PROBABILITY AND STATISTICS (UCS410)
EXPERIMENT 7 :
CHI-SQUARE, T-DISTRIBUTION, F-DISTRIBUTION

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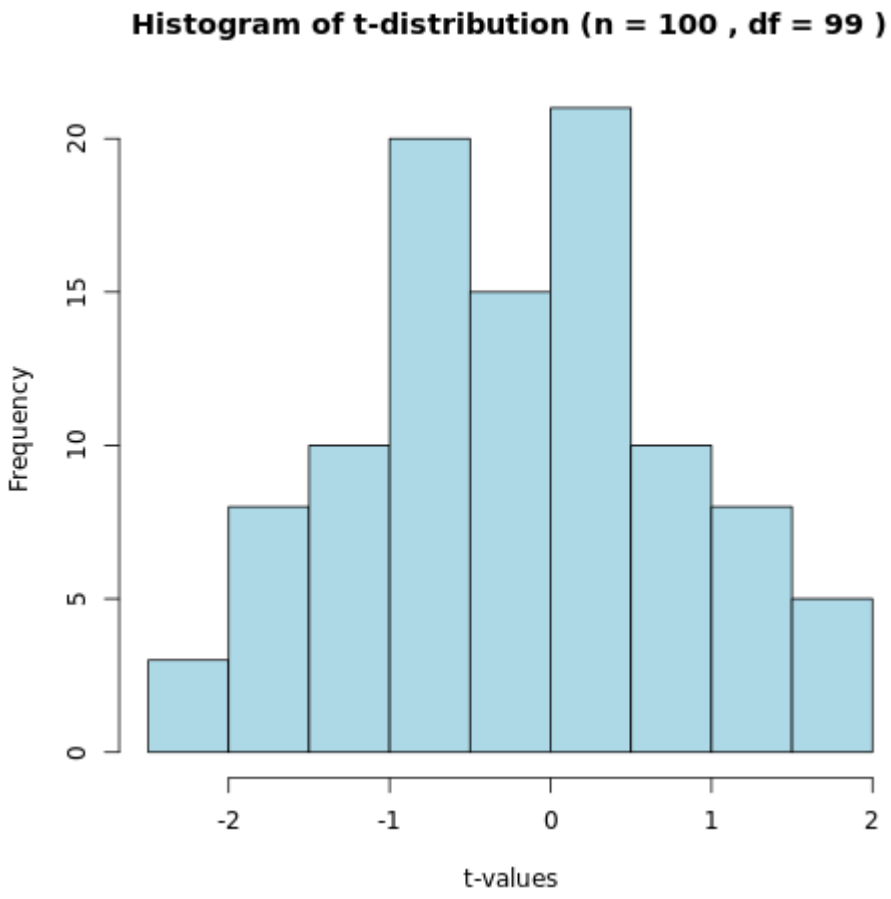
(1)

Use the rt(n, df) function in r to investigate the t-distribution for n = 100 and df = n − 1 and plot the histogram for the same.

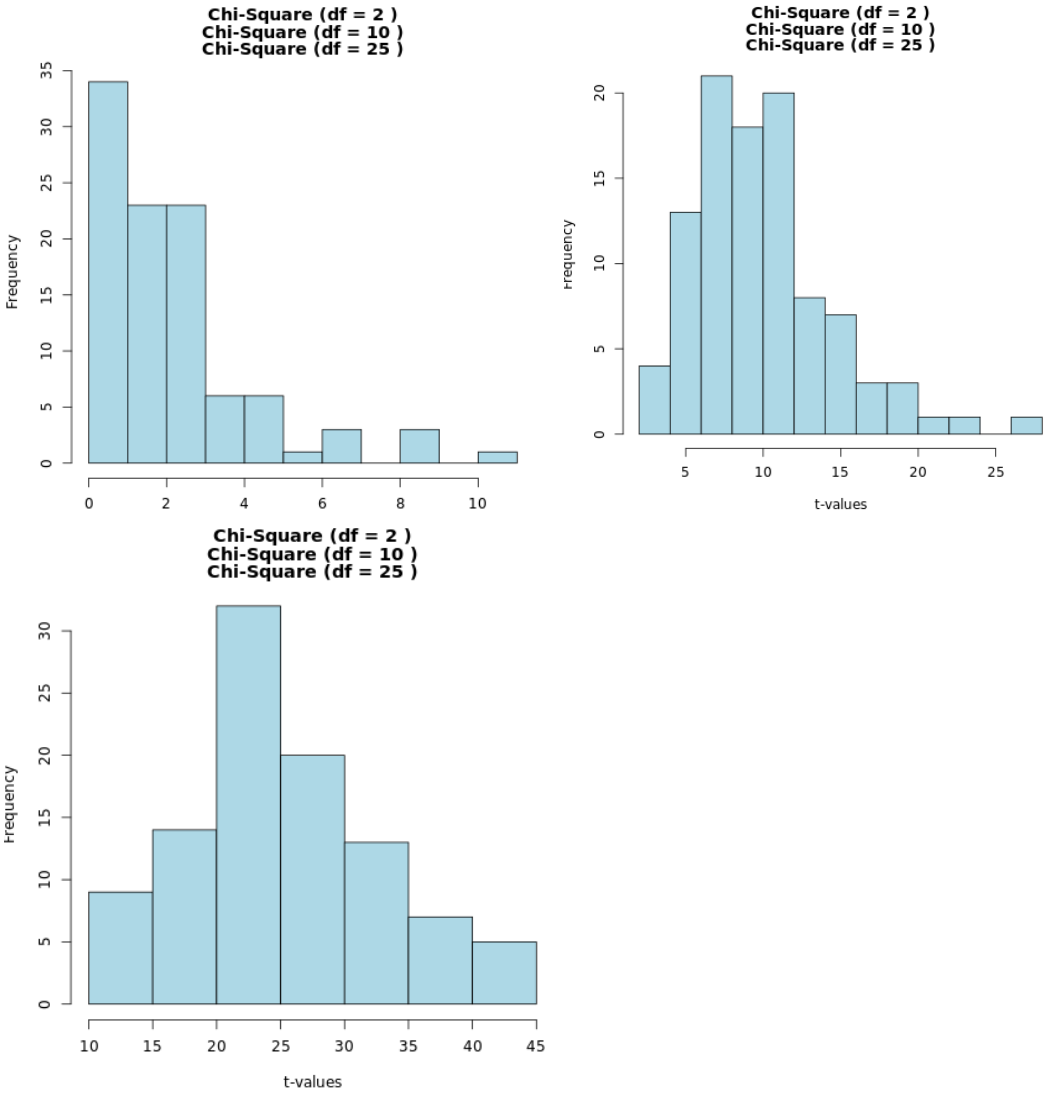
```r
n <- 100
df <- n - 1
samples <- rt(n, df)
hist(samples,breaks = 10,col = "lightblue", main = paste("Histogram of t-distribution (n =", n, ", df =", df, ")"),xlab = "t-values",ylab = "Frequency")
```



2) Use the rchisq(n, df) function in r to investigate the chi-square distribution with n = 100 and

df = 2, 10, 25.

```r
n <- 100

df <- c(2,10,25)

samples <- rchisq(n, df)

for(d in df) {

samples <- rchisq(n, d)

hist(samples,breaks = 10,col = "lightblue",main = paste("Chi-Square (df =", df, ")"),xlab = "t-values",ylab = "Frequency")

}
```



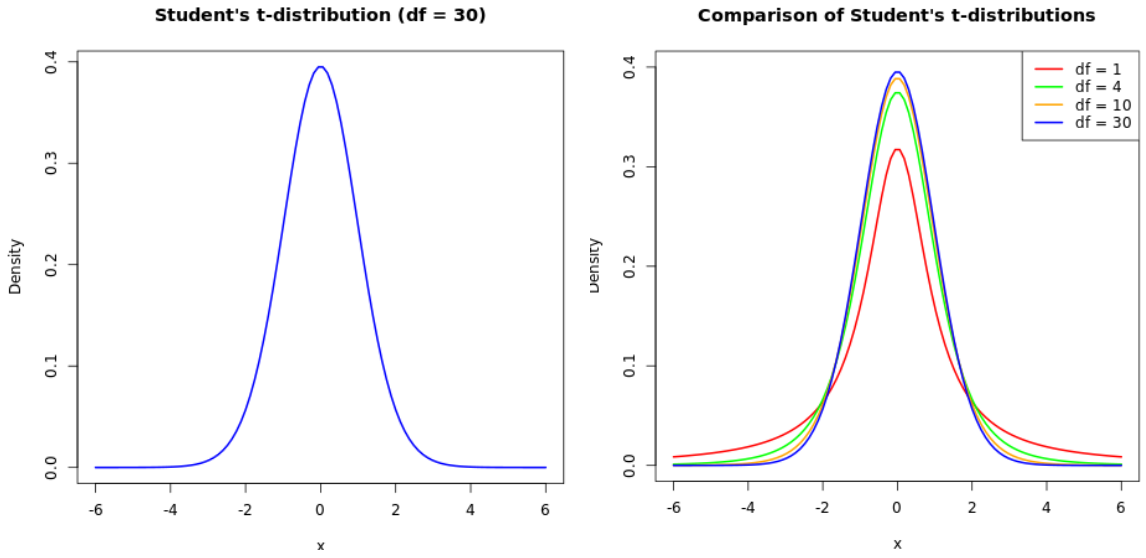
3) Generate a vector of 100 values between -6 and 6. Use the dt() function in r to find the values of a

t-distribution given a random variable x and degrees of freedom 1,4,10,30. Using these values plot

the density function for students t-distribution with degrees of freedom 30. Also shows a comparison

of probability density functions having different degrees of freedom (1,4,10,30).

```r
x<- seq(-6, 6, length.out = 100)
y<- dt(x, df = 30)
plot(x, y, type = "l", col = "blue", lwd = 2,main = "Student's t-distribution (df = 30)",xlab = "x", ylab = "Density")
dfs <- c(1, 4, 10, 30)
colors <- c("red", "green", "orange", "blue")
plot(x, dt(x, df = 1), type = "n",main = "Comparison of Student's t-distributions",xlab = "x", ylab = "Density", ylim = c(0, 0.4))
for (i in 1:length(dfs)) {
  lines(x, dt(x, df = dfs[i]), col = colors[i], lwd = 2)
}
legend("topright", legend = paste("df =", dfs),col = colors, lwd = 2)
```



4) Write a r-code

(i) To find the 95th percentile of the F-distribution with (10, 20) degrees of freedom.

```r
percentile_95 <- qf(0.95, df1 = 10, df2 = 20)
percentile_95
```

Program input

Output

```
[1] 2.347878
```

(ii) To calculate the area under the curve for the interval [0, 1.5] and the interval [1.5, +∞) of

a F-curve with v1 = 10 and v2 = 20 (USE pf()).

```r
area_0_to_1.5 <- pf(1.5, df1 = 10, df2 = 20)
area_1.5_to_inf <- 1 - area_0_to_1.5
area_0_to_1.5
area_1.5_to_inf
```

Program input

Output

```
[1] 0.7890535
[1] 0.2109465
```

(iii) To calculate the quantile for a given area (= probability) under the curve for a F-curve

with v1 = 10 and v2 = 20 that corresponds to q = 0.25, 0.5, 0.75 and 0.999. (use the qf())

```r
quantile<-c(0.25,0.5,0.75,0.999)

for(i in quantile) {

quanti<-qf(i,10,20)

cat(quanti,"\n")

}
```

Program input

Output

```
0.6563936
0.9662639
1.399487
5.075246
```

(iv) To generate 1000 random values from the F-distribution with v1 = 10 and v2 = 20 (use rf())and plot a histogram.

```r
random_values <- rf(1000, df1 = 10, df2 = 20)

hist(random_values, breaks = 30, col = "lightblue", main = "Histogram of F-distribution (df1 = 10, df2 = 20)",
     xlab = "F-Values", ylab = "Frequency")
```

Program input

Output