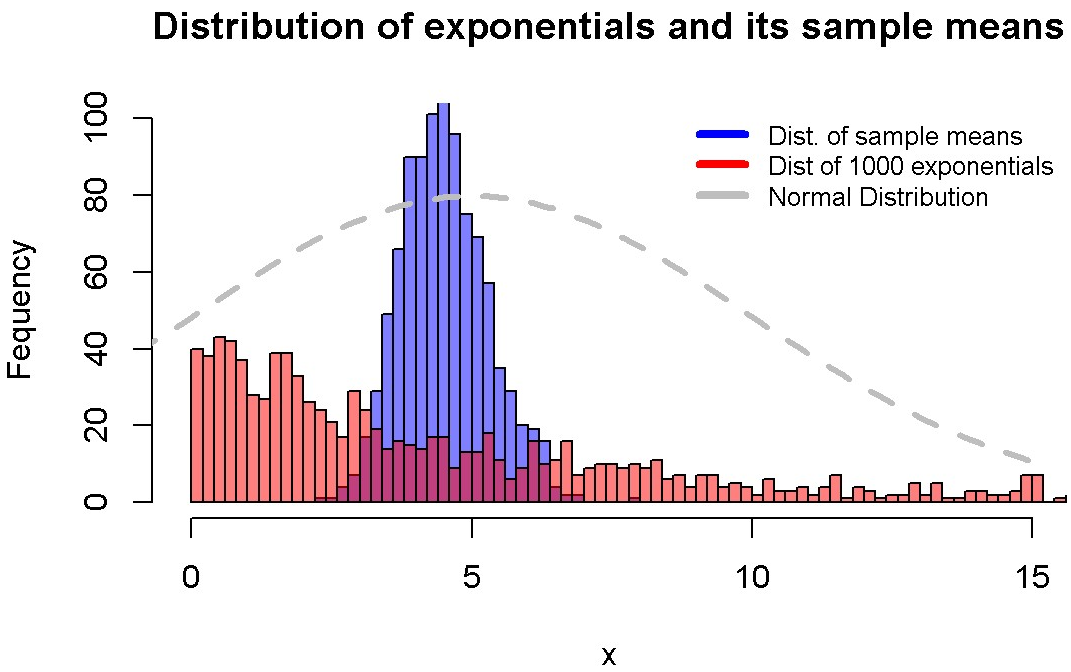




Findings - After 1000 simulation, average of sample means are very close to Theritical mean. The sample variance is also very close to theoritical population variance.

- Step 4: Compare the distribution of 1000 sample means (of 40 random exponentials)
  - Draw and compare it with 1000 random exponentials
  - Draw a reference line of nomal distribution

```
set.seed(2000)
xx<-rexp(sim,lambda)
hist(means, col=rgb(0,0,1,0.5), breaks=30,xlim=c(-.1,15),ylim=c(0,100),
     main="Distribution of exponentials and its sample means",
     xlab="x",
     ylab="Fequency")
hist(xx,col=rgb(1,0,0,0.5),alpha=1,add=T,breaks = 131)
curve(1000*dnorm(x,mean=1/lambda,sd=1/lambda), lty=2,lwd=3,
      col="gray",from=-1,to=15, n=100,add=TRUE)
legend("topright", c("Dist. of sample means","Dist of 1000 exponentials","Normal Distr
ibution"),
       cex=0.8, col=c("blue","red","gray"), lty=5, lwd=4, bty="n")
```



Findings - The Distribution of sample means are comparable to normal Distribution curve. However, sample means are more concentrated at the center. So, it shows that exponential distribution holds the characterstrics of normal distribution