In-class Assignment 14

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Question 1 (5 pt): Conduct the same simulation as that on page 22 of `Lesson14_lecture.pdf` except that the Poisson distribution is replaced by the continuous uniform distribution `Unif(0,10)`. Provide the plot similar to that on page 8 of `Lesson14_lecture.pdf`. (Hint: See the similar code in `Lesson14.R`.)

Answer:

```
library(stringr)

set.seed(0)
a <- 0
b <- 10
mu <- 5 # mean
sigma <- sqrt(((b - a) ** 2) / 12) # standard deviation
m <- 10000
n <- c(5, 10, 25, 100, 1000, 10000)
Z <- vector("list", length(n))
names(Z) <- as.character(n)
for(i in seq_along(n)){
  n_i_str <- as.character(n[i])
  for(j in 1:m){
    X <- runif(n[i], a, b)
    Z[[n_i_str]][j] <- (mean(X) - mu)/(sigma/sqrt(n[i]))
  }
}
str(Z)
```

```
## List of 6
##  $ 5    : num [1:10000] 0.798 1.293 -1.525 1.328 0.312 ...
##  $ 10   : num [1:10000] -0.151 0.111 -1.667 0.52 1.154 ...
##  $ 25   : num [1:10000] 1.0564 0.9936 0.0221 0.4458 1.0657 ...
##  $ 100  : num [1:10000] 1.19 1.27 2.12 -1.62 1.29 ...
##  $ 1000 : num [1:10000] -1.72 -1.36 -0.49 0.27 1.48 ...
##  $ 10000: num [1:10000] -0.188 -1.1 -1.015 1.655 -1.156 ...
```

```
z <- seq(-4, 4, length.out = 10000)
Z$SN <- dnorm(z) # gives the standard normal probability density function (pdf) values of
 ↪  z
str(Z)
```

```
## List of 7
##  $ 5    : num [1:10000] 0.798 1.293 -1.525 1.328 0.312 ...
```

```
##  $ 10   : num [1:10000] -0.151 0.111 -1.667 0.52 1.154 ...
##  $ 25   : num [1:10000] 1.0564 0.9936 0.0221 0.4458 1.0657 ...
##  $ 100  : num [1:10000] 1.19 1.27 2.12 -1.62 1.29 ...
##  $ 1000 : num [1:10000] -1.72 -1.36 -0.49 0.27 1.48 ...
##  $ 10000: num [1:10000] -0.188 -1.1 -1.015 1.655 -1.156 ...
##  $ SN   : num [1:10000] 0.000134 0.000134 0.000135 0.000135 0.000136 ...
```

```r
par(mfrow=c(2,3))
for(n_i in n){
  n_i_str <- as.character(n_i)
  hist(Z[[n_i_str]], breaks=50, prob = TRUE, xlab="Z",
       main = str_c("Histogram of n=",n_i_str))
  lines(z, Z$SN, col="blue", lwd=2)
}
```