

Monte Carlo's

Nicholas Ray

2023-09-29

A Monte Carlo is a type of simulation where 1) we are in control of the data generating process and 2) can isolate a single change in the analysis or creation of that data to learn its effects. For this reason, they are also referred to as “experiments” in a broad sense. I am going to walk through an example here (done the way I like to do it, keep in mind) and strongly encourage you to read the attached essay by Andy Phillips (2017), “Monte Carlo Analysis.”

```
mc<-function(obs){
  trials=100
  b1=1
  b2=2
  results<-data.frame(coef=rep(NA,trials))
  set.seed(1)
  data<-data.frame(
    x=runif(obs)
  )
  for (m in 1:trials) {
    for (n in 1:obs) {
      data$y[n]<-b1+b2*data$x[n]+rnorm(obs)[n]
    }
    results[m,1]<-lm(y~x,data)$coefficients[2]
  }
  return(results)
}
head(mc(obs=5))
```

```
##           coef
## 1  1.4794042
## 2 -0.9330572
## 3  3.3678140
## 4  3.2209606
## 5  1.9077284
## 6  1.3557252
```

We can also do a similar thing with graphs.

```
mc2<-function(obs){  
  suppressPackageStartupMessages(library(tidyverse))  
  trials=500  
  b1=1  
  b2=2  
  set.seed(1)  
  data<-data.frame(  
    x=runif(obs)  
  )  
  for (m in 1:trials) {  
    for (n in 1:obs) {  
      data$y[n]<-b1+b2*data$x[n]+rnorm(obs)[n]  
    }  
  }  
  plot<-ggplot(data,aes(x=x,y=y))+geom_smooth(formula=y~x,method="lm")  
  return(plot)  
}  
mc2(obs=5)
```

