Lab Assignment-7

Name: Khushi Prasad
SubGroup: 3CO20
Roll No.: 102183044
Subject: Probability & Statistics

(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.

CODE:

```
n = 100
df = n-1
x<-rt(n, df)
hist(x)
```

OUTPUT:

```
> rt(n, df)
  [1]  0.109377648 -0.486324580  0.864701879 -0.109494595 -0.540849897
  [6]  1.157029167  0.838709843 -0.594844764 -0.305368751 -0.358719461
 [11] -0.278575594 -0.792841803 -0.368111204  0.232386520  1.013603101
 [16] -0.347137687 -0.513031022  1.254822859 -0.821821524  0.778683504
 [21]  0.422708157  0.155008523 -0.774198618 -1.077166607  0.131681686
 [26] -0.593963644 -0.005645439 -1.313395028 -0.401726918  1.298949270
 [31] -0.267381405  0.489103663  0.445565652  1.172025186  0.880962368
 [36] -1.846570849 -0.956290070 -0.347724047 -1.813488152  0.409754786
 [41]  1.113908205 -0.071850392  1.382902475  1.019209770 -0.400323422
 [46]  1.418344194  1.075044227  0.700371231 -0.600212211  0.657252240
 [51]  0.328260781  0.959505079 -0.522419322 -1.333585789 -0.819714899
 [56]  1.023121639 -0.441756415 -0.798625135 -1.145229541  0.647684035
 [61]  0.960245380  0.028383763  0.081059900 -1.281738899 -0.816191341
 [66] -0.517969067 -1.217931954 -1.575591977 -2.314625961  0.857382261
 [71] -0.974960074 -0.018221630 -0.130408751 -1.368576412 -0.607084031
 [76] -2.166816071 -0.688297008 -0.848872586 -0.181205680  0.106671509
 [81] -0.820583870  0.657423492 -0.153697402  0.653034504 -1.099657985
 [86] -1.423408945  0.360044534  0.089676139  1.152910318  0.177612794
 [91]  0.338410451 -0.690561838 -1.336638233  1.190821940  0.105382395
 [96] -1.707495409  1.720789955 -0.828029673  0.026980328  0.285470031
```

(2) 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
df<-c(2,10,25)
rchisq(n,df)
```

OUTPUT:

```
> rchisq(n,df)
  [1]  7.37303347  6.87227805 14.36052725  0.12115293  9.58097878 20.21460692
  [7]  1.36988818  5.90715158 32.69807741  1.28893596 16.58616386 30.29821520
 [13]  1.69982128  6.55317678 16.49299149  2.58052045  5.03187783 26.33474724
 [19]  4.52787333  5.02781179 33.37173929  0.18575205 14.97858651 17.62929641
 [25]  9.98577206  7.23088830 27.52881081  0.43922620  7.76904522 14.59644592
 [31]  0.36836215  8.09725098 23.37085978  1.10932605  7.41158917 26.70951340
 [37]  2.47243530 11.44492804 16.78254028  0.04848953  7.24549346 19.09845182
 [43]  0.63087962 12.82464860 22.53055970  0.78393359  4.87440731 13.97629129
 [49]  0.55581698  6.43922790 24.32375620  1.67524545 11.56875899 22.10657040
 [55]  0.80446717  8.41165033 26.39758732  1.92396373 11.87898333 34.46553319
 [61]  0.52066457  6.74319407  9.99459268  5.65810413 18.78648314 26.00850735
 [67]  1.53213453  8.66315831 19.84715375  3.75956150 13.92887250 25.92900467
 [73]  0.25377121  9.86351013 33.30978257  0.23099773  5.96708375 35.39398775
 [79]  0.47845106  5.52817570 39.27217201  1.14065082  9.22757424 21.17260703
 [85]  0.70996293  9.76417291 16.00820465  0.54893504 11.62851793 29.62313950
 [91]  0.72017434 11.08915936 30.66710788  0.87664508  6.13822546 22.67524996
 [97]  0.12200535 16.55937422 22.05777617  1.57165831
```

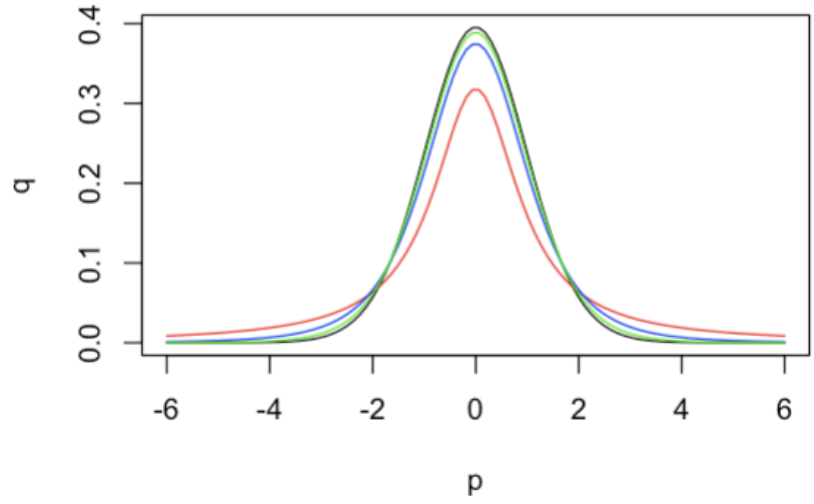
(3) Generate a vector of 100 values between -6 and 6. Use the dt() function in r to find the values of a t-distribution given a random variable x and degrees of freedom 1,4,10,30. Using these values plot the density function for students t-distribution with degrees of freedom 30. Also shows a comparison of probability density functions having different degrees of freedom (1,4,10,30).

CODE:

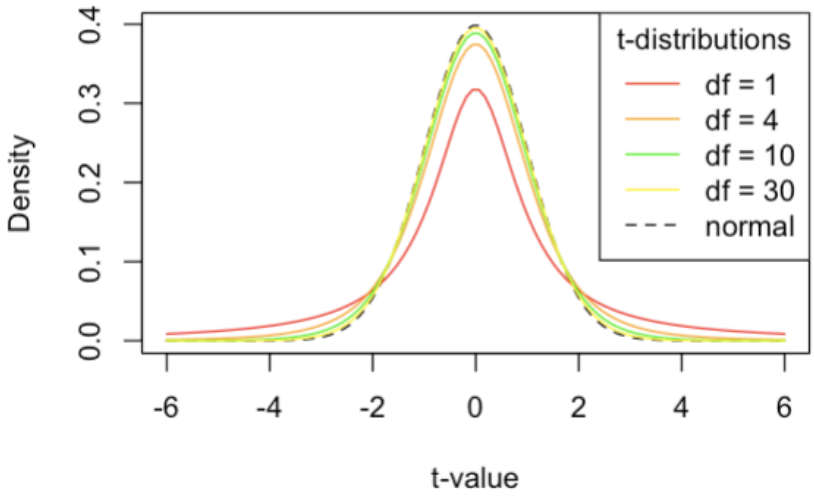
```
p<-seq(-6,6,length=100)
df<-c(1,4,10,30)
q<-dt(p,df[4])
plot(p, q, type='l')
color<-c('red', 'blue', 'green')
for (i in 1:3){
  lines(p,dt(p,df[i]), type='l', col=color[i])
}

x <- seq(-6, 6, length = 100)
df = c(1,4,10,30)
colour = c("red", "orange", "green", "yellow","black")
plot(x, dnorm(x), type = "l", lty = 2, xlab = "t-value", ylab = "Density",
     main = "Comparison of t-distributions", col = "black")
for (i in 1:4){
  lines(x, dt(x, df[i]), col = colour[i])
}
legend("topright", c("df = 1", "df = 4", "df = 10", "df = 30", "normal"),
       col = colour, title = "t-distributions", lty = c(1,1,1,1,2))
```

OUTPUT:



Comparison of t-distributions



(4) Write a r-code

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

CODE:

```
34  # (i)
35  qf(0.95, 10, 20)
```

OUTPUT:

```
> qf(0.95, 10, 20)
[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()).

CODE:

```
37  # (ii)
38  pf(1.5,10,20,lower.tail = FALSE)
39  pf(1.5,10,20,lower.tail = TRUE)
```

OUTPUT:

```
> pf(1.5,10,20,lower.tail = FALSE)
[1] 0.2109465
> pf(1.5,10,20,lower.tail = TRUE)
[1] 0.7890535
```

(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())

CODE:

```
41  # (iii)
42  q<-c(0.25,0.5,0.75,0.999)
43  qf(q,10,20)
```

OUTPUT:

```
> qf(q,10,20)
[1] 0.6563936 0.9662639 1.3994874 5.0752462
```

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

CODE:

```
45  # (iv)
46  a<-rnorm(rf(1000,10,20))
47  a
48  hist(a)
```

OUTPUT: