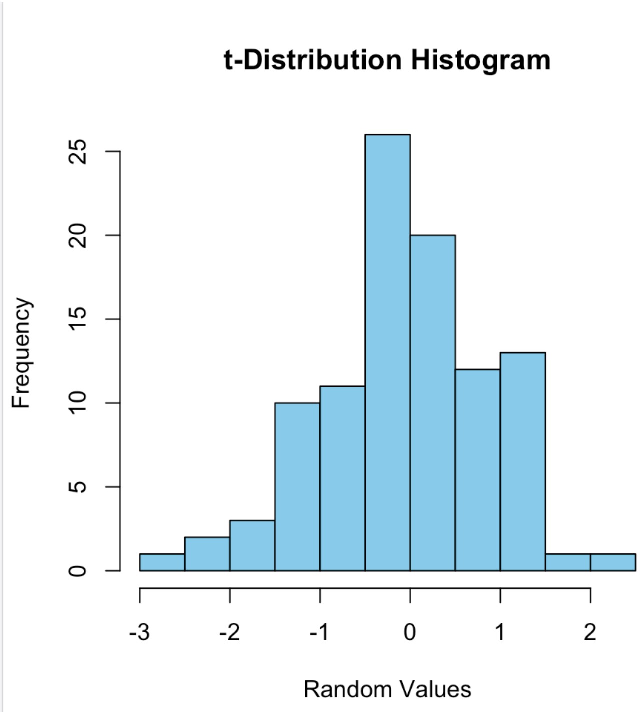
EXPERIMENT 7

Q1
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.

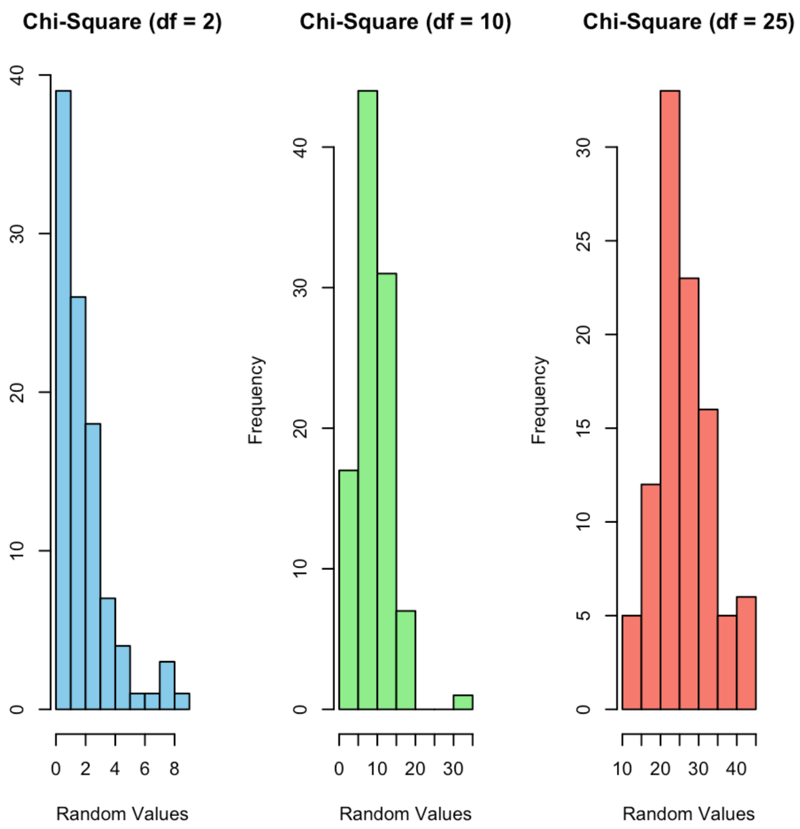
Code:
```
n <- 100
df <- n - 1

t_distribution <- rt(n, df)

hist(t_distribution, main = "t-Distribution Histogram", xlab = "Random Values", col = "skyblue")
```



Q2
Use the rchisq(n, df) function in r to investigate the chi-square distribution with n = 100 and df = 2, 10, 25.

Code:
```
n <- 100
```

```
degrees_of_freedom <- c(2, 10, 25)

chi_square_2 <- rchisq(n, degrees_of_freedom[1])
chi_square_10 <- rchisq(n, degrees_of_freedom[2])
chi_square_25 <- rchisq(n, degrees_of_freedom[3])

par(mfrow = c(1, 3))  # Set up a 1x3 grid for the plots

hist(chi_square_2, main = "Chi-Square (df = 2)", xlab = "Random Values", col = "skyblue")
hist(chi_square_10, main = "Chi-Square (df = 10)", xlab = "Random Values", col =
"lightgreen")
hist(chi_square_25, main = "Chi-Square (df = 25)", xlab = "Random Values", col =
"salmon")

par(mfrow = c(1, 1))
```



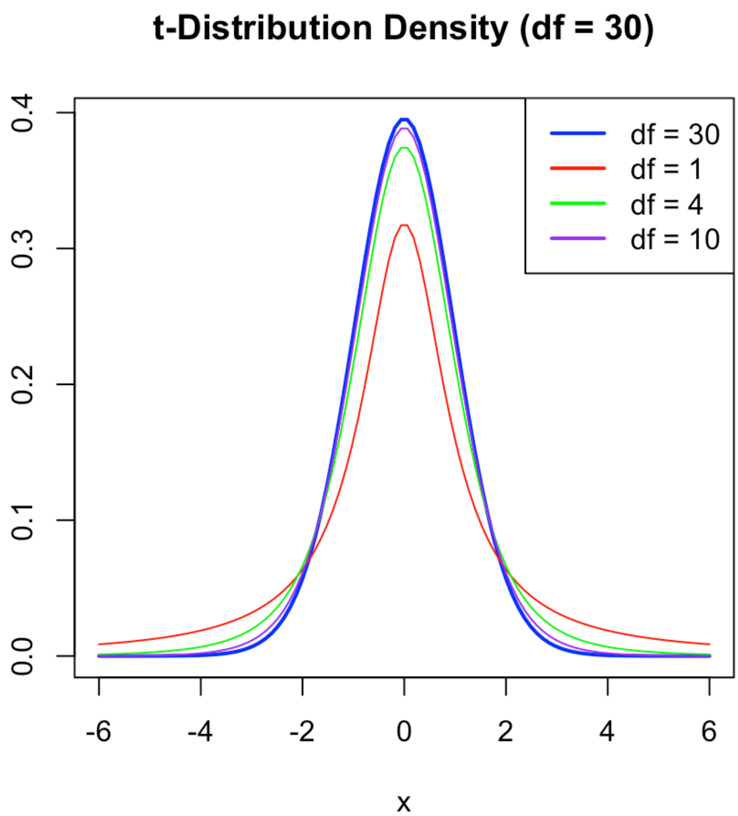
Q3

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).

Code:

```
x <- seq(-6, 6, length.out = 100)

t_dist_df1 <- dt(x, df = 1)
```

```
t_dist_df4 <- dt(x, df = 4)
t_dist_df10 <- dt(x, df = 10)
t_dist_df30 <- dt(x, df = 30)

plot(x, t_dist_df30, type = "l", col = "blue", lwd = 2, xlab = "x", ylab = "Density", main = "t-Distribution Density (df = 30)")

lines(x, t_dist_df1, col = "red")
lines(x, t_dist_df4, col = "green")
lines(x, t_dist_df10, col = "purple")

legend("topright", legend = c("df = 30", "df = 1", "df = 4", "df = 10"), col = c("blue", "red", "green", "purple"), lwd = 2)
```



Q4

Write a r-code

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

(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()).

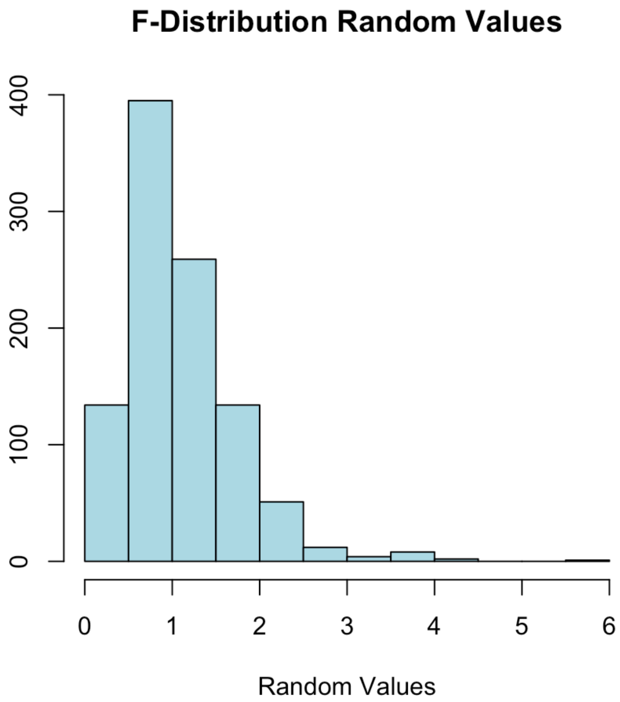
(iii) To calculate the quantile for a given area (= probability) under the curve for a F-curve with v1 = 10 and v2 = 20 that corresponds to q = 0.25, 0.5, 0.75 and 0.999. (use the qf())

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

<u>Code:</u>

```r
# Parameters for the F-distribution
df1 <- 10
df2 <- 20

# (i) 95th percentile of the F-distribution
percentile_95 <- qf(0.95, df1, df2)
cat("95th percentile of F-distribution:", percentile_95, "\n")

# (ii) Area under the curve for the intervals [0, 1.5] and [1.5, +∞)
area_0_to_1_5 <- pf(1.5, df1, df2)
area_1_5_to_inf <- 1 - pf(1.5, df1, df2)
cat("Area under the curve [0, 1.5]:", area_0_to_1_5, "\n")
cat("Area under the curve [1.5, +∞):", area_1_5_to_inf, "\n")

# (iii) Quantiles for given probabilities (0.25, 0.5, 0.75, 0.999)
quantile_25 <- qf(0.25, df1, df2)
quantile_50 <- qf(0.5, df1, df2)
quantile_75 <- qf(0.75, df1, df2)
quantile_999 <- qf(0.999, df1, df2)
cat("Quantile for probability 0.25:", quantile_25, "\n")
cat("Quantile for probability 0.5:", quantile_50, "\n")
cat("Quantile for probability 0.75:", quantile_75, "\n")
cat("Quantile for probability 0.999:", quantile_999, "\n")

# (iv) Generate 1000 random values from the F-distribution and plot a histogram
random_values <- rf(1000, df1, df2)
hist(random_values, main = "F-Distribution Random Values", xlab = "Random Values", col
= "lightblue")
```

```
> # (i) 95th percentile of the F-distribution
> percentile_95 <- qf(0.95, df1, df2)
> cat("95th percentile of F-distribution:", percentile_95, "\n")
95th percentile of F-distribution: 2.347878
> # (ii) Area under the curve for the intervals [0, 1.5] and [1.5, +∞)
> area_0_to_1_5 <- pf(1.5, df1, df2)
> area_1_5_to_inf <- 1 - pf(1.5, df1, df2)
> cat("Area under the curve [0, 1.5]:", area_0_to_1_5, "\n")
Area under the curve [0, 1.5]: 0.7890535
> cat("Area under the curve [1.5, +∞):", area_1_5_to_inf, "\n")
Area under the curve [1.5, +∞): 0.2109465
> # (iii) Quantiles for given probabilities (0.25, 0.5, 0.75, 0.999)
> quantile_25 <- qf(0.25, df1, df2)
> quantile_50 <- qf(0.5, df1, df2)
> quantile_75 <- qf(0.75, df1, df2)
> quantile_999 <- qf(0.999, df1, df2)
> cat("Quantile for probability 0.25:", quantile_25, "\n")
Quantile for probability 0.25: 0.6563936
> cat("Quantile for probability 0.5:", quantile_50, "\n")
Quantile for probability 0.5: 0.9662639
> cat("Quantile for probability 0.75:", quantile_75, "\n")
Quantile for probability 0.75: 1.399487
> cat("Quantile for probability 0.999:", quantile_999, "\n")
Quantile for probability 0.999: 5.075246
> # (iv) Generate 1000 random values from the F-distribution and plot a histogram
> random_values <- rf(1000, df1, df2)
> hist(random_values, main = "F-Distribution Random Values", xlab = "Random Values", col = "lightblue")
```



F-Distribution Random Values
0
100
200
300
400
0
1
2
3
4
5
6
Random Values