Samping Distributions

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# Uniform Distribution

## Definition

A random variable has a uniform distribution on the interval (for ) if its **pdf** is

If , then

## Example

Suppose .

1. Find the and using the definitions of and .

# part a.  
xfx <- function(x){x/10}  
EX <- integrate(xfx, 10, 20)$value  
EX

[1] 15

x2fx <- function(x){(x - EX)^2/10}  
VX <- integrate(x2fx, 10, 20)$value  
VX

[1] 8.333333

1. Find the and using the short cut formulas in (2) and (3).

, and

1. Simulate 10,000 values of the random variable and estimate and .

# part c.  
set.seed(89)  
sims <- 10^4  
X <- runif(sims, 10, 20)  
EX <- mean(X)  
VX <- var(X)  
c(EX, VX)

[1] 14.997757 8.392661

1. Find and for exactly and via simulation.

,

set.seed(46)  
sims <- 10^4  
n <- 8  
a <- 10  
b <- 20  
xbar <- numeric(sims)  
for(i in 1:sims){  
 X <- runif(n, a, b)  
 xbar[i] <- mean(X)  
}  
mean(xbar)

[1] 15.01263

var(xbar)

[1] 1.043381

# Exponential

## Problem

Let . Let

1. Simulate the sampling distribution of in R.

sims <- 10^4  
Y <- numeric(sims)  
for(i in 1:sims){  
 Y[i] <- sum(rexp(20, 2))  
}  
EY <- mean(Y)  
VY <- var(Y)  
c(EY, VY)

[1] 10.017660 5.028047

mean(Y <= 10)

[1] 0.5268