**Exponential distribution in R**

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Overview: In this project you will investigate the exponential distribution in R and compare it with the Central Limit Theorem.

# Sample mean (simulation) VS theoretical mean (calculation)

simulation <- function(){  
 set.seed(5)  
 lambda <- 0.2  
 n <- 40  
 total <- 1000  
   
 ##Simulate  
 simulated <- replicate(total,rexp(n, lambda))  
   
 ##Calculate the mean of 40  
 simulated\_means <- apply(simulated, 2, mean)  
   
 ##Get the experimental mean  
 experimental\_mean <- mean(simulated\_means)  
   
 st1 <- paste('Sample mean =',experimental\_mean,sep = ' ')  
   
 print(st1)  
}

The response of this function is:

[1] "Sample mean=4.9997019268744"

The theoretical mean is:

1/0.2

[1] 5

The sample mean is very close to the theoretical mean.

# Show how variable the sample is (via variance) and compare it to the theoretical variance of the distribution.

Theoretical variance:

(1/lambda)^2/40

[1] 0.625

Sample variance:

"Sample variance = 0.602604708900425"

# Show that the distribution is approximately normal.

simulation3 <- function(){  
 set.seed(5)  
 lambda <- 0.2  
 n <- 40  
 total <- 1000  
   
 ##Simulate  
 simulated <- replicate(total,rexp(n, lambda))  
   
 ##Calculate the mean of 40  
 simulated\_means <- apply(simulated, 2, mean)  
   
 ##Draw the histogram  
 hist(as.numeric(simulated\_means),breaks=50,main="1000 runs of 40 exponential distributions",xlab="mean of exponential distribution")  
 mean\_sim <- mean(simulated\_means)  
   
 ##Add the mean  
 abline(v=mean\_sim, col="red", lwd=4, lty=20)  
   
}

