Assignment 7

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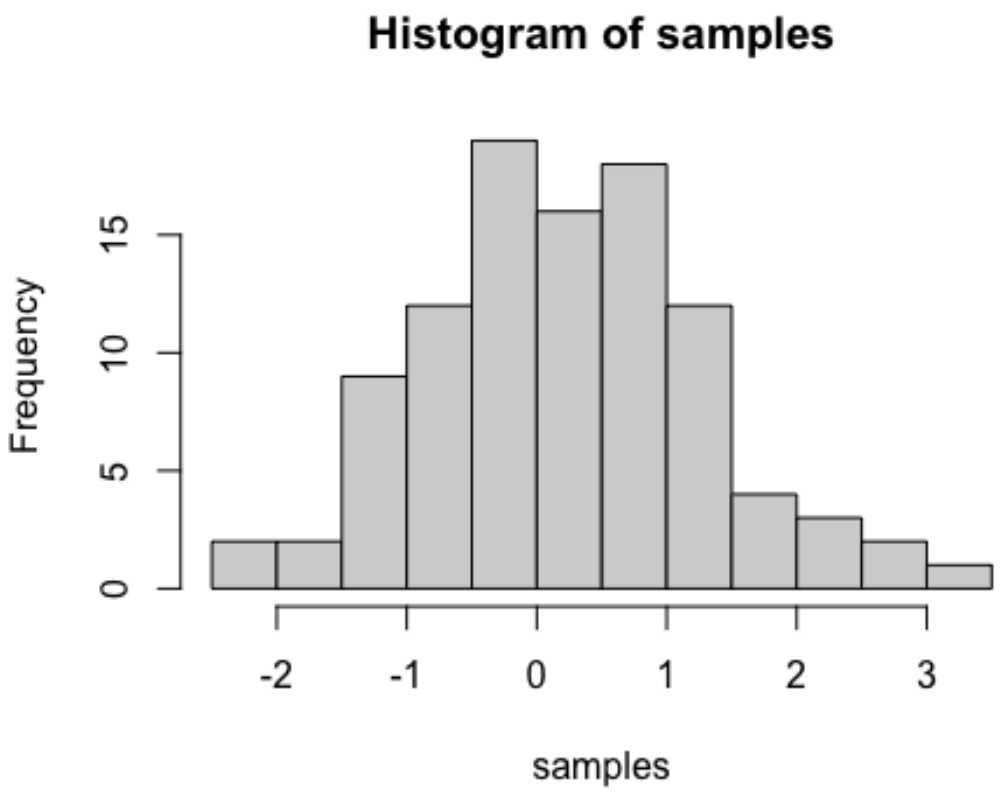
```
#Q1 Use the  rt(n,df) function to investigate the t-distribution for n=100 and df=n-1.
n=100
df=n-1
samples=rt(n,df)
samples
```

```
##   [1]  0.84529718  0.40261735 -0.13972855  1.54138900  1.07435789 -1.03621578
##   [7] -0.20908007  1.31454749 -0.33525011 -0.82878711  0.90109427  0.52534401
##  [13] -0.20037547 -1.37178563 -0.26735635 -0.98057955 -0.47615267  3.12546383
##  [19]  0.64716374 -0.71882277  1.31010210  0.17022327 -0.51186692  2.12207299
##  [25]  0.68419101 -0.46524351  2.06363115  0.03063393  0.76916922  0.68556965
##  [31] -2.04822859 -1.77283536 -0.35608549  1.93478298  2.61740522  0.06057504
##  [37]  1.04834909 -0.81590855  1.35509615  0.38891833  1.04452282 -0.49703209
##  [43]  0.40705397 -0.29760652  2.08772945 -0.58350819 -0.62238269 -1.14056963
##  [49]  1.13004343  0.66041921  0.62525451  0.98231408 -2.44542135  0.47000634
##  [55]  0.17244232 -0.51912676  1.78705935 -0.18495404 -1.08894232 -1.21791671
##  [61] -1.01328305  0.18555374  1.42707614 -0.06622144  0.43264772 -0.36003264
##  [67]  0.76547518 -0.16552667 -1.00441847 -0.52335585  1.58111369 -0.76708157
##  [73] -1.29200925  1.06524169  0.95320337  0.99328466  1.03248739 -0.80242671
##  [79]  0.17276229 -0.20629739  0.51291790 -0.13921512 -0.70046955  0.08468463
##  [85]  0.13281454  1.14080136 -1.10086176  0.19421082  1.40840184  0.72736942
##  [91]  0.61832491  0.43879501  0.68579341 -0.47206789  0.95582375 -1.53071291
##  [97]  0.08271806 -0.06417771 -0.45627932  2.57743817
```

```
hist(samples)
```




```
 #Q2 Use the rchisq(n,df) function  to investigate the chi-
square distribution with n=100 and df=2,10   #and 25.
 n=100
 df=c(2,10,25)
 rchisq(n,df[1])
```

```
##   [1]  1.763819929  8.710972913  4.761891006  2.088278949  0.687354990
##   [6]  3.869920839  0.707527175  1.454562579  2.429996043  0.994076170
##  [11]  2.545797872  2.296838209  0.511561037  2.329565263  1.545916776
##  [16]  1.635245206  1.792657166  0.813446992  0.178407214  1.107411805
##  [21]  2.745538083  2.459316064  1.983809582  1.332213397  2.465323702
##  [26]  0.477481669  2.109013843  0.629917938  9.231338840  2.327694262
##  [31]  5.336164162  2.056273974  0.644244550  0.786995657  0.213774274
##  [36]  4.562172594  7.890307925  1.301982688  5.410905188  0.761702496
##  [41]  3.722122697  1.824879133  3.914144771  5.777409062  0.065537149
##  [46]  3.614519875  0.125826504  2.669573131  1.865256665  1.493233493
##  [51]  2.658218339  6.517604054  1.367738807  7.549488589  3.093381353
##  [56]  0.955014202 15.201653595  3.569003545  3.509012276  0.326278374
##  [61]  2.186301029  0.045574866  5.712567904  1.766906105  3.944924048
##  [66]  3.282248929  1.267376592  7.448292649  1.293749541  1.462960484
##  [71]  0.519474961  5.267792723  0.878055113  0.499126436  1.301822882
##  [76]  1.377777614  1.657961123  3.199587039  1.085148852  1.844907553
```

```
##  [81]  1.058065120  2.031592423  1.246473208  1.250479121  0.619387916
##  [86]  1.475965449  0.008880755  0.530941972  1.369511909  3.462243457
##  [91]  0.012391490  0.425556365  1.279463970  1.157974225  0.998346432
##  [96]  0.591722704  0.071231930  2.936909206  1.654623050  3.597492928
```

```
 rchisq(n,df[2])
```

```
##   [1] 11.292330  5.050266  5.247433  5.141238 10.159409  8.007263
3.769839
##   [8] 11.726761  9.622777  7.208103  6.604565  9.920352  6.861079
8.029513
##  [15]  6.716343  3.230363  8.509523 14.856823 11.953241  8.901594
9.410177
##  [22] 15.892453  8.767815  4.322482  5.577548 20.678672 11.518313
11.055376
##  [29]  6.488092  8.359540  7.993190  2.330467  8.735177  9.940228
2.505855
##  [36] 11.693977 13.315649 14.753487  8.624562 17.919320  1.396939
8.778543
##  [43]  9.084504 12.192122 16.187598 11.448477  4.884357 18.069410
10.491222
##  [50]  7.861326  9.472529  8.900223 12.131068 14.316737  8.468715
6.149632
##  [57] 11.169060  4.218562  5.409430 14.346833  9.655849  5.284630
6.124135
##  [64] 18.458194 15.517321 14.629917  9.662419 13.288645 20.281109
5.304610
##  [71]  4.289285  6.801109  7.764662 15.436979  9.122242  7.099574
7.449234
##  [78]  8.076509  8.917183 19.204874  7.060630  8.306031 11.878694
10.560243
##  [85]  6.142450 11.964105  7.018016  7.280433 10.970607 12.788932
12.261013
##  [92]  7.975882  7.879425 10.128394  5.517360  5.673716  8.868517
8.113920
##  [99]  7.278465  6.747083
```

```
 rchisq(n,df[3])
```

```
##   [1] 41.211321 34.988413 28.912707 24.014155 12.672950 19.134216
22.495997
##   [8] 16.393447 25.903012 18.757433 28.134872 25.389368 15.439732
13.671852
##  [15] 24.634185 28.809242 25.540568 25.706940 18.001512 27.437395
15.162205
##  [22] 21.130822 19.615092 18.836700 18.580553 23.112398 20.905531
13.014435
##  [29] 17.050467 15.323932 29.760737 23.233154 37.794343 23.181011
16.621794
##  [36] 16.942812 27.020151 24.443033 24.727009 29.892266 19.832736
```

```
21.509623
##  [43] 18.024521 33.661470 23.658748 24.203495 25.158536 20.345825
23.174448
##  [50] 28.284599 20.395375 30.579316 44.736656 35.528651 30.546287
21.972080
##  [57] 22.188472 17.912574 27.265307 28.946909 25.733325 31.642766
24.060340
##  [64] 20.718292 15.444150 26.530855 22.259651 28.728861 21.532453
32.293067
##  [71] 24.942387 34.026739 21.752989 28.909502 37.583968 23.649606
37.086998
##  [78] 21.812121 17.745762 39.837606 19.930677 32.766339 22.838359
30.711233
##  [85] 22.865592 16.320052 19.749512 35.684510 23.663962  9.914486
15.533585
##  [92] 19.164893 21.369764 23.599618 24.999624 19.126080 10.879599
17.791769
##  [99] 42.274713 35.938967
```

```
#Q3. Generate a vector of 100 values between -6 and 6.use
the dt function to find
#the values of a t-distribution given a random variable x
and certain degrees of freedom.
#Using these values plot the density function for student's
t-distribution.
#Shows a comparison of probability density functions having
different degrees of freedom.

# Generate a vector of 100 values between -6 and 6
x <- seq(-6, 6, length = 100)
x
```

```
##   [1] -6.00000000 -5.87878788 -5.75757576 -5.63636364 -5.51515152 -
5.39393939
##   [7] -5.27272727 -5.15151515 -5.03030303 -4.90909091 -4.78787879 -
4.66666667
##  [13] -4.54545455 -4.42424242 -4.30303030 -4.18181818 -4.06060606 -
3.93939394
##  [19] -3.81818182 -3.69696970 -3.57575758 -3.45454545 -3.33333333 -
3.21212121
##  [25] -3.09090909 -2.96969697 -2.84848485 -2.72727273 -2.60606061 -
2.48484848
##  [31] -2.36363636 -2.24242424 -2.12121212 -2.00000000 -1.87878788 -
1.75757576
##  [37] -1.63636364 -1.51515152 -1.39393939 -1.27272727 -1.15151515 -
1.03030303
##  [43] -0.90909091 -0.78787879 -0.66666667 -0.54545455 -0.42424242 -
```

```
0.30303030
##  [49] -0.18181818 -0.06060606  0.06060606  0.18181818  0.30303030
0.42424242
##  [55]  0.54545455  0.66666667  0.78787879  0.90909091  1.03030303
1.15151515
##  [61]  1.27272727  1.39393939  1.51515152  1.63636364  1.75757576
1.87878788
##  [67]  2.00000000  2.12121212  2.24242424  2.36363636  2.48484848
2.60606061
##  [73]  2.72727273  2.84848485  2.96969697  3.09090909  3.21212121
3.33333333
##  [79]  3.45454545  3.57575758  3.69696970  3.81818182  3.93939394
4.06060606
##  [85]  4.18181818  4.30303030  4.42424242  4.54545455  4.66666667
4.78787879
##  [91]  4.90909091  5.03030303  5.15151515  5.27272727  5.39393939
5.51515152
##  [97]  5.63636364  5.75757576  5.87878788  6.00000000
```

```
# Degrees of freedom
df = c(1,4,10,30)
colour = c("black", "orange", "green", "yellow")

#find the values of t-dist
dt(x,df[1])
```

```
##   [1] 0.008602970 0.008951310 0.009321021 0.009713870 0.010131806
0.010576983
##   [7] 0.011051792 0.011558887 0.012101221 0.012682086 0.013305165
0.013974580
##  [13] 0.014694962 0.015471523 0.016310143 0.017217477 0.018201075
0.019269524
##  [19] 0.020432624 0.021701588 0.023089287 0.024610541 0.026282468
0.028124906
##  [25] 0.030160921 0.032417419 0.034925891 0.037723307 0.040853208
0.044367012
##  [31] 0.048325591 0.052801137 0.057879356 0.063661977 0.070269505
0.077844030
##  [37] 0.086551677 0.096583858 0.108155840 0.121499988 0.136849375
0.154405107
##  [43] 0.174278263 0.196396298 0.220368383 0.245321632 0.269758339
0.291538659
##  [49] 0.308123970 0.317144983 0.317144983 0.308123970 0.291538659
0.269758339
##  [55] 0.245321632 0.220368383 0.196396298 0.174278263 0.154405107
0.136849375
##  [61] 0.121499988 0.108155840 0.096583858 0.086551677 0.077844030
0.070269505
##  [67] 0.063661977 0.057879356 0.052801137 0.048325591 0.044367012
```

```
0.040853208
##  [73] 0.037723307 0.034925891 0.032417419 0.030160921 0.028124906
0.026282468
##  [79] 0.024610541 0.023089287 0.021701588 0.020432624 0.019269524
0.018201075
##  [85] 0.017217477 0.016310143 0.015471523 0.014694962 0.013974580
0.013305165
##  [91] 0.012682086 0.012101221 0.011558887 0.011051792 0.010576983
0.010131806
##  [97] 0.009713870 0.009321021 0.008951310 0.008602970
```

dt(x,df[2])

```
##   [1] 0.001185854 0.001299674 0.001426572 0.001568291 0.001726840
0.001904535
##   [7] 0.002104055 0.002328498 0.002581463 0.002867130 0.003190370
0.003556866
##  [13] 0.003973266 0.004447354 0.004988268 0.005606751 0.006315456
0.007129303
##  [19] 0.008065920 0.009146149 0.010394664 0.011840692 0.013518866
0.015470216
##  [25] 0.017743327 0.020395643 0.023494940 0.027120922 0.031366892
0.036341391
##  [31] 0.042169621 0.048994381 0.056976082 0.066291261 0.077128754
0.089682498
##  [37] 0.104139687 0.120662946 0.139365306 0.160277437 0.183307807
0.208198657
##  [43] 0.234483644 0.261456453 0.288162552 0.313426933 0.335927310
0.354313737
##  [49] 0.367362749 0.374140500 0.374140500 0.367362749 0.354313737
0.335927310
##  [55] 0.313426933 0.288162552 0.261456453 0.234483644 0.208198657
0.183307807
##  [61] 0.160277437 0.139365306 0.120662946 0.104139687 0.089682498
0.077128754
##  [67] 0.066291261 0.056976082 0.048994381 0.042169621 0.036341391
0.031366892
##  [73] 0.027120922 0.023494940 0.020395643 0.017743327 0.015470216
0.013518866
##  [79] 0.011840692 0.010394664 0.009146149 0.008065920 0.007129303
0.006315456
##  [85] 0.005606751 0.004988268 0.004447354 0.003973266 0.003556866
0.003190370
##  [91] 0.002867130 0.002581463 0.002328498 0.002104055 0.001904535
0.001726840
##  [97] 0.001568291 0.001426572 0.001299674 0.001185854
```

dt(x,df[3])

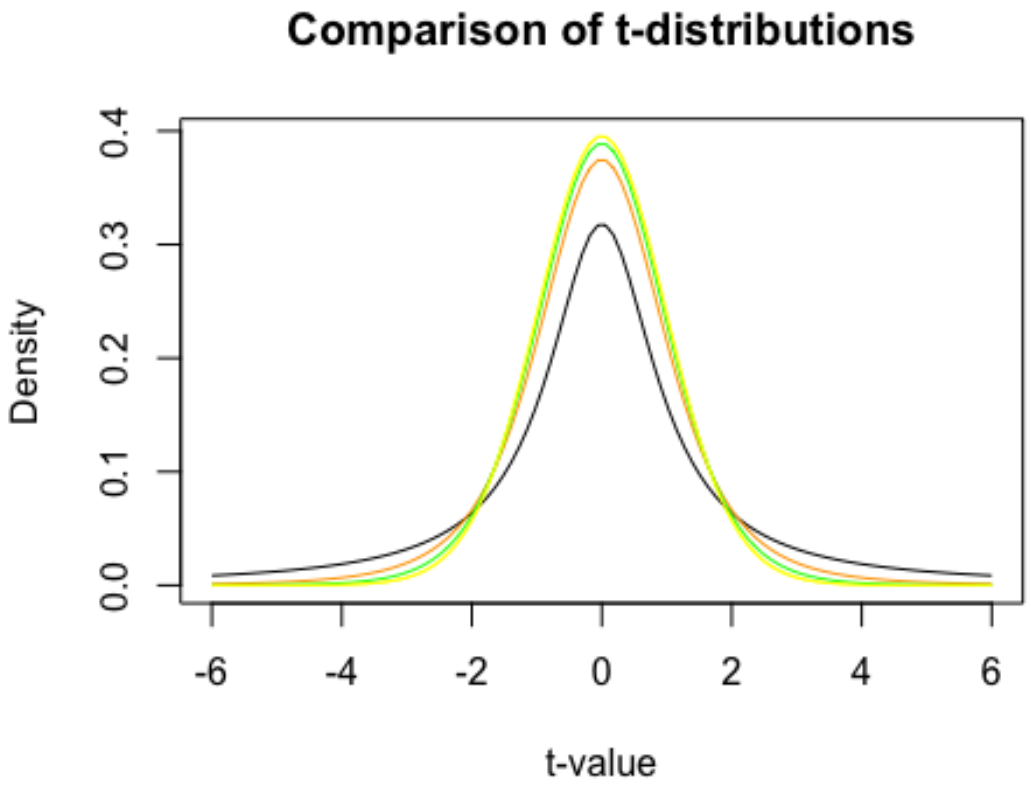
```
##   [1] 8.808511e-05 1.049214e-04 1.252258e-04 1.497602e-04 1.794627e-04
##   [6] 2.154911e-04 2.592754e-04 3.125844e-04 3.776092e-04 4.570665e-04
##  [11] 5.543283e-04 6.735831e-04 8.200373e-04 1.000165e-03 1.222017e-03
##  [16] 1.495608e-03 1.833383e-03 2.250800e-03 2.767036e-03 3.405837e-03
##  [21] 4.196543e-03 5.175295e-03 6.386451e-03 7.884205e-03 9.734397e-03
##  [26] 1.201647e-02 1.482550e-02 1.827413e-02 2.249422e-02 2.763790e-02
##  [31] 3.387746e-02 4.140377e-02 5.042225e-02 6.114577e-02 7.378367e-02
##  [36] 8.852619e-02 1.055239e-01 1.248621e-01 1.465323e-01 1.704005e-01
##  [41] 1.961789e-01 2.234026e-01 2.514189e-01 2.793936e-01 3.063382e-01
##  [46] 3.311623e-01 3.527460e-01 3.700297e-01 3.821091e-01 3.883232e-01
##  [51] 3.883232e-01 3.821091e-01 3.700297e-01 3.527460e-01 3.311623e-01
##  [56] 3.063382e-01 2.793936e-01 2.514189e-01 2.234026e-01 1.961789e-01
##  [61] 1.704005e-01 1.465323e-01 1.248621e-01 1.055239e-01 8.852619e-02
##  [66] 7.378367e-02 6.114577e-02 5.042225e-02 4.140377e-02 3.387746e-02
##  [71] 2.763790e-02 2.249422e-02 1.827413e-02 1.482550e-02 1.201647e-02
##  [76] 9.734397e-03 7.884205e-03 6.386451e-03 5.175295e-03 4.196543e-03
##  [81] 3.405837e-03 2.767036e-03 2.250800e-03 1.833383e-03 1.495608e-03
##  [86] 1.222017e-03 1.000165e-03 8.200373e-04 6.735831e-04 5.543283e-04
##  [91] 4.570665e-04 3.776092e-04 3.125844e-04 2.592754e-04 2.154911e-04
##  [96] 1.794627e-04 1.497602e-04 1.252258e-04 1.049214e-04 8.808511e-05
```

```
dt(x,df[4])
```

```
##   [1] 1.948678e-06 2.742971e-06 3.862943e-06 5.442161e-06 7.668593e-06
##   [6] 1.080643e-05 1.522639e-05 2.144773e-05 3.019610e-05 4.248311e-05
##  [11] 5.971486e-05 8.383942e-05 1.175458e-04 1.645301e-04 2.298498e-04
##  [16] 3.203887e-04 4.454635e-04 6.176038e-04 8.535416e-04 1.175449e-03
##  [21] 1.612457e-03 2.202481e-03 2.994355e-03 4.050262e-03 5.448382e-03
##  [26] 7.285618e-03 9.680204e-03 1.277386e-02 1.673306e-02 2.174888e-02
##  [31] 2.803476e-02 3.582149e-02 4.534868e-02 5.685228e-02 7.054761e-02
##  [36] 8.660837e-02 1.051419e-01 1.261628e-01 1.495662e-01 1.751045e-01
##  [41] 2.023705e-01 2.307906e-01 2.596315e-01 2.880217e-01 3.149896e-01
##  [46] 3.395167e-01 3.606011e-01 3.773274e-01 3.889359e-01 3.948821e-01
##  [51] 3.948821e-01 3.889359e-01 3.773274e-01 3.606011e-01 3.395167e-01
##  [56] 3.149896e-01 2.880217e-01 2.596315e-01 2.307906e-01 2.023705e-01
##  [61] 1.751045e-01 1.495662e-01 1.261628e-01 1.051419e-01 8.660837e-02
##  [66] 7.054761e-02 5.685228e-02 4.534868e-02 3.582149e-02 2.803476e-02
##  [71] 2.174888e-02 1.673306e-02 1.277386e-02 9.680204e-03 7.285618e-03
##  [76] 5.448382e-03 4.050262e-03 2.994355e-03 2.202481e-03 1.612457e-03
##  [81] 1.175449e-03 8.535416e-04 6.176038e-04 4.454635e-04 3.203887e-04
##  [86] 2.298498e-04 1.645301e-04 1.175458e-04 8.383942e-05 5.971486e-05
##  [91] 4.248311e-05 3.019610e-05 2.144773e-05 1.522639e-05 1.080643e-05
##  [96] 7.668593e-06 5.442161e-06 3.862943e-06 2.742971e-06 1.948678e-06
```

```
#plot the density function
plot(x,dt(x,df[4]),type = "l",xlab = "t-value", ylab =
"Density",
     main = "Comparison of t-distributions", col=colour[4])
for (i in 1:4){
```

```
  lines(x,dt(x,df[i]),type = "l",col = colour[i])
}
```




```
#Q4
#(i) Find the 95th percentile of the F distribution with
(10, 20) degrees of freedom.
qf(.95, df1=10, df2=20)
```

```
## [1] 2.347878
```

```
#(ii) use the pf() to calculate the area under the curve for
the interval [0,1.5] and
#the interval [1.5,+∞) of a F-curve with with v1=10 and
v2=20.
x = 1.5
v1 = 10
v2 = 20
# interval $[0,1.5]
pf(x, df = v1, df2 = v2, lower.tail = TRUE)
```

```
## [1] 0.7890535
```

```
# interval $[1.5,+inf)
pf(x, df = v1, df2 = v2, lower.tail = FALSE)
```

```
## [1] 0.2109465
```

```
#(iii) use the qf() 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.

q <- c(0.25, 0.5, 0.75, 0.999)
v1=10
v2=20
qf(q[1], df1 = v1, df2 = v2, lower.tail = TRUE)
```

```
## [1] 0.6563936
```

```
qf(q[2], df1 = v1, df2 = v2, lower.tail = TRUE)
```

```
## [1] 0.9662639
```

```
qf(q[3], df1 = v1, df2 = v2, lower.tail = TRUE)
```

```
## [1] 1.399487
```

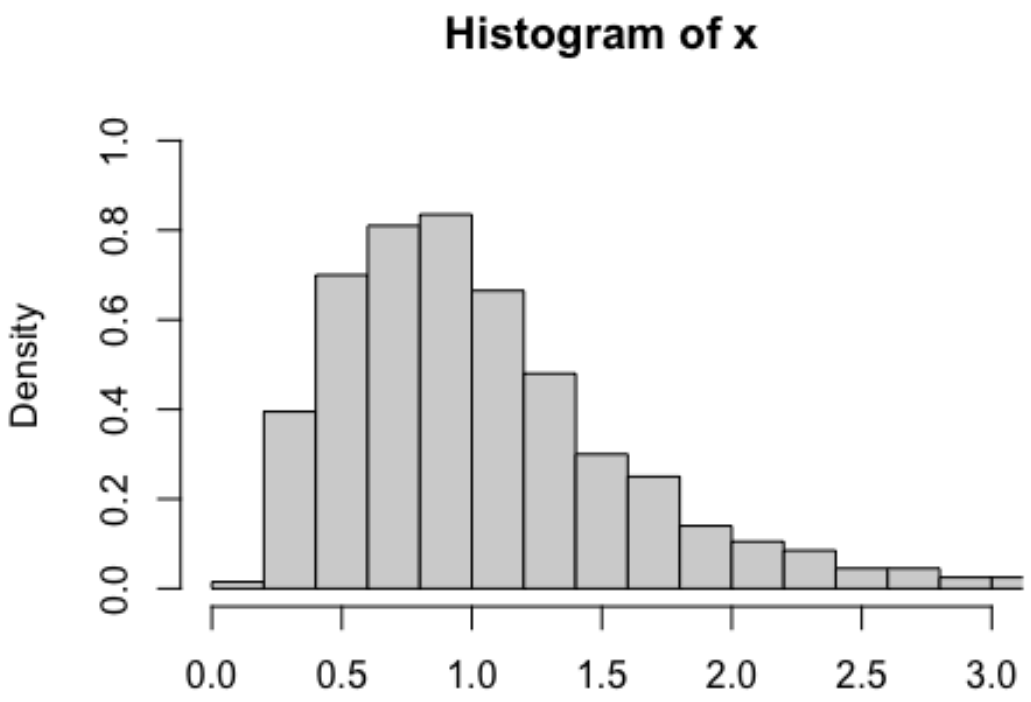
```
qf(q[4], df1 = v1, df2 = v2, lower.tail = TRUE)
```

```
## [1] 5.075246
```

```
#(iv) use rf()function to generate 1000 random values from
the F-distribution with v1=10 and v2=20.
#Thereafter we plot a histogram.

x <- rf(1000, df1 = 10, df2 = 20)

hist(x,
     breaks='scott',
     freq = FALSE,
     xlim = c(0,3),
     ylim = c(0,1),
     xlab = '',
)
```


Histogram of x
Density
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0