In the name of God

Producer:  
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Subject:

Normal-standard probability estimate with Monte.Carlo method

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Issue : If we are interested in the tail probability Pr(*X >* 20) when*X ∼ N*(0*,* 1), simulating from a *N*(0*,* 1) distribution does not work. Express  
the probability as an integral and use an obvious change of variable to rewrite  
this integral as an expectation under a *U*(0*,* 1*/*20) distribution. Deduce a Monte Carlo approximation to Pr(*X >* 20) along with an error assessment.

Solve:

So we know that the u value is between 0 and 1/20 , so we can say that:

And we know that

So:

We know that of we want to calculate this probabity we have:

> pnorm(-20)

[1] 2.753624e-89

And the Monte-Carlo estimate method for this probability is :

> N=10^6

> u<-runif(N,min = 0 , max = 1/20)

> fx<-function(u){exp(20/(-2\*u^2))/u^2 \* sqrt(2\*pi)}

> E<-c()

> for(i in 1:N){

+ E[i]<-fx(u[i])

+ }

> print(1/20\*mean(E))

[1] 0

Conculsion: we understand that our probability is very small and we can say its 0.