Quiz2

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## Topic: Monte-Carlo integration

### Problem description:

Write a function use the Monte-Carlo integration to get the integration on [a, b] for arbitray function.

, arbitrary f. Note: (a,b) is an arbitrary interval, finite or infinite Assume finite.

### Solution:

Use Monte-Carlo integration approach to estimate the integration, standard error and 95% CI.

#Function to be integrated over [a,b]  
f <- function(x){x}   
  
Integral <- function(n,a,b,h=f){  
u <- runif(n,a,b)   
Y <- (h(u))/(1/(b-a))  
Int <- mean(Y)  
  
u <- runif(n,a,b)  
YY <- (h(u)/(1/(b-a)))^2  
SE <- sqrt((mean(YY)-Int^2)/n)  
CI <- c(Int-1.96\*SE,Int+1.96\*SE)  
list("Int"=Int,"SE"=SE, "CI"=CI)}

### Evaluation:

Apply the function on both uniform distribution and exponential distribution.

Integral(1000,0,1,f)

## $Int  
## [1] 0.5075  
##   
## $SE  
## [1] 0.00854  
##   
## $CI  
## [1] 0.4908 0.5242

f1 <- function(x){exp(-x)}  
Integral(1000,0,10,f1)

## $Int  
## [1] 1.089  
##   
## $SE  
## [1] 0.05894  
##   
## $CI  
## [1] 0.973 1.204

### Reference

[Monte Carlo Integration](https://cran.r-project.org/web/packages/SI/vignettes/my-vignette.html)