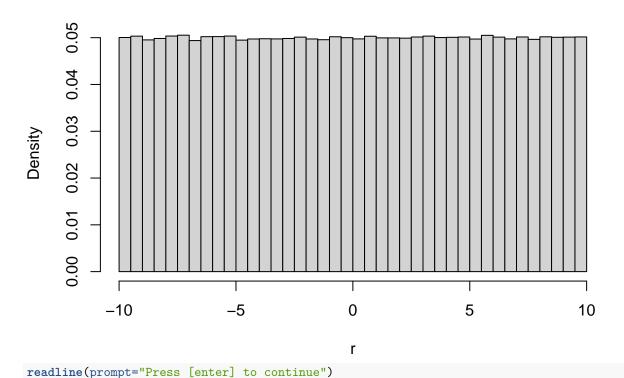
Lecture_2_MACSS

Auffhammer

2024-09-05

```
rm(list = ls()) # clear memory
set.seed(22092008) # set random number generator seed
N<-1000000 # population size
n <- 250 # sample size (for calculation of mean)
numloop <- 10000 # number of draws</pre>
# Placeholder
g <- integer(numloop) # vector to hold sample mean for each iteration
# # For normally distributed data
# sig2 <- 1 # variance for population
# mu <- 0 # mean of population</pre>
\# r \leftarrow rnorm(N, mean=mu, sd=sqrt(sig2))
# For uniformly distributed data
ub <- 10
lb <- -10
r <- runif(N, min = lb, max = ub)</pre>
sig2 <- (lb-ub)^2/12 # variance for uniform (SCIENCE!)</pre>
# Plot population
hist(r,prob=TRUE,breaks = 50,main = "Raw data")
```

Raw data



```
## Press [enter] to continue
## [1] ""
# Draw `numloop' samples of size n and calculate mean each time.

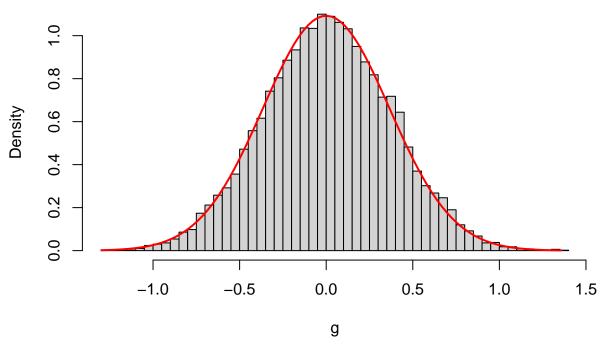
for(i in 1:numloop) {
   tmp <-sample(r, n, replace = FALSE, prob = NULL)
   g[i] <- mean(tmp)
}

# Calculate minimum and maximum of sample means (cleaner plot)
a <-min(g)
b <-max(g)

# Make histogram of sample means with 50 bins
hist(g,prob=TRUE,breaks = 50,main = "Sampling Distribution of sample mean")</pre>
```

Overlay normal distribution with predicted mean and variance
curve(dnorm(x,mean=0,sd=sqrt(sig2/n)),a,b,add=TRUE,lwd=2,col="red")

Sampling Distribution of sample mean



Now let's turn R into a calculator to calculate critical values and p-values.

```
qnorm(0.025)
## [1] -1.959964
# This looks up the critical value on a normal pdf, with 0.025 probability mass to the left of it. If y
qnorm(0.975)
## [1] 1.959964
#If you have a critical value and want to look up the probability mass, you do.....
pnorm(-1.96)
```

If you want to look up critical values based on a certain amount of probability mass in the tail for

[1] 0.0249979

This gives you the probability mass to the left of -1.96 z-scores. If you want to calculate the area 1-pnorm(1.645)

```
## [1] 0.04998491
```

Cool. What about t-distributions?

Well, you need one more parameter. The degrees of freedom.

So if you want the area in the tail to the left of a t of -2.23 with 23 degrees of freedom, you do...

pt(-2.23,23)

[1] 0.01789719

or if you want to figure out what the critical value for a certain alpha is given the degrees of free qt(0.05,23)

[1] -1.713872

Now chuck your t and normal tables forever!!!!