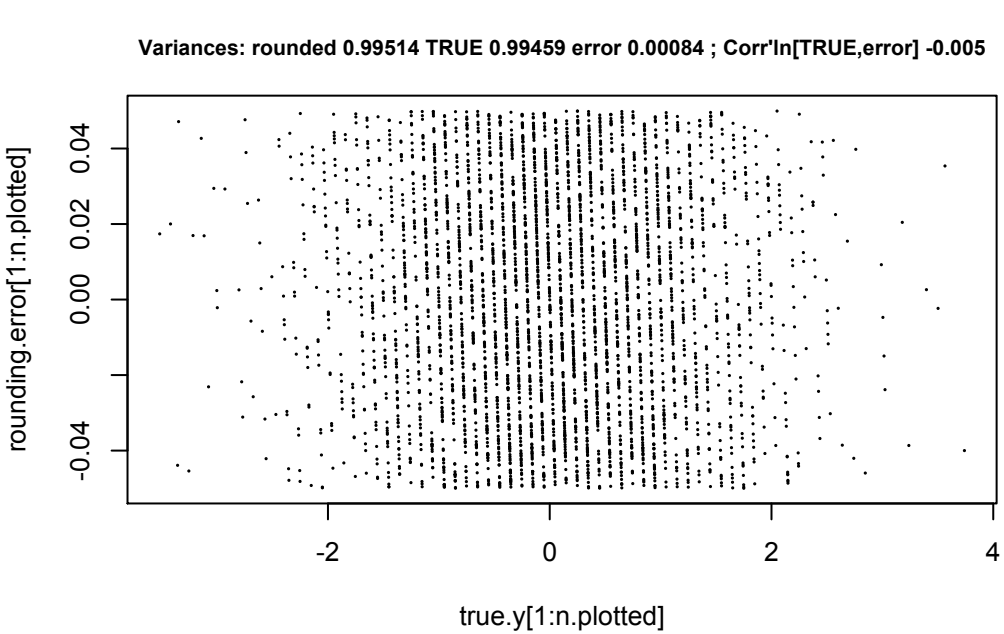
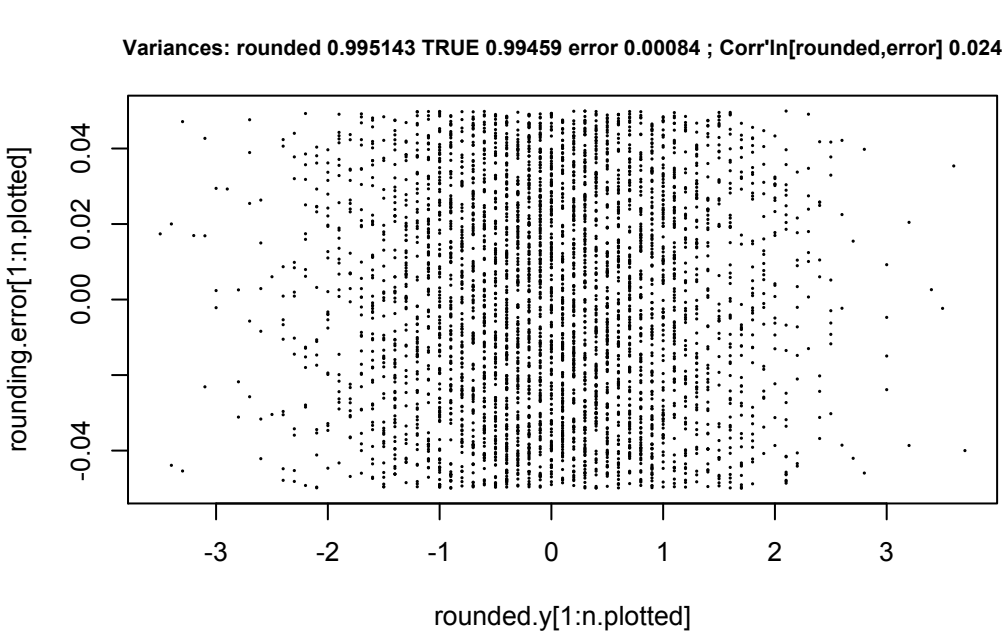
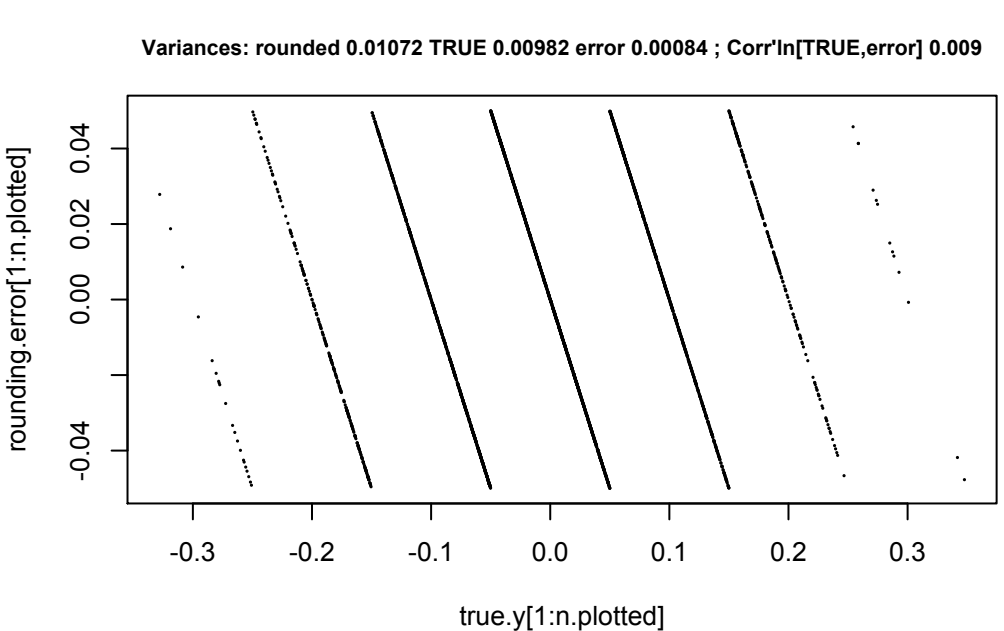
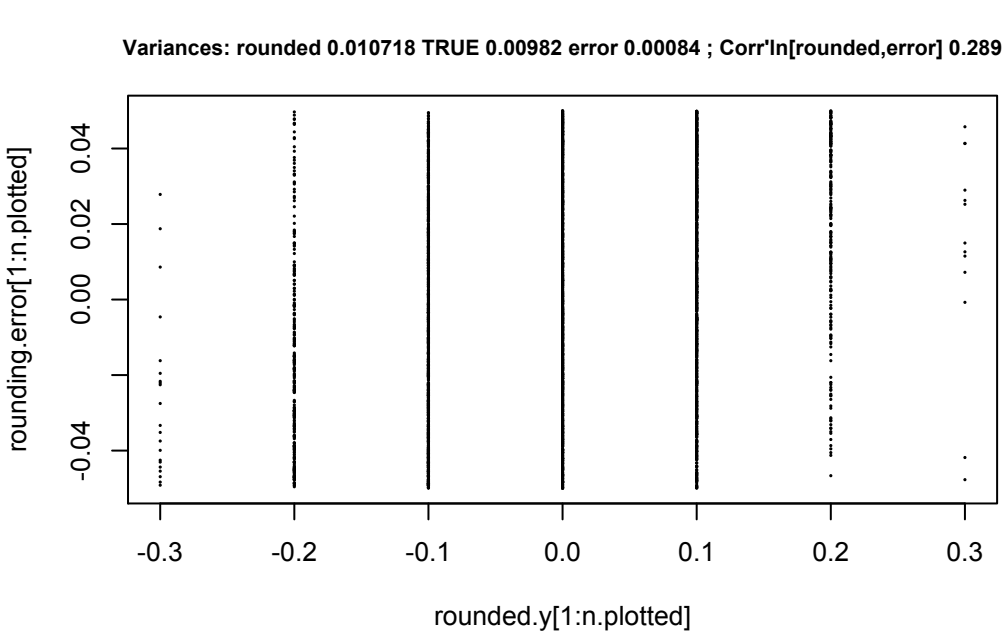

Variances: rounded 0.99514 TRUE 0.99459 error 0.00084 ; Corr'ln[TRUE,error] -0.005
rounding.error[1:n.plotted]
0.04
0.02
0.00
-0.04
-2
0
2
4
true.y[1:n.plotted]


Variances: rounded 0.995143 TRUE 0.99459 error 0.00084 ; Corr'ln[rounded,error] 0.024
rounding.error[1:n.plotted]
0.04
0.02
0.00
-0.04
-3
-2
-1
0
1
2
3
rounded.y[1:n.plotted]


Variances: rounded 0.01072 TRUE 0.00982 error 0.00084 ; Corr'ln[TRUE,error] 0.009
rounding.error[1:n.plotted]
0.04
0.02
0.00
-0.04
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3
true.y[1:n.plotted]


Variances: rounded 0.010718 TRUE 0.00982 error 0.00084 ; Corr'ln[rounded,error] 0.289
rounding.error[1:n.plotted]
0.04
0.02
0.00
-0.04
-0.3
-0.2
-0.1
0.0
0.1
0.2
0.3
rounded.y[1:n.plotted]

```r
par(mfrow=c(2,2),mar = c(4,4,3,1))

n=10000 # ideally 1000000 but plotting may crash your R

n.plotted = 4000

# by rounding to 1 decimal place induces bins w=0.1 wide

for(sigma in c(1,0.1) ){
 true.y=rnorm(n,0,sigma)
 rounded.y = round(true.y,1)
 print(c(var(true.y), var(rounded.y) ,
 var(rounded.y) - var(true.y), ( (0.1)^2 )/ 12))
 rounding.error = rounded.y - true.y
 txt = paste("Variances: rounded",
              format(round(var(rounded.y),5),nsmall=5),
             "TRUE",format(round(var(true.y),5),nsmall=5),
             "error", format(round(var(rounding.error),
5),nsmall=5),
             "; Corr'ln[TRUE,error]",
             format(round(cor(true.y,rounding.error),3),nsmall=3)
             )
 plot(true.y[1:n.plotted], rounding.error[1:n.plotted],
  cex=0.1,pch=19,
 main=txt,cex.main=0.8, ylim=c(-0.05,0.05))

 txt = paste("Variances: rounded", toString(round(var(rounded.y),
6)),
             "TRUE",format(round(var(true.y),5),nsmall=5),
             "error", format(round(var(rounding.error),
5),nsmall=5),
             "; Corr'ln[rounded,error]",
             format(round(cor(rounded.y,rounding.error),
3),nsmall=3)
             )

 plot(rounded.y[1:n.plotted],
    rounding.error[1:n.plotted],cex=0.1,pch=19,

   main=txt,cex.main=0.8,ylim=c(-0.05,0.05))
}
```

```r
####################
# TAKE-HOME MESSAGES
####################

# if MANY bins [top],  **********

# errors and true y close to uncorrelated
# variance(errors) << variance(true) & variance(rounded)
# so corrections are minor even if ignore the correlation

# var(rounded) = var(true+error) is close to
# var(true) + var(error), so substract var(error)
# from var(rounded) to get var(true)
# and use var(error) = (width of bin)^2  / 12

# note that with w=0.1, var(Uniform) = 0.01/12 = 0.00083

# if FEW bins [bottom],  ********************

# variance(errors) closer in magnite to
# variance(true) & variance(rounded)
# so corrections matter more

# errors are now substantially correlated with true y

# so, ignoring this is more crucial, and
# Sheppard's corection is less accurate.
```