

Un po' di conti con R

Laura Poggiolini



$e = 2.7182818284590\dots$

```
> nepero.stampa = function(nrepl=10){  
+ sommatoria = 0  
+ for(i in 1:nrepl){  
+   somma=0  
+   passi=0  
+   while(somma<1){  
+     x = runif(1,min=0,max=1)  
+     somma= somma + x  
+     passi = passi +1  
+     print(paste("x = ", x, "somma = ", somma))  
+   }  
+   print(paste("addendi necessari = ", passi))  
+   sommatoria = sommatoria +passi  
+   numero = sommatoria/nrepl  
+ }  
+ return(numero)
```

$e = 2.7182818284590\dots$

```
> nepero.stampa(3)
[1] "x = 0.471521817147732 somma = 0.471521817147732"
[1] "x = 0.259943447541445 somma = 0.731465264689177"
[1] "x = 0.961298547917977 somma = 1.69276381260715"
[1] "addendi necessari = 3"
[1] "x = 0.34814626770094 somma = 0.34814626770094"
[1] "x = 0.360761466203257 somma = 0.708907733904198"
[1] "x = 0.906922378810123 somma = 1.61583011271432"
[1] "addendi necessari = 3"
[1] "x = 0.878186135552824 somma = 0.878186135552824"
[1] "x = 0.753064807737246 somma = 1.63125094329007"
[1] "addendi necessari = 2"
[1] 2.666667
```

$$e = 2.7182818284590\dots$$

```
> nepero.stampa(3)
[1] "x = 0.990168200340122 somma = 0.990168200340122"
[1] "x = 0.274367363657802 somma = 1.26453556399792"
[1] "addendi necessari = 2"
[1] "x = 0.310078250942752 somma = 0.310078250942752"
[1] "x = 0.628038288094103 somma = 0.938116539036855"
[1] "x = 0.56093581370078 somma = 1.49905235273764"
[1] "addendi necessari = 3"
[1] "x = 0.595493057277054 somma = 0.595493057277054"
[1] "x = 0.169480212964118 somma = 0.764973270241171"
[1] "x = 0.0188182829879224 somma = 0.783791553229094"
[1] "x = 0.0620550808962435 somma = 0.845846634125337"
[1] "x = 0.948873344808817 somma = 1.79471997893415"
[1] "addendi necessari = 5"
[1] 3.333333
```

$e = 2.7182818284590\dots$

```
> nepero.stampa.addendi = function(nrepl=10){  
+ sommatoria = 0  
+ for(i in 1:nrepl){  
+ somma=0  
+ passi=0  
+ while(somma<1){  
+ x = runif(1,min=0,max=1)  
+ somma= somma + x  
+ passi = passi +1  
+ }  
+ print(paste("addendi nec. = ", passi))  
+ sommatoria = sommatoria +passi  
+ numero = sommatoria/nrepl  
+ }  
+ return(numero)  
+ }
```

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```
> nepero = function(nrepl=10){  
+     sommatoria = 0  
+     for(i in 1:nrepl){  
+         somma=0  
+         passi=0  
+         while(somma<1){  
+             x = runif(1,min=0,max=1)  
+             somma= somma + x  
+             passi = passi +1  
+         }  
+         sommatoria = sommatoria +passi  
+         numero = sommatoria/nrepl  
+     }  
+     return(numero)  
+ }
```

$e = 2.7182818284590\dots$

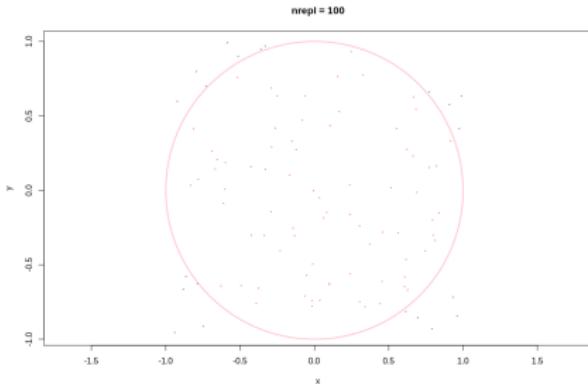
```
> nepero(10)          > nepero(10^3)        > nepero(10^5)
[1] 2.3               [1] 2.694           [1] 2.71863
> nepero(10)          > nepero(10^3)        > nepero(10^5)
[1] 2.9               [1] 2.806           [1] 2.71867
> nepero(10)          > nepero(10^3)        > nepero(10^5)
[1] 3.3               [1] 2.663           [1] 2.71627
> nepero(10^2)         > nepero(10^4)        > nepero(10^6)
[1] 2.75              [1] 2.7083          [1] 2.719159
> nepero(10^2)         > nepero(10^4)        > nepero(10^6)
[1] 2.65              [1] 2.718            [1] 2.718215
> nepero(10^2)         > nepero(10^4)        > nepero(10^6)
[1] 2.71              [1] 2.7254          [1] 2.718826
```

$\pi = 3.141592653589793 \dots$

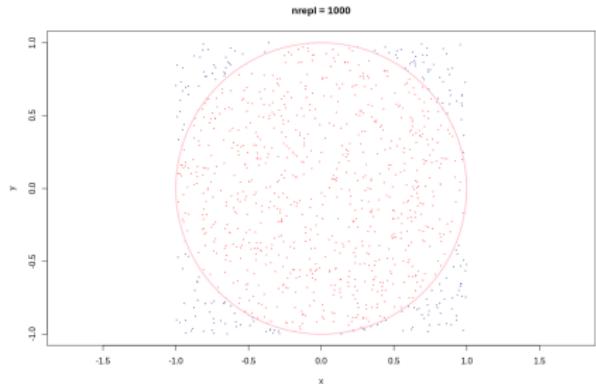
```
> pi.greco=function(nrepl=10000){  
+ xy=runif(nrepl*2, min=-1, max=1)  
+ dim(xy)=c(nrepl,2)  
+ inside=apply(xy^2,1,sum)<1  
+ plot(xy, asp= 1, pch=20, cex=.5, col=c("navy","red"))  
+ [inside+1],  
+ xlab="x", ylab="y",  
+ main=paste("nrepl =",nrepl))  
+ a=seq(0,2*pi,length.out=100)  
+ xy.circle=cbind(cos(a),sin(a))  
+ lines(xy.circle,col="pink",lwd=2)  
+ return( sum(inside)/nrepl *4)  
+ }
```

$$\pi = 3.141592653589793 \dots$$

```
> pi.greco(10^2)
[1] 3.48
```

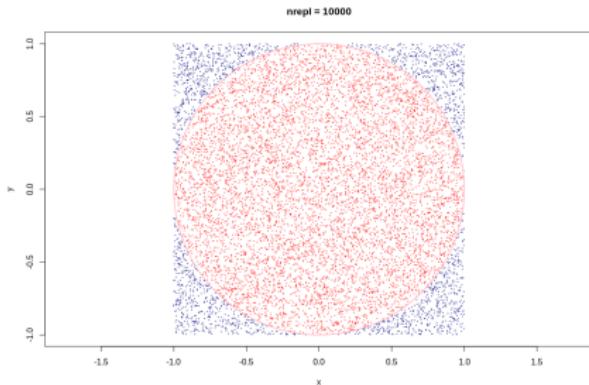


```
> pi.greco(10^3)
[1] 3.144
```

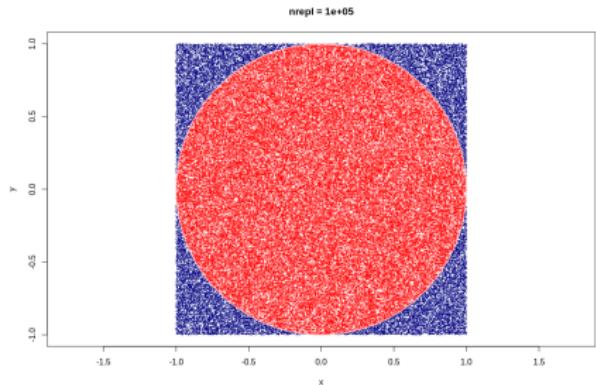


$\pi = 3.141592653589793\dots$

```
> pi.greco(10^4)
[1] 3.1392
```

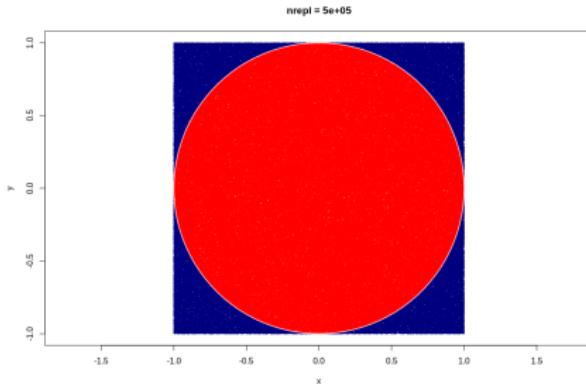


```
> pi.greco(10^5)
[1] 3.13596
```

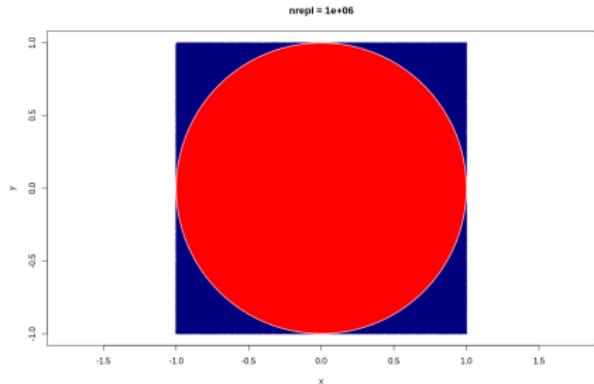


$$\pi = 3.141592653589793 \dots$$

```
> pi.greco(5*10^5)
[1] 3.13972
```



```
> pi.greco(10^6)
[1] 3.141628
```



$\pi = 3.141592653589793 \dots$

```
> pi.greco6 = function(nrepl=10000){
+   x=runif(nrepl, min=0, max=0.5)
+   dim(x) = c(nrepl,1)
+   somma= sum(1/sqrt(1 -x^2),1)
+   print(somma*3/nrepl)
+ }
```

> pi.greco6(10)	> pi.greco6(10^2)	> pi.greco6(10^3)
[1] 3.435581	[1] 3.163184	[1] 3.14968
> pi.greco6(10)	> pi.greco6(10^2)	> pi.greco6(10^3)
[1] 3.438705	[1] 3.148172	[1] 3.138437
> pi.greco6(10)	> pi.greco6(10^2)	> pi.greco6(10^3)
[1] 3.470597	[1] 3.16018	[1] 3.136856

$$\pi = 3.141592653589793\dots$$

```
> pi.greco6(10^4)      > pi.greco6(10^6)      > pi.greco6(10^8)
[1] 3.140381            [1] 3.141563          [1] 3.141594
> pi.greco6(10^4)      > pi.greco6(10^6)      > pi.greco6(10^8)
[1] 3.142163            [1] 3.141603          [1] 3.141571
> pi.greco6(10^4)      > pi.greco6(10^6)      > pi.greco6(10^8)
[1] 3.142324            [1] 3.141674          [1] 3.141602
> pi.greco6(10^5)      > pi.greco6(10^7)      > pi.greco6(10^8)
[1] 3.140723            [1] 3.141564          [1] 3.141579
> pi.greco6(10^5)      > pi.greco6(10^7)      > pi.greco6(10^8)
[1] 3.142115            [1] 3.141517          [1] 3.141577
> pi.greco6(10^5)      > pi.greco6(10^7)      > pi.greco6(10^8)
[1] 3.141635            [1] 3.141594          [1] 3.141604
```