STAT 206 Homework 4

Shahab Geravesh UC Riverside

Due Monday, November 2, 5:00 PM

General instructions for homework: Homework must be submitted as pdf file, and be sure to include your name in the file. Give the commands to answer each question in its own code block, which will also produce plots that will be automatically embedded in the output file. Each answer must be supported by written statements as well as any code used. (Examining your various objects in the "Environment" section of RStudio is insufficient – you must use scripted commands.)

In lecture, we fit a gamma distribution to the weight of cat's hearts. We did this by adjusting the parameters so that the theoretical values of the mean and variance matched the observed, sample mean and variance. Since the mean and variance are the first two moments of the distribution, this is an example of the method of moments for estimation.

The method of moments gives a point estimate $\hat{\theta}$ of the parameters θ. To use a point estimate, we need to know how precise it is, i.e., how different it would be if we repeated the experiment with new data from the same population. We often measure imprecision by the standard error, which is the standard deviation of the point estimates $\hat{\theta}$. (You saw the standard error of the mean in your introductory statistics classes, but we are not computing the standard error of the mean here.)

If we actually did the experiment many times, getting many values of $\hat{\theta}$, we could take their standard deviation as the standard error. With only one data set, we need to do something else. There is usually no simple formula for standard errors of most estimates, the way there is for the standard error of the mean. Instead, we will see how to approximate the standard error of for our estimate of the gamma distribution computationally.

We can draw random values from a gamma distribution using the `rgamma()` function. For example, `rgamma(n=35,shape=0.57,scale=15)` would generate a vector of 35 random values, drawn from the gamma distribution with "shape" parameter a = 0.57 and "scale" s = 15. By applying the estimator to random samples drawn from the distribution, we can see how much the estimates will change purely due to noise.

Part I - Estimates and standard errors

1. Write a function, `gamma.est`, which takes as input a vector of data values, and returns a vector containing the two estimated parameters of the gamma distribution, with components named shape and scale as appropriate.

```
gamma.est<-function(x){mean<-mean(x); variance<-var(x)
return(c(shape=mean^2/variance,scale=variance/mean))
}
```

2. Verify that your function implements the appropriate formulas by showing that it matches the results from lecture for the cat heart data.

```
library(MASS)
data(cats)
gamma.est(cats$Hwt)
```

```
##      shape      scale
```

```
## 19.0653121  0.5575862
```

```
gamma.est(subset(cats, cats$Sex == "M")$Hwt)
```

```
##      shape      scale
## 19.8357612  0.5708216
```

```
gamma.est(subset(cats, cats$Sex == "F")$Hwt)
```

```
##      shape      scale
## 45.9399792  0.2003076
```

3. Generate a vector containing ten thousand random values from the gamma distribution with $a = 19$ and $s = 0.56$. What are the theoretical values of the mean and of the variance? What are their sample values?

```
set.seed(5)
a<-rgamma(n=10000,shape=19,scale=.56)
a
```

```
##     [1]   8.433658  9.032957 10.529638 14.892328  8.958695 10.721684  8.446514
##     [8]  10.695325 13.527924  8.518792 10.239032  7.939318 12.395215 12.642548
##    [15]  12.752831 14.197496 12.132272 12.426615  9.665163 15.663784  9.644360
##    [22]   8.407730  8.220714 16.383429 13.498966 14.229263 12.778778  8.071070
##    [29]  14.004338 11.662476  9.224930  8.517386  6.778057  9.289468  9.365244
##    [36]   9.281087 11.144384 10.093717 10.817100 12.967931  8.983514  9.241662
##    [43]  12.253894 10.090539  7.539411  7.803223 13.244874  6.620389  8.610162
##    [50]   8.250895  9.646048  9.968845  9.874233 13.666922 11.840870 11.273042
##    [57]  11.644984 11.054739  7.258297 10.820664  9.048564  9.371326 12.842941
##    [64]  10.302074 15.990615 14.164444  6.623624 10.178294  7.340277  7.959043
##    [71]   7.410391 12.881633 11.304580  9.542017  9.425787 10.217660  7.817465
##    [78]  12.051691 10.868249 10.221138 12.081006 10.307919  8.624545  5.897091
##    [85]  14.636242 17.569338 10.699095  7.362010  7.300799 11.507045 10.486669
##    [92]   9.879090  8.460838  7.428822  7.766518 11.070491  9.418863  6.964971
##    [99]   7.179012  9.907047  7.586577  8.994873 11.486643 11.065502  7.935247
##   [106]   9.706992  8.531431  9.223807 12.794418  9.638272 11.475122 11.271630
##   [113]  10.078309  9.435945  8.110188  9.151295  6.280305 13.557194  9.561650
##   [120]  10.308204 10.813135  5.008098  8.898616 14.650276  9.165923  6.217421
##   [127]  10.076080 10.238330  7.181551  9.654706  6.568813 13.353280  9.071186
##   [134]   7.944146  7.183216 16.281167  8.778485 13.850301 14.712845 10.878400
##   [141]   8.555332  9.455664  9.566798 12.030253 11.260915  9.156805 14.020265
##   [148]  13.449065 12.811838 12.601239 14.872770 13.306185  8.098549  9.661397
##   [155]   8.113709 11.035199 11.373053 11.884423 12.738675  9.493632 11.658966
##   [162]   9.813799 11.670149  9.253725  8.447903 10.019269 12.752551 11.291499
##   [169]   8.630055 10.279949  9.354549  9.246132  9.290510  9.460363 11.966431
##   [176]  15.980865 10.899645 14.955649 16.181400 12.101572 11.698218  9.852705
##   [183]  11.106134 10.078921 10.148170  7.105547  9.946903  9.927437 14.956309
##   [190]   9.573828  9.727105  4.876071 12.089193  6.913373 10.587127 12.861238
##   [197]   8.972582 11.992814 13.722896 11.188877 11.278081 11.377315  9.330953
##   [204]   8.122427 11.083097 13.979972 12.734385  9.708488 10.727619 11.070306
##   [211]  10.067093 13.030994 10.062879 12.819863  9.365441 11.995409 13.450316
##   [218]  11.390611  8.461280  9.839868  8.580338 10.554925 10.489956  8.660297
##   [225]  11.741405 11.690640 10.024819 13.479843 10.819392 15.626171 10.696802
##   [232]   6.906527  9.534208  9.498725 14.569982 13.402455  7.745782 12.290939
##   [239]   7.906355 13.059968 12.052152  8.526632  7.363742  7.110168 13.935614
##   [246]  11.075003 12.142259  8.224377 10.280066  9.810620 13.679696 11.197792
##   [253]  10.368229  8.658439  8.483356 13.453474  8.875502 10.530658 11.507992
```

```
##    [260] 11.068188 17.341513 12.824006 10.355996  9.418044 10.676426  9.963258
##    [267]  5.900031  8.579798  8.920540 10.236571 15.167407  6.265489  8.657496
##    [274]  8.443612  9.888243 13.081157  8.952167  8.936760  9.933667 13.611935
##    [281] 10.176574 12.921856  6.339844 12.913472 13.044188 11.207264 11.483849
##    [288]  6.882001  9.783833 11.214816  7.505420 12.557622 14.733164 14.134614
##    [295] 12.231103  8.764263 10.886562  7.844086 10.850562  8.671999 12.346282
##    [302]  6.303751  8.982832  9.033924  9.513626 11.084610  6.445289  8.271241
##    [309] 17.561108 15.757676  9.077212 14.216600 10.432785  8.589328 12.048993
##    [316] 10.280123 11.382021  6.170300 10.436007  6.498365 10.630844  6.549957
##    [323]  7.690008 14.785763 13.674403  7.197784 11.792089 11.952933  8.202152
##    [330] 10.158283 11.074098 14.885056 11.540023 13.748793 15.166690 13.003967
##    [337] 11.641463  9.432487  9.804342 12.521759 12.192533 11.217067 13.898524
##    [344]  9.676379 12.950892  6.267560  9.100060 10.357455 10.013096  9.677826
##    [351] 12.040630  7.766428 10.796536 12.081193 12.708298 13.861554 14.743664
##    [358]  8.863222 12.728552  6.972131  8.710662 13.895730  9.727983 12.428352
##    [365] 11.322861 11.746077  9.333621 11.172722 11.680052 11.891772 10.545606
##    [372]  9.741161  9.508565  5.849508  8.984220  8.250084 13.630508  9.530863
##    [379]  9.314156 10.084837 14.603529 10.404652  7.914795 11.610169 17.212591
##    [386] 13.533967 10.370968  7.476383 13.176556  9.770000  9.128240 14.033808
##    [393] 13.164770 11.948865  7.731203 12.091026 11.266864 11.980922  9.327685
##    [400]  9.223384  9.168421 10.079613  9.303507  9.296285 11.685168 10.191634
##    [407] 12.593905 10.074021 12.490510 11.181443 10.409160  8.075835 12.107253
##    [414] 13.140227 11.436902 11.037380  6.317594 11.397527  9.101953 10.076717
##    [421] 10.402667  8.245672 12.254659 11.305974  8.740569 10.589346 12.277048
##    [428] 16.846279 10.255003  8.858380  9.116249  7.734760 10.566574  9.426811
##    [435]  9.947746 11.361698 11.622392 14.534191 13.033468  7.989627  8.833675
##    [442] 11.736917 14.554735 12.465568 11.251982  7.110682  8.272413  9.339650
##    [449]  8.054591 12.748684  7.819605 10.808125 11.476610 11.114846 11.057484
##    [456] 12.022500  9.578133  9.818561 10.825554  9.697451  7.742781 10.334654
##    [463] 13.671523 10.114344 12.881159 14.757267  5.883087 11.470832  9.593825
##    [470] 13.286261 10.667515  9.222576  8.575308  8.376623  8.770939  9.494159
##    [477] 11.176614 11.634754  8.710448  8.362740  7.293891 11.286853 13.720310
##    [484] 17.451017  8.087040 11.630829  8.226767  9.815242 10.011768 12.856371
##    [491] 16.583436 11.681857 11.596346 10.734499 10.560331 15.963757 13.799478
##    [498]  8.163162 12.945091 13.679339 11.068314  5.379238  8.081721  9.273713
##    [505] 11.411205 11.377551 10.289851  7.342492 10.125370 16.147513 10.865325
##    [512]  7.513195 12.198550  8.723290 12.410571  8.320319  9.836986  7.457155
##    [519] 11.212462  9.225068 11.995569 14.006536 12.915191 13.195335 13.229221
##    [526] 11.725637 13.492321  9.555255 17.960647  4.725418 10.235463  8.957936
##    [533]  6.775764  5.878980  9.420845 10.867987 16.839106 14.588145 14.726590
##    [540] 16.379828  9.324738 10.900391 15.674563 14.674982 10.227467  7.621254
##    [547]  4.725715  8.583974 11.380343 13.213288 13.578328 10.279274  7.908705
##    [554]  5.058852 13.791722 11.058590  8.317542 10.261251 10.659288  6.750384
##    [561] 13.443569 11.812702  9.610523  8.023263  9.990693  9.733622 10.427583
##    [568]  8.957709 10.825944 14.137940  8.084052  8.334004  8.730705 11.872963
##    [575]  9.393271 10.204818  7.800963  6.064288 11.213576 15.236396  8.111434
##    [582]  7.632009 11.891553 12.048889  9.329777 11.585292  8.581368 12.493062
##    [589] 10.262711  9.694947 11.420540  7.818971 14.620748  9.170772 11.103096
##    [596] 11.891081 12.241776 10.298100 12.668570 15.481795 13.446354  9.242090
##    [603] 12.874564  7.029369  8.650562 10.862754 11.477674 12.026396  9.129575
##    [610]  9.258997 11.383714 11.230274  8.600191  8.188597  9.650085 14.462746
##    [617]  9.763140 13.633953  9.795688 11.338762  6.987021  9.121843  8.404630
##    [624]  7.183561  7.652844 10.476819  7.472909 11.127358  9.104579 12.973119
##    [631] 13.131022 11.739330 14.534501 10.992887 13.631507 13.329420 14.782760
```

```
##    [638] 11.932130  7.724277  8.341722  9.089199 10.281738 12.140827 15.958883
##    [645] 10.161818 15.150100 11.825726  9.008456 11.594248 10.889399 10.489768
##    [652] 10.207428 11.648640 13.217926 11.242848  9.014042  8.712509  7.720363
##    [659] 10.890360 10.737180 13.588286 11.591389  9.628916  8.545543 13.133832
##    [666] 12.485066  9.732753 14.424457  9.260912 11.129590 12.823892  9.143453
##    [673] 10.906547  9.229328  9.142010 15.641495 14.877939  8.132410 12.100944
##    [680] 12.482716  8.842307 11.163604 11.451095 10.891521 12.169284 15.788328
##    [687] 10.112452 10.888701  8.816333  8.321226 12.088769 16.328513 10.122285
##    [694] 14.153035  9.382878  8.276753 10.030625  8.518115 11.901139  7.604056
##    [701] 12.303580  8.103014 12.175437  8.756966 10.165298 14.632594  6.700113
##    [708] 14.749862  9.505219 12.088220 13.222370 11.641455  9.745870  7.137821
##    [715] 13.833505  9.094649  9.295365  7.080068 10.971394 12.180112  6.700969
##    [722]  6.137159  6.230686 10.825389  8.762996  8.450159 12.558693 14.409464
##    [729] 16.480425 13.823857 12.554171 11.380389 12.809907 10.472717 11.104655
##    [736]  8.285415  7.672875  8.397004 11.708796 11.106226  8.778534  9.231342
##    [743]  9.461782  7.530977  8.736493  9.084628  8.678171  9.650120 14.612355
##    [750] 10.909408  8.583361  9.771182  9.723615 10.772078  9.721253  8.723901
##    [757]  6.772947 12.039953 11.754006 13.730382 16.781406 12.418220  9.590116
##    [764]  5.872898 12.032027  9.876662  9.645990 11.322711 10.918690  9.087151
##    [771]  9.621486  8.270743 15.264576 14.826965 13.151008  7.151687 13.103148
##    [778] 12.690698  9.515149  9.396839 10.627944 10.219244 11.623106 11.229496
##    [785] 10.839596 12.973489  8.189616  9.840471  7.816076  9.953915  8.084889
##    [792] 10.628945 12.991748 13.492390 12.010487  8.267037  8.284820 15.740542
##    [799] 11.449132 10.048665 11.480686 10.816232 12.412010  7.776874 12.920335
##    [806] 13.167240 12.386179 10.103807 10.418542 14.686694 17.372198 10.434530
##    [813] 10.756075  8.749610  8.288837  8.454568 10.126845  7.169073  9.138810
##    [820]  9.381085 15.266020  7.621575  9.353773  9.491579 11.387419 12.364536
##    [827] 14.198589 10.740679 10.345412  8.501216 11.645599  9.105447 12.230141
##    [834] 12.939121  8.585732  9.283533 11.142560  9.572458  7.373728 12.224120
##    [841] 12.846273 10.514731  8.500055  8.564403  7.449349 12.025528 12.375127
##    [848] 15.054506  6.087880 11.725056 11.598513 14.776260 11.282353 10.924231
##    [855] 11.015697  7.614144  4.917178 13.527521  9.351436 13.469870 12.221259
##    [862] 10.949189 13.050929 15.126877 13.954048 11.997172 15.429309 10.996827
##    [869]  7.822978 10.575334 11.068100 11.193055  7.762733 11.000338 12.419152
##    [876] 14.064533 10.400352  8.367867 15.771568  6.378884 13.160922  9.295803
##    [883]  9.645455 11.309943 10.237408 10.284223  6.239279  8.780604  8.877934
##    [890]  7.696275  9.521018  9.648358  9.784141 13.206426  8.590769 15.281439
##    [897]  7.871010 13.007715 10.634447 11.340906 10.465638  8.539801 10.364931
##    [904]  7.650216 11.007995 15.463293 12.105695  9.631434 12.458462 15.158555
##    [911]  9.209106  5.300200  7.398077 10.310648 10.653151 10.086797 10.292240
##    [918] 14.339007 12.014796  6.588267 12.316271 11.906269  9.367260  8.702983
##    [925] 11.332095 10.820775 11.606308  9.990273  9.658039 10.898978 11.903929
##    [932] 10.062396  7.080560  9.198343  9.010639 11.178179 11.886798 14.095403
##    [939] 11.409169  9.547076  8.147053 11.752519 15.179771 11.454945 11.073027
##    [946] 10.666230 13.957202 12.479836  9.611787 11.572235 15.276039 10.677698
##    [953]  9.864541  7.870109  5.573672  9.411573  8.250463 11.391239 13.712285
##    [960]  8.685922  9.221622 11.027616 13.326940  8.675230 14.363482  8.894439
##    [967]  9.366125  7.025411 10.730219  8.367954  8.235734 10.411562 14.390903
##    [974] 13.678046  7.215464 13.122535 15.109145 11.570602  7.955337 13.554383
##    [981] 16.190706 14.900167  7.479987  5.197656 10.693123 12.452254  7.101449
##    [988] 10.053427  7.432270  8.511853  8.068031 15.062967 14.643758 10.213756
##    [995] 13.219518  9.424069  8.400034 10.279290 10.499878 12.994145  9.495003
##   [1002]  9.119982  9.927796 12.568938 10.778871 13.056948 11.326347 10.422568
##   [1009] 16.291755 10.503934 11.490759 12.165163  8.375986  8.159248  8.807553
```

```
## [1016] 10.971654  9.499698  9.760748 10.108555 16.799270 12.984609 13.099643
## [1023] 11.912795 11.192608 10.925887  7.080183 11.186532 10.833292  8.331657
## [1030] 10.034830 10.872108 12.362874  7.296328 11.848837  8.305638 12.261944
## [1037]  9.983820 11.435342  8.269613  7.734579  8.063321 11.632914 10.814237
## [1044] 10.581575 16.240575 11.733371 11.873167 12.022801  9.847957 10.579595
## [1051] 13.940415 13.713697 17.931051 11.563265 12.557648  9.278156  7.504572
## [1058] 11.018804 10.149999 12.293962  9.976688  9.016190 17.917880  8.459564
## [1065]  7.385932  7.738890 15.434660 11.135940 13.283174 11.129973 12.803689
## [1072] 14.626773 10.780234 19.235380 11.359702 14.393930  7.463895  8.237446
## [1079] 13.361385 10.344807 14.393470 16.536179  7.474105 15.686548  8.095504
## [1086] 10.855635 12.711911  7.600317 10.064167  7.340140  9.539874 10.816589
## [1093] 10.587240 11.159634  9.159026 11.797498 11.180319  7.893022  8.850594
## [1100]  6.920463  7.709803  7.738825  9.197615  9.239749  7.516540  5.878069
## [1107] 12.420180 12.626082  8.045096 10.469529 10.122969 10.340878 13.199946
## [1114]  8.983929 12.874771  6.472450  6.728403 11.566763  8.746245  8.617163
## [1121]  7.550581  9.354668 11.376971  8.915579  8.788476 11.642830  8.950768
## [1128]  8.921569 12.809633 12.508710 12.789309  9.460154 11.222862 13.764999
## [1135]  9.291340 10.143044  9.383865 10.131098 12.127834 12.274489 10.338825
## [1142]  9.935034 10.118799 12.644789  9.466196 14.503136 13.129897  9.116784
## [1149] 13.173578  8.679320  8.797406  7.080395 11.114686 11.205228  9.653117
## [1156] 10.462343  8.048181 10.051575 14.295527  9.011222  9.310522 12.305936
## [1163]  9.089136 12.480254 11.716881 10.816848  7.988446  4.430800 10.397799
## [1170]  7.981121 14.259958 10.774202 17.052591 14.377064 12.736525  9.607298
## [1177]  7.313817 10.982477 10.274669  6.962898 16.465238  8.495912 10.163736
## [1184] 11.737639  8.105231 11.305004 11.729708  9.033666  9.028661 14.169546
## [1191] 13.578443 11.548473  8.115636 13.649879 15.198551 12.305929 12.463680
## [1198] 11.050700 12.020454 11.761613 10.479501 11.006023  9.859491 11.890663
## [1205]  6.256860  9.938919 14.896243  8.729890 11.790605  7.271290  8.145477
## [1212]  8.184885 12.989213  7.601005  7.692358  9.242751 13.815717  7.394102
## [1219] 10.040692 13.724715  8.597953 13.755904  7.241449 11.165043 10.537976
## [1226]  9.415685  8.418410 10.715556  7.521319 19.523646 11.891615 13.007818
## [1233] 12.861599 12.092294  9.663604 13.034803  7.366548 11.744780 10.738548
## [1240] 11.092957  9.475884  9.438078  8.848168 10.222874  8.849660 14.387397
## [1247] 10.471771 16.020776 10.101410 13.032635 12.336426 10.710931 10.969858
## [1254] 10.685603 10.429901 11.147429  7.877203 14.254803  8.154458  8.908946
## [1261]  8.970196 16.608982 10.786432 12.632666 10.337658 12.545624 12.676670
## [1268]  9.639389 14.776066 10.699101  6.980018  9.128919 11.502881  7.867607
## [1275]  9.450785 18.463232 10.479947  8.580567 10.399916 12.380284  7.930016
## [1282]  9.588538  9.938294  8.591801  9.689474 11.344720 13.786783  9.911460
## [1289] 15.741161  6.862698  8.330270 10.879670 14.009279 11.170952  9.088256
## [1296] 12.051304 12.474792  8.600122 10.227852 15.018373  8.978916 10.112756
## [1303]  6.950609  9.549103  9.574692 12.700910  8.978872 13.299449  7.187813
## [1310] 11.750823 11.405369 10.078841 11.811251  7.860358  8.426543 10.938836
## [1317]  9.897006 11.828666 14.898795 10.241909  7.160488 11.987718 14.639070
## [1324]  9.609566  8.788680 12.324682  9.861819  9.969345 10.991176 14.189626
## [1331]  8.472412  7.562445  8.572377  9.459056 10.865841  7.451945  9.305710
## [1338] 10.716261  7.897164  7.332334 13.882658 13.755594 15.499068  8.512663
## [1345] 12.169411 12.480938 11.039390 10.667379  7.100934 10.901125  9.242377
## [1352] 12.552714 12.253084 12.153008  9.406442 11.365860  7.885297  7.179974
## [1359] 15.374578  9.390086 10.442874  8.050180 12.295437  9.471426 14.293094
## [1366] 13.486718  9.272926  7.192484 11.159611  9.426469 12.220521 13.485606
## [1373]  5.882360 14.595983 11.026188 13.133599 12.168002  8.537555  9.478297
## [1380] 15.273636 11.475911 11.292252  9.081596  8.326091  8.347737 12.095689
## [1387] 11.725689 17.448888 14.355276  6.552522  7.181361 10.218967  9.965978
```

```
## [1394]  8.907484 11.548675 10.061225 12.537290 13.800375  8.730847  9.794923
## [1401] 10.494622  9.652467 10.151876 11.108691  9.583390  9.083716  9.469965
## [1408]  8.420305 10.998071 13.186217 10.303378 22.723950 15.663375  8.376453
## [1415] 12.440435 10.085453 11.065732  9.745243 12.099509  9.629348  9.466721
## [1422] 10.685054  8.948042 12.046080 12.156494 12.753111  5.837070 12.129528
## [1429] 11.419856  8.900094  5.961288  8.575260 10.660321  8.593059 11.414764
## [1436] 10.295971 10.381813  6.353286 13.198335 11.918435  8.919986  8.845587
## [1443]  8.170603  8.240781 13.404262  9.231301  7.076763 10.733273  5.879489
## [1450] 14.312400 13.147550 12.472739  8.758843  9.478914 10.077727  7.680447
## [1457]  9.668207  9.334454  7.950409 16.059974 15.589426  7.073649 11.551595
## [1464]  3.857756 12.636362  8.010408 12.085254 10.692911 12.806615  8.320771
## [1471] 11.025263 11.672694  9.087734 10.024290 11.050452  9.839309 15.585189
## [1478]  8.918627 11.733125  9.294764 13.612073  9.080720  7.169799 12.860805
## [1485] 16.762518  7.365023 10.686166 14.766164 11.370056 10.810839 12.271628
## [1492] 11.595892  9.838373 14.216413  9.962875 10.530514 12.232213 11.024143
## [1499] 10.259211  9.053726 10.243351 11.189474 11.510953 13.894128 13.397618
## [1506]  6.317812 10.537853 15.945281 10.980374  8.414410 16.952512 13.967854
## [1513] 10.707706 12.519046  9.998555  7.994920  6.415960 13.875245  9.274875
## [1520]  7.620430 12.707414 11.221744 12.900632 14.236099 10.445370  8.494340
## [1527] 10.239200 12.478476 11.979027 10.072983  7.193011  8.876879 14.912388
## [1534] 13.671251  8.453962 10.704813 14.827447 15.171115 10.503041 10.342584
## [1541]  7.747293 10.163812  9.049073  9.578738 12.018296 10.560281 13.257180
## [1548] 12.997562  9.908417  9.749740  5.378551 16.407890  8.356411 11.105550
## [1555]  5.887971 10.195589 11.138264  9.179340 11.425029 11.433770 10.096357
## [1562] 11.069477 17.157613 10.143449  7.393527 14.441195  8.827401 10.181460
## [1569]  7.403498 10.213906 12.606794 12.178120 10.742751  7.116260 12.510585
## [1576] 12.445390  9.737101 12.988020 10.988354 11.528115  9.670506 13.095773
## [1583] 15.472828 10.194116  9.459816  7.053236 12.218599 10.383952 15.695975
## [1590] 12.534950 11.486405 11.977370 13.305155  7.401004  8.981194  9.611377
## [1597] 13.152905  9.065640  9.401029 13.475770 12.870416 11.468708 17.631510
## [1604] 12.572895 10.192058 12.351474  8.498704  9.797576 11.779681 10.444776
## [1611]  9.946680 11.671735 11.139196 13.653479  9.785544 14.958240 13.333609
## [1618] 18.059698  8.311479  9.814802  7.513741 12.503879  9.167107 14.299091
## [1625] 10.567390 10.278432  9.725377  8.996623  9.372081  7.337505  9.698315
## [1632] 13.110712 10.738027 13.037135  9.402857 10.755168 11.683373 10.617969
## [1639]  9.157550  5.992260  9.610688  9.133436 10.199707  8.777504 10.436015
## [1646]  8.496658  7.154620 10.659970 11.669483  9.419872 13.115803  9.379060
## [1653]  7.896340 10.484633 10.646775 11.683247 10.956077  7.853938 13.593568
## [1660] 16.456923  7.922775 17.820152 10.383399 10.625169  7.920262 12.123255
## [1667] 14.673633  5.802757  7.631630 10.754379 13.166582 16.996773  5.407414
## [1674]  7.685242  8.665673 11.774236  8.981112 12.870618 10.377999  9.841928
## [1681] 11.013541 12.587973 13.789058 14.126976 13.115418  8.925553 14.883928
## [1688]  7.643503  6.986673 14.173887  6.865890 11.217521  8.294301 12.038204
## [1695] 10.526412  9.703014 12.589486  8.082422 12.006412 10.336288  9.472094
## [1702]  9.981424  8.179176 11.280314 13.306240  8.434234  9.004218  6.684257
## [1709] 12.140399  6.530787  8.214989 11.449566  6.395871 11.663946 13.894864
## [1716]  9.664416  9.082805  8.755419 15.093279 17.731169 12.893956 14.106810
## [1723] 11.159777 13.763411 10.570693  7.951838 10.674801 12.592126  8.294284
## [1730] 10.637802  8.714576 11.886749  9.056317 11.229339 10.549438  8.090937
## [1737] 14.256721  8.358002 15.033512 10.178033 11.395191 11.385399  8.717047
## [1744] 11.912878 11.553358 10.388730  9.963931  8.302021 18.772185 11.479337
## [1751] 10.519083  5.569984  8.539034  8.148146  7.488157  7.061063 13.391689
## [1758] 15.929787  8.525392 12.598478 11.216230  8.701106 11.954277 16.261183
## [1765] 11.152679 12.532279 13.302148  9.482543  7.486177 14.175315 14.404425
```

```
## [1772]  9.497597 13.509159  8.136545 11.040373  8.708240 12.826629 10.718199
## [1779]  9.817567  9.842198 13.146057  7.207535 12.164147 13.668514 10.491252
## [1786]  9.007504 10.199140  8.080009 11.116429  6.368259 14.110238  7.158820
## [1793] 10.148692 11.615139  8.163242 11.752469  8.472366 12.806985  9.645217
## [1800]  9.005843 10.781018  8.116818  9.354978 12.009535 12.201082 13.291752
## [1807] 15.643225 10.071733 11.655414 11.708495  9.975188 10.294275 12.096098
## [1814] 10.880554 10.706523 11.935394  9.704901 16.599813 14.997113  7.355072
## [1821] 10.153126  9.401052 10.457909 14.485330  9.654697  8.068390  9.439456
## [1828]  9.690002  9.197746  9.976769 11.753628 10.592524 12.618137 15.279312
## [1835]  8.725713  7.332795  8.101841  9.845226 13.317149  9.070126 11.599331
## [1842] 10.423103 13.840890  9.733408  9.134253  9.956022  8.066601  7.418357
## [1849]  9.513545  9.051038  7.825842 11.288423 13.665781 10.682488  9.441590
## [1856]  6.366477 10.885258  8.782108  9.158929  8.083534  8.558209 12.103178
## [1863]  8.557487 12.572190 12.568927  6.409202  8.209963  7.801573  7.214925
## [1870]  8.725296 10.014968  9.412351  9.377988  7.028010 10.027258 12.078498
## [1877]  9.139682 10.333663 11.293209 11.836328 11.841271  9.797828 15.811312
## [1884]  8.393082  9.567376 12.628117 10.579657 10.128193 10.320093  7.691825
## [1891] 10.939535 13.453615 12.500590 11.386294 10.288768  6.939472  7.346843
## [1898]  8.209695 10.042555  9.765312 11.001953  9.324626 12.168864  9.432925
## [1905] 13.832541  6.257654  6.527732 14.106255 14.007355  7.310514  8.823562
## [1912] 10.138003 11.258126  8.064182 13.116632 12.591698 13.848301 10.504589
## [1919] 11.629152  9.960274 15.342524  7.878027 11.639428  9.723900 12.578063
## [1926]  9.299465 11.200598  9.648365 13.307400  8.866503  7.858227 11.971591
## [1933] 12.718400 10.244654 12.648528 14.251709 11.189834  7.831083 16.396811
## [1940]  8.966548  8.908984  8.963767  9.911111 11.151497 12.802469  9.484277
## [1947]  7.874814  8.493124  9.301159 10.006224 12.218688 11.757299 10.723458
## [1954]  9.952123 10.765165 10.035469 13.588393  8.495562 12.180196 13.708301
## [1961] 13.748044  8.734654 10.974277 12.596630 11.870590  8.396934 12.303949
## [1968]  5.888897 12.159420  6.980130 11.026459  9.331997  8.944130 14.262422
## [1975]  9.241878 11.355208 10.988945 10.716753 12.626123  9.920431 10.145095
## [1982] 10.876473  7.288011 14.082602  6.802944 12.064478  9.143183 12.226768
## [1989]  8.619689 13.314033 11.338222 10.875198  6.919346  9.995563 18.655641
## [1996]  9.836019 11.955740 11.036034 12.060594  9.916327 13.722989  8.074130
## [2003]  9.514574 13.859992  8.416266 10.073803  7.126215 15.198907  9.482598
## [2010] 10.559705  6.809377  7.795463  8.195707 11.941393  9.316304 10.912817
## [2017] 11.760830  8.678711  8.683973 12.378455  9.672041 12.293552 10.510774
## [2024] 11.484707 11.932175  9.841764 11.284146  7.473216 10.633014  7.391712
## [2031]  8.960430 10.675443  8.443162 11.289019 11.120911 10.752560 11.686032
## [2038]  8.933130  9.669406  7.053342 16.484707 10.332508  9.347588 10.342673
## [2045] 10.384716 11.717435  9.200649 10.106918  7.000238 13.652718  7.338179
## [2052] 14.803375 11.075792  8.531274  9.127080 15.165754  9.115273  9.533333
## [2059] 13.160781 16.346976 11.914118 10.275325 11.085795  9.430584 11.145890
## [2066] 12.510259  7.418381  9.100778 10.938154  8.714726  7.420631 12.499705
## [2073] 13.512730 10.230691 12.288635 12.879653 13.583903  9.090741 10.211658
## [2080] 12.323214  9.532929 11.293390  9.821094  6.984532  8.187336 12.962996
## [2087] 10.703010  8.939153  9.900786 10.161240 12.269102  8.060473 11.647196
## [2094] 18.201591  4.070772 11.076415 13.580312 10.745765 10.889451 15.411817
## [2101] 14.764864  6.242315  9.411063 14.696076 12.934909  6.839361 12.245894
## [2108] 11.294904 12.637027 10.652609  8.025906 12.699972  9.070559 10.898243
## [2115]  8.029126  7.963451  9.660064  8.873188  9.435599 16.197215 11.134033
## [2122]  9.863715 11.936003 10.772955 11.182187 12.534131  9.897377 12.429279
## [2129] 12.356498  8.496934  6.646442  9.066342 10.222733  9.625995 11.648290
## [2136]  8.658414  9.556825 10.682366 14.194709 13.123626 10.806689 12.214926
## [2143] 10.924804 10.823881  7.397139 14.031312 18.002279 14.830627  8.617296
```

```
## [2150]  7.660780  8.432184 12.537270  9.554288  9.894463 13.437674 11.058829
## [2157] 10.105936  9.470712  7.536759 11.901500 10.696639 14.228192  8.887628
## [2164] 10.706451 10.242419  8.543942  8.427219  6.572737 12.643188  4.504233
## [2171]  9.137862 11.460834  9.718101  9.282754 12.160136 10.775313 11.270262
## [2178]  9.778787  8.281603  9.579462  8.862785 14.313191 12.080102  6.819093
## [2185] 11.350360  8.961044 11.806955 10.470708 11.167784  8.835242  6.246779
## [2192] 12.250616 10.998754 11.756419 10.767055  9.329565 11.778453 14.424798
## [2199] 13.045775  6.692752  9.289720 13.673103 17.836836  8.372396 19.021171
## [2206]  9.921765 12.300708  9.556008  9.879556 10.419050  8.809875 13.547761
## [2213] 13.367856  9.789724  7.798181 10.839073  7.079070 12.176565  7.207062
## [2220] 11.638221 12.540399 17.078068 12.648472 11.388018  9.176540 14.296294
## [2227] 12.693493  7.852167 14.701279  9.286062  8.968963 12.897128 11.410803
## [2234]  9.384166 10.535431 12.761274 11.552047 13.168844  9.224589 12.849230
## [2241]  9.847756 12.884670 12.359922  9.496557 13.479729  7.105932 13.641151
## [2248] 12.159843  6.101691 11.655373 12.647931  7.820048  7.674838  9.969128
## [2255] 10.307920 11.304696 10.941993 10.934158 11.656541 10.382233  8.996472
## [2262] 14.819859 14.682581  9.751411  7.669925 12.165329 12.484232 12.476047
## [2269]  7.789364 10.091903 11.610399  7.399685 11.933307  8.675366  7.362747
## [2276] 11.278275  7.538111 12.011358  8.054799  9.010905  8.735559  7.559093
## [2283]  6.823652 12.999139 11.237751  9.258690  8.406203 12.866146 10.619407
## [2290] 13.728567  7.615946 13.629347 13.190819 13.380569 13.534844 12.403112
## [2297] 11.455115  9.157149 12.727267 11.001001  9.462405  6.489789 13.571559
## [2304] 11.420826  9.989797  6.845977 13.193667 11.498533 13.920302  8.415621
## [2311] 11.961283  7.665181  7.248328  7.678077 14.422099  6.683284 10.144626
## [2318]  8.895607 12.803630  9.727408  9.934649 11.341854 11.675678  7.008860
## [2325] 13.087696 11.749543  8.820612 12.985164  9.593513  9.681621 11.779030
## [2332] 11.376978  9.686963 13.380868 12.301841  9.002741 11.157824  8.633967
## [2339]  8.068562  9.609064 12.167004  6.493785 14.348235 14.104860 13.721876
## [2346] 10.166556 10.915698 11.258617 14.748568 11.534037 11.350095  8.490266
## [2353] 12.159755  9.114404 12.584738 15.578081  9.514069 13.579851 13.159790
## [2360]  9.458439 10.232913  7.870353 10.111034  8.414553 10.041668 11.102036
## [2367]  7.510753 13.316014  8.100868 14.210663  8.243743  7.869917  8.727026
## [2374]  9.066655 12.795862 10.282731  9.643410 10.931442  9.552339  9.594972
## [2381] 12.123664 13.582439  8.607750 12.045461  9.201518 12.331767  7.500525
## [2388]  6.741464 12.499538  9.214922  9.328886 10.946506 14.155019 11.920771
## [2395]  7.614239 14.732716  8.809722  9.488374  7.917102 10.661424 11.984950
## [2402] 14.084271 10.433602 12.275410  8.649171 13.659211 13.205455  4.583370
## [2409] 10.090418 13.500051  9.808804 13.100449 13.138856 10.819828 11.961908
## [2416] 10.361574  8.445835 10.830226 13.440667  4.697747  7.128051 12.152122
## [2423]  7.648269  8.480134  8.149345  8.337714 12.183008 10.329527 11.977117
## [2430] 14.710873  9.237076 11.300516  9.759157 10.776281  8.775237 10.655596
## [2437]  8.478412 12.071462  6.923819 12.223161  8.722093 10.054430  8.906504
## [2444]  9.256530 12.980824  7.733197 11.731494  9.920920 12.364348  8.810207
## [2451] 14.382640 12.723462 11.993764  8.178963 12.798936 11.985669 16.066751
## [2458]  6.143246  7.791434 14.157761  8.460550  9.696750 10.818802 15.170275
## [2465]  8.947051 13.460914  8.838299 11.032750 10.991225  9.958276 11.634809
## [2472] 10.694118 12.446124  8.306056  8.665868  8.670024 11.279370 12.062974
## [2479]  9.865810 11.880760 11.583898 11.960347  9.103142 12.508864  9.380639
## [2486] 13.488510  7.952568  8.294127 10.253459 11.898175  9.257184  8.638123
## [2493] 13.161682 11.376956 10.710158  9.567277  9.915815 12.350900 12.858785
## [2500] 12.348607  8.503870 12.800985  9.119969  8.367700 11.967904  8.420531
## [2507] 12.740176 11.402840  8.081871 12.959512 12.982443  8.220979  7.637162
## [2514]  8.738179 11.436596 10.410718 11.672141 12.105480 10.059218  8.434300
## [2521] 12.530922  4.619072 12.144167 11.513038  5.860755 13.430301 13.105819
```

```
## [2528] 13.220410  8.330411  9.229215  8.063958 18.497981 15.257800 11.746036
## [2535] 12.380742 11.356633  7.422035 15.070257 13.746025 10.257149 22.574970
## [2542]  7.767573 10.304955  9.660507 10.961947  6.350645 12.098024  9.072979
## [2549]  7.300077  6.950813 13.170676 15.023659  8.020218 12.036732  7.478210
## [2556]  9.787398 10.217304  9.524523 14.703372  8.933407  9.279775 14.718697
## [2563]  7.219714 16.298714  9.536579 11.460124  6.901346 15.681434 10.562275
## [2570] 13.232803  9.378588 11.900831 11.493116 12.206233 13.157864 19.051822
## [2577] 13.091273  9.174209 13.009522 11.384523  6.897227  8.048360 10.633004
## [2584] 15.910989 11.822142  8.109643 10.032963 10.882388  9.114815 11.240018
## [2591]  9.248762  9.740382 13.400387  9.023893 11.536691 14.153667 13.615459
## [2598] 11.878643 13.146340 11.098378  8.575643  9.579950 19.541715 11.428617
## [2605] 11.874698  9.617088  9.603901  8.599416  7.382982  9.382697 10.638159
## [2612] 16.029439 10.097627 10.804291 13.210713 12.607993 13.182763 10.469243
## [2619]  7.382302 12.276248 10.413973  9.294149 11.636271  9.559369  9.832623
## [2626]  7.312931 15.744128 15.532820  8.557420 10.581175 11.049427 10.768014
## [2633]  9.172148 13.179642 12.696404  9.017008 10.407649 14.050569 13.430132
## [2640]  8.667008  9.547660 12.214732 10.063573 13.994831 11.862898  8.415462
## [2647]  8.498179  8.560040 15.200986  8.441217 10.434538 10.365097  5.613602
## [2654] 11.990953 11.409808 11.637844  8.066194 14.348248 10.237995 10.862864
## [2661]  8.981808 10.787436  8.438162 13.955976  7.691665  6.930961 10.159734
## [2668]  9.769946 10.423631 12.734653  9.793510  8.578828  9.279575  7.330654
## [2675]  9.711875 12.940431 12.562927 15.777879 12.856471 13.880419 14.128996
## [2682]  9.974972  9.224490 10.217967 10.000036 13.469500 15.430860 13.948749
## [2689]  9.909134  9.692035  7.731179 12.995129  7.567866 10.700471  8.852900
## [2696]  9.834979 10.052844  8.387683  9.688327  8.887985 13.799218 10.601334
## [2703] 12.226029  8.280286  8.656800  7.944691  9.183992 12.902394  7.223050
## [2710] 10.337644  7.420871 12.370249  9.673911 15.880873  5.642213 10.098448
## [2717]  9.281946  9.379042  7.714222 11.621696 12.630256 12.089356  8.856408
## [2724] 14.277837 14.953560 10.300477  8.378518 15.111312  9.107351 13.642201
## [2731]  8.493432  9.460028  8.958728  8.041758  7.066196  9.093515  8.969296
## [2738] 12.193632  9.709820 12.295367 10.007929  9.859816 11.047361  8.747822
## [2745] 10.507795  9.171342 10.290720 11.567222 10.518321 10.932497 12.822982
## [2752] 10.458070 10.821019 10.753968 14.730454  8.916781  9.409089  7.594278
## [2759]  9.065302 11.584691  7.808253  8.112161  8.038693 10.458877 10.335612
## [2766]  8.831423  7.015938 10.955895  7.981334 13.871801 10.641508 13.379517
## [2773] 14.448073 11.741022  4.673266  7.860771  7.112193 10.388326  9.080122
## [2780] 11.818928  7.725170  8.341982 10.562613  8.988661 12.581874  8.888772
## [2787]  5.342005  9.995485 14.077871 11.793495  8.535884  7.905128 13.305259
## [2794]  9.361735 10.309536 10.640313 10.563515 11.278159  8.463171 13.409881
## [2801] 12.323896  9.509655  9.297894 12.019780 12.547266 11.206122 13.464477
## [2808] 11.909873  9.919396  8.620497 15.274555  9.306065  8.756488 11.767630
## [2815]  8.890164 10.866202  8.546284  8.581657 10.550791 11.193039  9.304807
## [2822] 14.107491 13.640944 14.005386  7.844383 12.068040 11.687762 13.306835
## [2829]  9.569327 11.529048 12.043581 11.354942  8.261017  8.822635  9.488244
## [2836] 11.010539  8.294556 10.342977 10.089055  9.385816 12.632755  7.197947
## [2843] 11.058388 10.880456 12.222492  9.136837 10.134805  8.621533 13.057997
## [2850] 12.093868 11.272251  8.952739  8.688252  8.078077  7.514077  9.355468
## [2857]  8.241200 10.187031 15.734817  9.582320  9.536611 10.398095 12.238227
## [2864] 12.979454  8.637339  6.922057  7.893234 10.098070 12.557647 10.457129
## [2871]  9.106513 16.561154 11.457438 10.538992 15.632025 13.174364  9.580270
## [2878]  8.442936 10.594597  7.821410  6.962636 10.531957 13.078413 12.807995
## [2885]  9.000111 14.806898 13.942479 15.001927  8.160757 11.289875  7.146497
## [2892] 11.249922  7.964927 10.262608 16.191634  9.637173 10.678756 11.619507
## [2899] 11.917065  9.618864  9.650306  8.512077 12.779603 12.305046  6.656498
```

```
## [2906]  8.882992 11.428570 11.038171 13.904710 11.033315 10.317545  8.285421
## [2913] 10.090546  7.255762 12.145834  9.940823 13.553635 13.292216 14.111636
## [2920] 13.188087  8.595008 12.882031  8.224123 12.620597 11.714113 12.581153
## [2927]  7.896026  7.927310  7.529341 14.676962  9.918428 13.135034 14.133571
## [2934] 11.737149  7.777803 12.964612 12.637852 13.366198 12.346509 14.674167
## [2941]  5.624686 10.893295  9.239176 14.178049  8.564519 14.758833  9.537615
## [2948] 13.272560  7.889022 12.745862  8.294296  7.153752  9.033638  7.662690
## [2955] 10.007332 12.789093 10.914482  6.680402 12.327243  7.540500 11.942687
## [2962]  6.685463  9.660580  5.503885  9.174327 12.483938  9.727014  9.115078
## [2969] 13.224529 10.462309  6.114090 15.585625 11.709240 14.792970 14.787956
## [2976] 10.576707 11.439387  9.065621 13.613730 11.105614  7.443693  9.919065
## [2983] 12.323154 11.551943  8.334352 17.529844  9.265847  9.069823 14.706086
## [2990] 10.183914 15.237447 13.527895 14.436547 12.068654  6.334645 15.122852
## [2997] 13.210454  9.225156  7.050483 11.387802  6.336300  8.911521  9.379387
## [3004] 11.843987 12.782754 10.188287 11.039049  8.675990 10.214777  8.503538
## [3011] 17.165374  6.669303 10.271480 12.013997 10.394897  9.540349  7.104355
## [3018] 11.742628  9.562328 10.899124 15.190152  6.139214  8.551428 10.926993
## [3025] 10.464599  9.485614 12.791369  8.591186 12.945270 11.641162  9.493869
## [3032] 11.565588 10.345179  9.080886 12.493400  9.894459  7.026424  7.473561
## [3039]  9.382562  5.557411 11.079011 11.085446 16.717693  7.946425  9.623637
## [3046]  8.783293  9.351999 11.276166 13.412801  8.472577 11.066313  9.516885
## [3053] 10.145676 10.580658 11.395501  7.011837 12.133098 10.298201 12.671492
## [3060] 12.043086  8.978993 10.926300 10.527059  9.725241 12.904128  7.249989
## [3067] 10.541077  8.698614  8.546628 10.294760 13.656221 12.027822 10.491192
## [3074]  8.083550 13.256633 12.674943  5.603618  8.375283  9.798074 11.785056
## [3081]  8.817789  9.595346 11.805186 12.189799 10.384809  8.549883 11.553422
## [3088] 11.719701 10.809600  6.767630  7.669299  7.658857 12.176913  8.192042
## [3095] 11.389505 11.997288 10.548143 13.958382  9.241528 10.374006 11.428996
## [3102]  9.440012 16.094312  7.568447 10.110012  9.879876  8.147107 12.327232
## [3109] 10.117925  9.520666  9.167644  6.293113  9.671272  8.234715 14.296468
## [3116]  8.700648 10.451556  7.526457  6.883225 13.305105 11.367776  9.952941
## [3123] 12.764632  8.908599  9.766505  9.374057  9.489364 10.145562 12.283361
## [3130] 11.419649 12.126200 11.207077 12.173549 13.307844 10.938945 11.955873
## [3137]  9.804736 13.441124 15.400312  7.120360 11.201096  8.310838 13.022788
## [3144] 13.188215  8.874315 13.031902  8.319645  9.273628 12.736013  7.903641
## [3151]  8.614793 12.386635 11.439970  9.779655  9.731249  9.480712 12.214861
## [3158]  8.086106  9.683681  6.827282  8.162230 15.541438 15.372961  9.684520
## [3165]  8.147432 13.897694 11.576829 12.327300  8.934764 10.760145  9.445552
## [3172]  7.060491 13.010846  6.023740  8.806224 11.068677  7.478639 11.059711
## [3179]  7.660522 10.065036  7.225976  7.117431 12.343518 11.133484  9.847975
## [3186]  7.022098 11.015054  9.956005 11.287470 17.811921 10.983481 10.425538
## [3193] 14.523000 10.502360 10.230386 10.117359 14.337810  8.603357  5.582791
## [3200] 13.137605  7.943427 12.033812  8.352782 10.477802  7.592642  8.916326
## [3207] 12.316240 13.458819 12.885616  8.661678  8.850993  9.336905  5.510585
## [3214]  7.227749  9.243110 10.905460  9.246384  9.277704  9.316124 12.565614
## [3221] 10.956694 12.203503 10.064839 11.662518  8.093898  9.830235 11.317744
## [3228]  9.793751 16.896407 11.754719 10.546419  6.309633 10.141860 16.135668
## [3235]  9.589219 10.701299 10.994692  8.610120  9.404488 13.463650 10.719501
## [3242] 11.165219 11.849065 10.126585 10.003891  7.639294  6.489793 12.116406
## [3249] 12.689731  9.872036  8.222639 14.141392 11.670889  8.097936  7.821768
## [3256]  8.117312 11.019658 11.499499 10.056702  8.433979  8.982604  8.556306
## [3263] 11.222858  7.510857 10.250168 16.095841  6.060351 10.101504  9.680109
## [3270] 10.636563 10.552617 16.951538 10.838007  7.893296  6.195216 11.006235
## [3277] 10.290440  8.252480 12.137262 10.548253 11.935665  7.276830 14.625980
```

```
## [3284]  8.978205  6.999596 12.293248 11.751051 11.247995 14.921052 14.177648
## [3291]  8.887025  7.130974 11.653133 10.173163  9.876794  7.518880  9.489707
## [3298] 12.001060  8.564142 12.529734 11.096792 13.594708  6.738027 20.266083
## [3305]  9.998401 10.464190  7.482546  9.174140  8.356668  5.668299 14.866579
## [3312]  8.033072  8.861161 12.187853 11.504704 13.026876  6.510346 10.508845
## [3319]  6.435069  8.897148  7.433092 11.077356  8.894201  9.124931  9.705339
## [3326] 12.455613 15.426510 15.751125  6.730110 10.164336  9.994490 12.936657
## [3333] 16.750189 10.004890  6.089560 11.614503 11.301591 11.925353 14.478863
## [3340] 15.975600 10.201857  6.032154 18.499739 11.125374  9.595021 10.800131
## [3347]  9.899275  9.659411  7.926871 12.175878 11.678000 12.810168  9.991291
## [3354]  9.580632  7.692207  9.432147  9.218195 13.365898 10.397997 14.215437
## [3361]  8.800438 12.482487  9.271434 10.695496  6.812122 12.006453 10.791826
## [3368] 12.157655 14.880344 11.728403  8.159532  8.786144 15.451820  9.535599
## [3375] 12.860474  7.639193  8.235265 14.442307  9.715239  8.790108 15.053331
## [3382] 10.763617 11.824240 11.045123 10.511484 11.181394  8.274810  8.548999
## [3389]  6.574453  9.502663  6.734276 12.153474 13.205208 10.900043  8.808130
## [3396] 12.460542 17.056263 12.248125 12.826729  9.777275 18.016148  6.801696
## [3403] 14.003431 14.975523  7.932625 14.184018 12.479558  9.412353 10.986552
## [3410] 14.893175 15.544174  5.213120 11.136275 12.326206 11.576905 10.794270
## [3417] 14.007830  7.355051 11.142342 13.857370  9.517224  7.918462  8.570075
## [3424] 10.430613 12.179056  7.432747 10.079999 11.095797 14.004739 10.988018
## [3431] 11.392818 12.108933  7.248191  6.277013  9.540670 13.822267  7.964198
## [3438] 10.345567  9.082370  9.508702  9.996948 10.505478  9.152701 13.784841
## [3445] 15.253943  8.468858  7.137691  8.054535 13.014965 10.846023 11.667955
## [3452]  9.175724 11.429902  7.342372  7.161479 11.458576  8.127322 10.444055
## [3459] 10.355416  5.576123  9.385981 11.708595  8.188313 17.147835 14.459288
## [3466]  6.811319  7.954561 12.287571 10.470066 13.760984 11.756997 12.702530
## [3473] 12.708371  9.287276  8.335984  8.472973 11.598774 12.880907  6.586010
## [3480] 10.877104  9.348532  9.548086  8.334696 10.782293 10.328635 14.498834
## [3487]  8.473925 14.833177 13.145703 12.982474  9.445721  7.337038 10.865314
## [3494]  8.083217 12.030292 12.413195  6.435050 12.881419 14.313403  8.382900
## [3501] 11.090820 11.236309  4.450408 11.359497  9.267612  8.663558 10.126591
## [3508] 10.609283  9.533805  8.299866 10.761427  8.504950  7.218226  9.898654
## [3515]  6.673566 12.005086 12.456430  9.803477 14.663100 11.200255 10.429306
## [3522]  8.117213 10.781791 11.235353 12.980893 16.190437 12.204628  9.763814
## [3529] 11.213297  9.484291 11.212037 10.249652 11.919119  9.950867 10.244998
## [3536] 12.793131  9.378409  9.914459 10.550548 10.548266 17.786333 14.370989
## [3543] 14.481239  9.598239 10.112722  9.607932 11.798901 10.928080 14.633057
## [3550]  7.647505 10.087937  9.479638 12.233503 14.170656  9.134582 12.833305
## [3557]  8.126499  7.822789  9.442480 11.061816 10.750332  8.099499 14.822481
## [3564] 11.957444  8.854968 11.864823  8.780521 10.782691 10.953648 16.546916
## [3571] 10.007166 15.112505 10.021210 12.059848  9.608032 11.661340  8.758800
## [3578]  9.101544 14.004875  8.613877  8.541785 13.479987  8.701326  5.465488
## [3585]  7.672604 11.277091 10.609177 11.423480  9.942949 13.535088  9.585119
## [3592]  9.073070 10.755581  9.698077 12.425709 11.261901 11.614068  8.264444
## [3599]  9.854412  8.229175  9.682961  9.541191  9.715939 13.662690 10.440108
## [3606] 13.613594 10.423366 12.702860 11.657939  7.940210 11.729346  8.849526
## [3613] 10.814346 11.754961  9.890803 11.774567  6.233913  4.806355 10.535133
## [3620] 10.408358  9.953088  8.729696 10.925203  5.779305 12.541975  9.716944
## [3627]  8.701762  8.040222 12.270137 11.116864  7.295793 10.253072  7.828609
## [3634] 11.623578 10.454145 11.279985  4.970322  9.467175 10.414472 15.337722
## [3641] 10.865863 12.479836 13.949952  9.837705 11.282350  9.816813 13.431351
## [3648] 10.566500 11.914281 11.016561 10.565421  9.827721 12.778571 12.724281
## [3655] 15.253276 18.121991 10.421377 12.299457  7.070590 12.294763 15.558827
```

```
## [3662] 14.976059  7.142453 11.555890 11.975800 10.349264  8.898993 10.677696
## [3669] 14.575953  9.285173 11.335622 12.587615  8.976649  8.364489 10.249887
## [3676] 12.374667  6.927766 12.890296  8.967122  7.453119 16.281394 11.188606
## [3683] 11.980307  9.203065  9.373480  9.197972 10.840673  7.400025 14.604204
## [3690] 12.724735  7.219534  8.862771 14.095270  9.957259  6.123868  8.368467
## [3697] 11.732666 13.465338 11.606928  9.347992 13.307505  9.505739  8.006487
## [3704]  7.783378 12.668587  8.809021 15.975087 11.101336  7.171253  7.652823
## [3711]  9.969972  9.845356  9.989689 11.112222  9.356995  9.634928  7.921198
## [3718] 10.845552 11.924785  9.761320  8.097677 10.795048 13.609126  8.751040
## [3725] 10.049526 11.362306  7.284220 10.407388  8.646703 12.746929 10.917806
## [3732] 12.837248  9.590604 10.154242 10.799180  7.139534  9.178783  7.996445
## [3739] 10.137564  9.505648  6.899655 16.274382  9.592008 11.202053  8.900382
## [3746]  8.362978  8.902684 10.198357 13.089253  9.098672  6.917069  9.584799
## [3753]  9.747091 11.287664 11.840290  8.350654  9.014170  9.575123  9.417783
## [3760] 16.211759  9.177580 11.648034  6.951088 11.923446 12.031942  6.231392
## [3767] 11.823120 17.048457 11.026100 12.492715 13.566060  9.219569  9.546212
## [3774] 10.449942  6.465109  6.805907  6.061568 11.896840  8.991471 11.807887
## [3781]  9.819283 12.096305 16.576437 14.538565  8.206446 13.511664  8.111810
## [3788] 10.242659  6.649682  8.702616 10.447499 12.568319 13.184084 14.396605
## [3795] 11.829648 13.238014 13.166543 13.301040 10.657154 12.592055 13.147271
## [3802]  8.976763  8.866237 13.262774 11.359193  7.413775 15.372517 11.395215
## [3809] 14.897641  8.705920  8.941608  8.296859  6.884338  9.847459  8.757212
## [3816]  9.466930 15.561226 11.873468 10.213561 12.122366  8.824333 11.686396
## [3823]  8.744211  7.776163 13.013373  4.959439 12.261611  7.064971  9.092410
## [3830]  8.990427  6.712139 15.360905 13.004330  7.435094 11.681164 10.696216
## [3837]  9.168452 12.746228 13.698497  6.520712 10.661476  9.044596  9.491882
## [3844]  9.465908 10.114026 10.623440 11.547166  9.631695  7.751993  6.372562
## [3851] 12.463605  9.903392 13.956472  7.379018  9.361146  8.162597 12.226352
## [3858]  9.104364 13.981338 11.602782 12.766374 16.343032 14.022402  8.498435
## [3865]  7.812775  9.716905 13.383499  9.958701 10.942240 11.647366 13.668144
## [3872]  9.979813 10.118666 11.410282 10.146288 11.093010  7.806375  8.826562
## [3879]  8.846966 12.004999  7.549297  8.798307 13.955400 12.622836  6.697840
## [3886] 11.653156 11.644206 10.250750  8.290485  9.608607  8.958045 10.756766
## [3893]  7.128673  9.725002 19.545780  5.692027 11.672612 10.536649  8.036710
## [3900] 11.419813  8.043783 10.761191 11.692847  7.926354 12.684355 10.560222
## [3907]  9.420444 12.354056 11.247985 10.781773 13.459135  9.513057  9.600490
## [3914] 12.583033 12.154273 11.926492 12.240126  8.822623  9.367846 15.074495
## [3921] 16.628526  8.735175 15.388450  9.102588  8.806519 10.756260  8.880785
## [3928]  9.573457 11.380758  8.950659 11.016499  9.499703  8.215852 14.149033
## [3935] 10.884811 12.150366 12.995499  8.803707 10.522404  8.788386 10.081915
## [3942]  8.766613  7.269707 11.965355  9.149171 11.407952 12.201902 12.213872
## [3949] 10.772259 15.822573 14.821728  7.064117 14.702968  9.876074 11.861901
## [3956]  6.315978 10.721087  9.900158  5.843884 11.840957 11.098361 14.792213
## [3963]  8.418415  9.315918 11.254503  7.138484 12.821289  7.618286  8.031690
## [3970]  6.915084 11.279863 10.052853  6.914537  7.910256 11.481819  6.447266
## [3977]  8.754299 10.189708 11.651809 13.278203 13.320471 13.588417  9.524690
## [3984] 10.463230 12.827402 11.044349 11.517075 10.548531 12.548104  8.878019
## [3991]  6.408912 10.451401 10.226736  9.757724 10.464965 11.222845 10.216280
## [3998] 10.772127 12.300289 12.095307 11.080116 14.769950  9.578753 11.318167
## [4005]  9.865795  7.751061 12.731587  8.816620  7.566981  9.590608 10.642573
## [4012] 12.267278 12.937017 11.521094  7.831246 10.706829  7.390738  9.424182
## [4019] 14.602919 13.435444  9.377085  7.434911 13.469971 14.061939 12.371334
## [4026] 10.421029  8.132883  8.773199 12.701398  8.129886 17.394669  9.112228
## [4033]  7.597834 11.141067 10.616222 12.295164 17.453425 11.764148 12.387468
```

```
## [4040]  4.988397  8.879464  7.434840 11.915357 16.519533 12.236747 12.032737
## [4047] 10.850542  9.251105 10.831718  7.887976  9.737555 11.871886  8.665695
## [4054] 11.773994 10.608040 10.284449 14.679598 10.247871 11.737918  7.905972
## [4061] 14.114784 10.028566  9.232489  6.046076  7.638970 10.873816 10.603846
## [4068] 12.225013 11.122921 11.243267  6.679127  9.748864 12.027850 13.261916
## [4075] 11.874341 15.468377  9.902782 10.205432 13.258747 14.457176 13.502060
## [4082]  7.877862  7.548432 12.182209  9.217489 12.067130 14.056277 11.857844
## [4089]  9.876285  9.128238 11.171493 11.559172  9.567698  9.336250  6.561006
## [4096] 11.880303  8.089170 13.167394 11.886009  8.078467 11.247252  6.612028
## [4103]  9.429109  9.214623  9.608440  8.504498  9.106021 12.246365  9.170614
## [4110] 10.738622 18.910461 12.214962 12.730880  8.545697 13.785632 16.354647
## [4117]  6.315276  7.539763 10.966989 10.011660 11.030493  9.529653 10.700101
## [4124] 13.645455  8.787374 13.944705 13.099723 11.238032 10.448500 14.113627
## [4131] 12.132015 13.195555 14.213718 12.694916  9.774569  7.360972 12.666697
## [4138] 12.052064 13.535291 15.350250  8.727222 11.881795 10.045974  7.459314
## [4145]  9.011590  5.779046 10.917002 14.849352  9.067081 11.218122 11.522466
## [4152]  8.157843  8.051491 13.109872  9.736892  7.218452 13.751385  9.842998
## [4159]  9.332254  7.934259  8.213273 13.615379 12.617652 11.263264 13.158614
## [4166]  9.977094  9.645900 14.517087  9.302993  9.624200 10.954128 12.923451
## [4173] 10.203800 18.198323 10.731182  7.977010  8.042906  9.591597  6.984870
## [4180]  6.803374 13.065795  7.613596  7.905861  7.613995 12.138836 12.154691
## [4187]  9.213627 11.807369  6.876538 13.343279  9.159371 12.286495  7.009642
## [4194] 13.214021 13.048290 13.080505 10.321894 10.269973 11.505283 11.554578
## [4201] 12.317775 12.290028 10.308411 11.445252  7.776936  9.845707 10.040224
## [4208]  8.992706  8.331294 11.958636  9.607456 10.110597 16.327963  7.853726
## [4215]  9.223009 12.103433 12.967576  8.884703  8.713371 13.893755 11.175887
## [4222]  8.308423 12.989281  9.123032 16.082890  8.395602  8.945686 10.370922
## [4229] 11.235475  9.120687 16.483201 11.377023 11.542328  9.230117 12.884055
## [4236] 10.542124  9.194880  8.585424 14.877735  5.960279  7.968088 11.501215
## [4243] 10.381555 12.027025 12.900152  8.049952 15.043867 12.568162  6.459531
## [4250]  8.936577 11.241187  7.545836  9.211692 11.502872 18.082979  7.989051
## [4257] 15.778175 12.081611 10.286572 11.550403  8.778110 11.256308  8.471869
## [4264] 13.314581 16.046478 15.536765 12.360460 10.734869 12.075167  8.778423
## [4271]  7.371613 10.222865 13.448465 11.670283 12.343378 11.055222 11.680995
## [4278]  8.286120 12.580697  9.802111 13.051626  6.450173  8.416396 11.342685
## [4285]  8.192527 14.151943  8.058470 10.929267  9.878436 10.688606  8.952551
## [4292] 10.764320 14.276487 10.151424 16.032494  8.435059 11.089848  9.479806
## [4299]  8.367499 11.643898 11.875700 10.667587 10.300823  9.980379 12.003428
## [4306] 14.814879  8.323485 10.650487 11.569441  8.985545 10.168699  8.566000
## [4313] 11.300590  9.027926 14.163434 10.302747  9.295512  9.368237 10.253816
## [4320] 14.180282  7.218777  7.826393 14.917330 13.869976  8.329230  9.007827
## [4327]  8.239127 10.770723  9.288402  9.675918  7.901970 10.088400 15.431975
## [4334] 11.467152  9.158841 15.204295 11.910504  5.828488  6.782328  8.566923
## [4341]  9.430144 10.213735 10.156124  6.280122  9.656747  7.114157 11.806102
## [4348] 13.503812  9.278542 10.359060 12.569746 13.501710  8.137185  8.215620
## [4355]  9.867256 11.317914 10.488866 12.027170 14.034363 11.817128 10.496680
## [4362]  7.624469 11.422032 14.953727  8.893906 11.975897  9.927397 10.783761
## [4369] 12.058907 10.501933  9.431658  5.377392  9.222999  9.669345 10.462435
## [4376]  7.653513 11.400712  9.044996  9.880458 10.848518 14.738206 12.321261
## [4383]  9.008330 14.700950  7.708166 11.306558  9.736238 11.351158 10.837487
## [4390]  9.997299  8.334310 13.378418  9.949712  7.703636  8.971193 10.953986
## [4397] 10.097088  7.846157  8.342068  9.055855 10.730195 13.228928 11.437671
## [4404]  8.050352 11.210049 10.802097 11.457215  8.488409  6.611689  9.141725
## [4411]  7.638712  9.332914  8.108495  9.871103 10.956412 11.848879  9.772582
```

```
## [4418] 12.393761 10.654032 12.644275  9.220302 12.772825 12.904281  8.223348
## [4425]  8.363003 11.444644  8.335724  8.952485 10.882886 11.997234  9.658170
## [4432]  8.491715 13.140949 11.208265  6.847331 14.138494 10.943674 10.594920
## [4439] 10.702400 14.248420  8.822690  7.910655  8.022107  8.177116 12.397366
## [4446]  9.192948  7.952871  9.752243 16.259771  7.344390  7.600479  7.246092
## [4453] 10.103522  8.851752 11.991468  7.316087  7.255486 13.546069 15.269636
## [4460]  9.963220  7.299829  8.082057 12.973018 13.824299  9.951957 15.770105
## [4467] 14.017351 11.785438  8.493022  9.653602 10.557838  8.274499  8.933059
## [4474]  9.644569 12.172248  9.177032  8.229586  7.476680  7.737854  9.950806
## [4481]  7.727341 15.181676 12.818838 13.620142 10.686707 13.548383 11.610797
## [4488] 11.395584  8.434122 13.314795  8.441403  7.809613  6.779958  7.607545
## [4495] 13.469381  8.662308 12.987644  9.013735  8.099133  8.529161 12.780426
## [4502] 13.181086 13.551714 11.790715 12.408443  9.595197  8.920446  8.878920
## [4509] 14.804006 10.045688  9.630256  5.168561 14.126109 11.283728 14.080659
## [4516] 11.574102 16.548755  6.005396 12.469366 13.767210 12.250244 10.821070
## [4523]  8.454533  7.582003 10.075986 10.729373  8.889081  7.499653  8.753111
## [4530]  8.388443 10.266745  9.541965 16.159600 15.986113 12.473577 14.964670
## [4537]  7.596084 13.900294 15.663635  6.368274  8.367206 10.322085 10.804474
## [4544] 10.060082  8.598514 11.889738 12.564904  9.679570 11.275016  7.942124
## [4551]  9.017324 10.836946  9.134122 10.590735 13.004853 12.285996  7.988850
## [4558] 11.685957 10.463085 11.986337  7.624214 14.760613  8.791532 11.359928
## [4565] 13.792245 10.050453  9.122210 11.527132 10.774771 12.390957 13.336006
## [4572] 10.836906  8.157169 10.854652  6.009356 14.188662 12.246280  7.374314
## [4579] 13.846045 12.865136 12.865629 11.726528 10.953163  7.665278 11.287154
## [4586] 10.531005  8.928613  9.546722  9.050711 11.114605  8.238537  7.497975
## [4593] 10.613228  8.650286 10.165775 13.683803  8.827000 10.462363  9.123208
## [4600] 13.727572 11.604283 10.159507  8.065592 12.678121  6.383255 10.766172
## [4607]  9.047113  7.864659 13.700960  9.623030 12.956922 12.267918 10.991570
## [4614] 11.646390 12.275828  9.169166 10.523653 17.665019  9.089590 11.975773
## [4621] 10.038106 10.904007 10.432339 11.617908  9.638264  7.798783  8.243341
## [4628] 16.472420  9.857991 10.407664 13.086776  6.005551  8.722654 11.265425
## [4635] 15.237509 11.425552 11.962867 10.954351 10.860649 16.305266 15.250874
## [4642]  9.837885 13.404134  6.449786  9.099250  7.351630  8.290104 14.764440
## [4649] 10.775972 10.109803  6.777529  4.888686  7.595831 13.432667 12.318253
## [4656] 13.631286 12.276772 12.224166 12.956006  7.495081 11.231309 12.190289
## [4663] 10.675643 10.277509  7.311082  8.308901  7.035608  8.288235  6.499044
## [4670] 11.289961 11.364782 13.410185 10.901524 14.180282 11.404412  8.093071
## [4677] 12.207850  7.499810 17.647888 10.666768  9.928045  7.559719 10.629747
## [4684] 10.876954 13.093429  9.006188 11.200294 15.141166 12.693215 12.605503
## [4691] 13.981913 12.550275 13.609590 12.096914  9.205615  7.168579 13.705061
## [4698] 10.335396  7.047586 10.567651 13.627606 12.810703 11.559771 11.068110
## [4705] 12.477785 10.998342 10.029129 16.342725  8.324522 10.717853 12.471290
## [4712]  8.570209 10.880220  9.574759 10.287460  9.398125 10.184448  9.146596
## [4719] 19.389833  8.910528  9.562921  7.862718  8.100424 11.414081 10.056604
## [4726] 13.550200 10.700712  8.630480 10.468797 13.511417 11.684806 18.230392
## [4733] 10.233640 12.599060  9.718505 10.075906 13.978179 13.700855  9.931630
## [4740] 11.765266 10.725304 12.922244  9.542067  9.058593  7.880180 15.545233
## [4747] 12.666357  9.350098  8.045369  9.920930 13.942036 11.135818 12.589207
## [4754]  9.693546 17.384822 16.987520 12.688410 13.458529  9.405623 10.772552
## [4761]  8.056088 14.042262  8.109255  8.046672 11.172168 13.517071  9.732553
## [4768] 10.519416  7.348529  7.371143  8.665933 12.865013 11.878244 11.643806
## [4775] 12.283632  9.706726 12.159340 13.795216  7.073434 13.861252 11.070694
## [4782] 10.529130 13.817813  7.285121 12.815401 10.380681 10.553900  9.328027
## [4789] 15.238029 11.970390  9.790134  8.752015 12.431137 10.881499 14.010407
```

```
## [4796] 11.758043  7.248227  5.533840 10.452243 12.196360 12.537935 12.879688
## [4803] 13.392227  9.838407 10.354166 11.008293 12.459645 10.776476 11.693250
## [4810]  9.766519 10.187354  8.608878  8.273428 14.063613 13.210218  9.959154
## [4817]  9.178384 11.225424 10.060839  8.761352  7.306827 11.847375 11.693615
## [4824] 12.919845 13.544091  8.822022  9.721229 12.087949 12.862763  5.186187
## [4831]  9.858058 13.894741  9.671027  8.473856  8.725590 10.711027  6.433945
## [4838] 11.869108  7.662748 12.354533  7.389850  7.882361 10.308350  8.966745
## [4845] 12.958143 14.244498 11.974959  7.989000  9.935516 12.498090  7.136653
## [4852] 12.849712 12.013853 10.069678  7.655506 12.580519 10.373128 13.357553
## [4859] 11.700263 13.007480 13.369013 12.472365 11.754200 11.661179  5.720468
## [4866] 13.812441 11.515193  8.453581 10.255682  8.925942 12.414705 11.321719
## [4873] 12.860929 10.468538 12.260983 14.411284  9.178327  9.150796  6.403466
## [4880] 10.610781  8.953567 12.370550 10.519544  8.819584 12.733002 13.731128
## [4887] 10.964505 16.637118 14.306746 12.501395 11.142339 13.803165 11.528917
## [4894] 15.303871 13.158683  8.681971 12.999834 10.256771 11.329215  9.843338
## [4901]  9.670157 11.110906 14.458754 15.006729  8.177233 13.811435  9.569225
## [4908]  9.853287 10.940102  9.866445  9.036924 15.683156 10.119178  9.938616
## [4915] 10.489175  8.919296 12.395150  9.151126  8.512903  7.257432 11.473832
## [4922] 11.846075  9.021437 12.435890 17.194785 12.075692 15.292061  9.771488
## [4929] 10.556742  9.651310 12.833560  9.598341 12.360592 10.854882  8.076219
## [4936] 12.836004 13.863306 13.172276 11.161123 10.683485  9.574952 11.988064
## [4943] 11.398729 10.939572  7.677070 12.590713  9.463802 14.194616 10.544557
## [4950]  8.055901 10.484647  7.013699 10.999440  6.336694  7.137807  8.036917
## [4957] 13.245734 12.789268 11.047388  9.179920 11.002086 13.574327  6.147427
## [4964] 11.137235 15.577704  9.460609 17.008065 13.598742  6.462788 10.020283
## [4971]  7.621883  8.600835 12.352006 11.563926  7.942576 12.859059 17.895936
## [4978]  7.598724 11.549197  9.222093 10.199373  8.811340 15.596737 11.897175
## [4985]  9.726048  8.789916 11.973322  8.249125  8.082004  9.587667  9.134921
## [4992]  7.434797 13.835490  9.907846  8.762851 13.177867 14.055952  9.575528
## [4999]  9.640821  7.632282 10.156461  9.557302 12.326925 12.655416 13.971144
## [5006] 11.514700 11.542129  7.933002  8.546020  8.300221  9.018796 11.378233
## [5013] 12.650961  6.713876 14.891076 10.761900 16.905089 10.261703  8.908673
## [5020]  9.316306 11.597914 11.868338  8.084052  8.013413 10.872970 12.049485
## [5027] 12.256557  9.385198 12.341827  9.347195 12.448244  9.998570  8.908850
## [5034] 14.345013 11.061114 12.552109 10.827306 11.414656  7.702217 10.112486
## [5041]  8.596723 14.100251  9.911449 13.533011 12.220766 10.939620 11.612927
## [5048]  9.319085  9.062301 10.889535  8.860559  9.580747 10.555843  7.593522
## [5055]  7.606787  9.097925 12.180408  8.977393  7.101005 10.902533 11.677858
## [5062] 11.273982 12.869427  9.766434 10.212868  7.646411 10.794752 13.391624
## [5069]  9.279699  6.348067  9.733406 10.099090 11.702170 10.225569  7.187672
## [5076] 11.472247  9.366972 11.729882 11.837517 11.327148 11.047548 10.137126
## [5083] 11.439987  7.446768  9.913973  7.019162  7.599046 10.474722  5.968838
## [5090] 13.548571  9.911879 14.503153 11.174972 14.082778 11.621807 10.779944
## [5097] 10.429176 13.091825  9.353655 11.245682  8.656977 11.342292  9.463646
## [5104] 11.979024 12.047980  9.101904 15.325876 15.581172  9.946859 10.868389
## [5111] 11.387269 18.808160  9.552643  9.139664  9.760751  9.885556 11.714482
## [5118] 12.093530 13.739538 10.138173  8.598710 13.232208  9.587364 12.267777
## [5125]  9.308069 10.782590 10.453757  8.774707  8.790312 10.610925 11.254101
## [5132]  8.894487 10.704591 16.724170 12.455825 10.912140  8.126935 17.168545
## [5139]  8.688165 10.257966 14.018247 11.848306  9.679962  9.450980  9.935787
## [5146]  9.059946 12.176562  8.112119  9.242787 10.094559 10.085467 12.654399
## [5153] 11.544297  8.731926 12.991198 15.529750 10.831034  9.462045  8.208573
## [5160]  5.418708  9.735351 11.060111 14.619151 10.173411  9.287449 15.228843
## [5167]  7.418198  7.025222  7.035295 13.501643  7.509738  9.481876 12.080665
```

```
## [5174]  6.902592 11.261772  9.171670  9.677571  9.536456 13.994396 10.708456
## [5181]  9.202178 12.007937 10.878150  8.825351 10.077148  9.678426 10.737210
## [5188]  7.763558 13.417294  9.961896 15.641026  7.826204 10.670980  8.705117
## [5195]  8.156694  8.843182 11.422268  8.716553  8.943616  9.201193  9.764037
## [5202] 14.582777 11.316001 14.242520  5.422323  8.202186 11.936960 12.618433
## [5209] 10.374927  7.975816 12.488179  9.365450  7.366388  8.329281 11.680443
## [5216]  9.307402 14.499733  7.474092 14.819336 12.608328 11.597186 12.226605
## [5223] 13.451003 14.444929  7.651564 11.892011 14.073422 13.261480 10.968469
## [5230]  9.249468  8.241442 11.432677 14.377503 10.341039  6.801513 10.484438
## [5237]  8.020418  9.536688 15.597854  9.135748  7.271738  9.269692 12.644915
## [5244]  4.649024  9.067077 10.198337  8.583734 11.550872 10.600513 11.888470
## [5251]  9.501898 12.060666 10.851401  8.673929 10.577971 12.311706  8.883219
## [5258] 13.259674 10.588536 12.591678  8.602663 11.948474  8.411792  7.771540
## [5265]  8.427499 12.606157  6.255376 12.070167 10.779393 10.965264  9.511175
## [5272]  8.201342 11.793273 11.804022 12.359157  5.627911  9.653908 11.881091
## [5279] 10.474473  8.701543 18.642383  8.318411  9.355217 11.026909  8.536092
## [5286] 12.929670  7.273229 15.605139  8.462000 12.642343  9.593641  9.039899
## [5293] 16.864330 10.389537 11.955113  9.698956 14.183283  9.686746 13.312962
## [5300] 12.238495 11.482408 14.343729 10.302471 10.732085  9.894262  7.073583
## [5307] 10.080307 12.762809 13.193114  9.937120  9.541205  6.701710 11.984164
## [5314]  7.741051 10.341926 11.492099  8.755770  6.170484 10.545347 10.984998
## [5321]  7.160695  9.245890 12.607764 10.572535  8.470275 11.797564 12.630888
## [5328]  9.123350  8.957780 10.680686 17.260902 12.797352  7.691154  7.292987
## [5335] 12.070104  9.789077 10.211959  8.743729 11.532553 10.796529 10.254606
## [5342] 15.051009 10.636517  9.653771 10.234303  8.225386 11.523377 12.560896
## [5349] 13.917224 13.275333 17.222584  9.448437  9.279582  9.343966 11.502073
## [5356] 15.586224 12.720626  7.125889  8.426822  7.968365  9.350395  6.812008
## [5363]  8.644018  9.345269  9.372318 14.770392  8.601123  9.103703  9.839554
## [5370]  9.201390 10.012607  7.611421  9.992719 10.603211 13.661428 14.225471
## [5377] 12.299763 10.312752 11.153995  9.563108  9.603388 10.082697  6.823565
## [5384]  9.295763 12.580354  8.556325 15.277306  9.333708 11.639557 12.143736
## [5391] 14.859192 13.454930 11.577383 13.379748 12.877750 12.778823  8.578884
## [5398]  7.879232  7.620662 14.345074 10.576809  9.709712  7.930809  8.314777
## [5405]  7.080758 11.060267 10.248904 13.945775 11.778926 11.140160  8.669921
## [5412]  6.593877  9.279782 10.026596  9.067142  9.912439 10.402071 10.060664
## [5419] 12.440558 10.537374  7.038805 10.818401  7.317718 11.396099 13.426362
## [5426] 10.771791  8.645053 11.309786  8.180772 14.650173  7.137732  7.846771
## [5433] 12.236843  7.868037 13.456768 10.727275  7.098081  6.242333  9.108651
## [5440] 13.526934 15.288024  8.174465 11.756909  6.666030  8.229918 10.763802
## [5447]  8.640712  9.622398  9.449842  6.780429 12.008859  8.363918 11.893608
## [5454] 14.506467  9.428970 10.285458  7.178745 16.434665 10.213627 16.375525
## [5461] 13.475584  9.532261  8.983399 10.129877  7.538456 12.479523  8.922806
## [5468] 10.732302  9.872160 11.382178  9.462611 12.542268 11.230926  7.652170
## [5475] 11.034159 11.603479  8.276390 10.505024  7.990376  6.905755  8.627141
## [5482]  9.393102 11.891760  5.931008 11.428580  7.120901  7.707090  8.617177
## [5489]  7.211486  6.768085  9.495965 10.749360  9.093869 15.343767 10.277875
## [5496] 10.404349 16.599861 11.492138  6.579953 11.465647 10.340354  8.113784
## [5503] 14.102580  9.548550 14.599051  7.585162 10.107557  7.977207 12.072337
## [5510]  9.251440 10.200873 13.072484 12.019729 15.834387  6.441985  6.537182
## [5517]  7.172604  7.146678 16.939397 10.263988 10.975604  9.711185 13.021663
## [5524]  6.726666  9.521939  9.997457 15.400191 11.299477 15.115845  9.139003
## [5531] 10.389882 13.932967  8.609256 10.212925 10.085590 11.313906 10.625931
## [5538] 10.481590 15.250474  9.272052  8.703020 11.131654 10.739877  8.830112
## [5545] 12.218620 12.387745 11.187886 13.657053  9.978155 10.715865  8.647990
```

```
## [5552]  5.321113 13.248482 11.901741 13.075927  8.005367  9.328488  7.565582
## [5559] 15.711088  5.015673 11.333022  8.379460  5.217355  5.734347 15.019550
## [5566]  9.588818 15.345570  9.774740  9.759516  9.031218  8.039448  9.915056
## [5573]  8.906932  9.919563  8.573956 12.039241  7.743069 10.032962  9.416302
## [5580]  7.452121 11.883488  9.096849  9.926305  9.876725  9.903867  8.560430
## [5587]  8.681595 11.253880  6.806914 14.634659  7.143371 14.105623 11.564890
## [5594] 10.260818  8.393459  8.529655 13.938520 11.487461 11.873500  9.754233
## [5601]  7.828472 11.412233  6.850952 11.341826 10.925134 10.218766 10.099127
## [5608] 12.443674 10.505701  7.039826  9.202921 10.253020 12.494299  7.292905
## [5615] 14.693366 15.544401 10.163741 10.062741 12.561710 10.980615  9.403413
## [5622] 12.034838  8.613890 12.380205  6.281751 11.383571  9.333572 13.763973
## [5629]  6.997978 11.536050 10.345034  8.823621 10.460496  7.716620  8.676481
## [5636]  9.505300 12.447831  9.109912 11.196720 11.729508 16.392526  9.854136
## [5643] 11.637420 10.019136 10.309129  9.968497 11.317556  8.980247 10.090315
## [5650] 11.563223  8.185804  8.702728 12.230043  8.961319  8.430359 10.112928
## [5657]  9.677985 15.433081  8.815716 13.764236 10.065526  8.337036  9.568409
## [5664] 14.480008 13.556054 16.646975  9.872671 10.349732 11.099042  8.588200
## [5671]  7.832225 10.102129 10.462993  8.019248  8.244833 10.184398  9.493934
## [5678] 10.588815  9.169737  9.636797 13.706114 13.044101  5.538444 16.753657
## [5685]  9.105974 11.000431  9.707219 10.766422 13.322553  8.624278 14.530827
## [5692] 15.539150 11.387314  9.738148 14.738551 11.689729 15.626002 11.039715
## [5699]  9.156067  9.079636 10.396701 11.110398 11.555012  8.601427  8.894282
## [5706]  5.721152 18.851583 18.121426  9.999332  7.957828  8.068952 11.095724
## [5713] 13.187867  8.667182 12.370020 10.750055 13.406120  9.161294 11.465339
## [5720] 10.823453 10.248695 10.250871 10.506797 10.013793  6.238749 11.476637
## [5727] 10.539827 11.013654 10.247995 10.875571  5.637308  9.020280 16.973719
## [5734] 13.937253  8.982039 11.646102 10.575605 10.209411 16.925649  8.825929
## [5741] 11.741092 11.944426 12.244120 11.106328 14.904719  9.378774  7.615686
## [5748] 10.189519 10.347980  5.884999 10.476853  7.643420  4.773743 11.158329
## [5755]  8.577422 13.771718 11.033973 11.095040 10.981601  8.064378 10.463949
## [5762]  8.151248 10.378918 12.602249 12.106479  7.000818 11.393026 12.888471
## [5769] 13.914781 13.674742  8.323331 14.626049  9.774370 13.841312  7.931690
## [5776]  9.593870  7.156492 11.817312  9.247669  9.501637 12.941094  9.772819
## [5783] 12.419778 10.348821  9.923664 14.058432 13.078846 12.779552 15.338752
## [5790]  7.360105 12.306368 16.029985  9.225278 10.811731  7.735902 10.968004
## [5797] 16.008793 10.272539 13.585837 12.990901  7.870642  9.796686 10.383666
## [5804]  8.934755  9.148724 10.627407 12.733235 11.484978  5.441786 12.166096
## [5811]  8.792047 11.051741  7.751745  8.267130  7.521138 13.077451 12.011495
## [5818]  9.437390  7.109408  9.719693 13.320494 11.757402 13.680243 10.928418
## [5825]  7.505086  5.430764  9.126316 11.764942  6.440091  8.923011 10.646056
## [5832] 12.550646  9.268570 11.028940 10.668608 15.186995  7.889175 10.327811
## [5839]  9.199059 13.532270 20.471394 13.298490  6.002176  8.349352 12.793930
## [5846]  8.274797  7.912087 10.897156 12.434644 10.788783  8.293528 11.722848
## [5853]  6.943493  6.642141 10.392220 10.594924  7.953282  8.166107 11.925944
## [5860] 11.555023  7.480692 15.094927  7.202056 12.129753  7.256622  8.133005
## [5867] 16.123947 11.843795 13.144653  9.512011 11.021185  7.976999 10.254574
## [5874] 12.781038 11.540349 13.483535  8.133919 12.031831  8.283235  9.273050
## [5881] 10.752287  9.084339  8.632466  8.521589  9.640631 12.563449 10.713482
## [5888] 13.984486 10.210787 10.549910 10.724043  7.253487 13.251992  7.772289
## [5895] 12.245822 10.283645 12.267378  9.946363  9.571050 11.246781 12.257427
## [5902] 16.878710 10.110082 10.170146 10.994799  8.164492  5.639402  9.599514
## [5909] 11.105115 10.596617 16.410785  7.359337 13.202293 13.051063  9.981329
## [5916]  9.214610 11.626312 10.770463 11.373769 12.450113  9.528697  8.068835
## [5923] 11.996022 10.694280  8.196771  7.599141 12.938085 10.025088 10.536040
```

```
## [5930] 13.349994 14.834208  8.180101  9.817605  5.614829 18.372343 10.811022
## [5937]  7.679266 11.340791 14.746114 11.890437 10.544185  9.268435  7.599746
## [5944]  7.451455 10.410704 11.471046 14.095838  8.754308 15.149389  7.168315
## [5951]  9.508033 13.652331  5.721021 13.207747  8.780630  7.912770 13.024709
## [5958]  7.605486 17.540674  9.544260 14.683273  6.761584 13.315715  8.348831
## [5965] 11.744982 11.662929 11.110196 11.804285 14.004108  7.627128 15.219384
## [5972] 10.228541 10.579558 12.833232 10.048775 17.069655 11.498601 10.663145
## [5979] 10.043445  9.930580 11.010174  9.827603  8.929982  9.073056  8.844814
## [5986] 15.331273 10.549329 13.025106  6.612404  8.909676  9.999834  6.957596
## [5993] 10.002324 13.637170  9.773487 11.723750 10.769413  7.886863  8.323931
## [6000]  7.605540 10.445261  9.897059 13.660528  9.684679 10.310977 16.969743
## [6007]  7.696686 13.637860 13.704486  7.355976  7.790232 10.177728 13.853240
## [6014] 11.823208 12.071219 12.462891  8.863623 10.621063 11.135541  8.112272
## [6021]  5.837876 10.985065  9.710655  8.036679  9.609795  8.245602  8.778165
## [6028]  8.163183  9.241330  9.981055 14.070275  9.001165 11.893281  7.927200
## [6035]  8.874300 10.209840  9.160700  8.868901  9.329424  9.628226 10.195984
## [6042]  9.007772 10.633110 13.264664  9.707954  7.233089 11.549841 12.192349
## [6049]  9.721102 11.514242  9.302155 14.513858  9.720444  8.427039 12.129275
## [6056]  9.653833 12.531871  7.819590  9.305139  8.124904  9.521988  9.609987
## [6063] 11.269322 13.369042 12.965078 10.195725  7.474260  8.918090 10.243002
## [6070]  7.223222  7.758484 13.048971  7.649802  8.418424 12.614172  9.589992
## [6077] 11.595707  8.056299  9.389590  7.620681 13.725366  9.212164 13.799587
## [6084]  7.262891 13.136382  9.900073  6.703970  8.829991  8.174776 15.911499
## [6091] 13.444983 10.890807 11.386046  7.504953 12.147491 13.222395  7.055268
## [6098]  8.633019 11.483642 10.847918 13.670619 13.088482 12.343622  7.656539
## [6105]  6.088419 10.788214  9.631373 11.156284 10.267064 12.423588 10.292378
## [6112] 11.171050  8.310436 10.666498  9.039739  8.533151  8.325373 12.597084
## [6119]  8.584232  6.544674  7.358833  8.369102 11.708383 13.523097 11.861845
## [6126] 11.358983  8.296546 13.073898  7.203510  9.827648  9.431748  9.053855
## [6133] 12.224883  8.638896 16.214556 11.081551 12.238286  7.830340 11.881848
## [6140]  9.131908 10.030907 12.726886 11.802334  7.640650  7.003638 12.889098
## [6147] 13.722818  9.893012 10.383675 10.715567  9.631119 10.644543  9.206876
## [6154] 12.078035  8.209354  9.940775  8.612240 11.606087  6.028217  8.982498
## [6161] 15.297955 10.115629 14.655832  7.919399 13.009765  9.625661 13.826877
## [6168] 11.875506  7.262443  9.895630  9.883797  7.634566  7.439539  9.640186
## [6175] 17.877602 16.021712  8.583655  7.261419  8.164691  7.538806 11.482922
## [6182] 10.697633 12.213353  6.759333 12.783726  8.568857  8.890271 11.609618
## [6189]  6.272013 10.086077  7.474366 10.388157 11.671905 12.512191  8.988655
## [6196]  9.160845 10.919678  8.545058  7.733846 13.577188 11.390666 11.060426
## [6203]  9.115857 12.462543  8.505850  8.291424 11.198235  9.984836 12.316827
## [6210] 10.818358  5.647953  7.700084 10.151681 11.789521 11.081644  7.787245
## [6217] 10.040920 11.963827 11.528839 10.428680 10.455234 11.976332  7.709795
## [6224] 11.156857 11.564129  7.574763 10.130139  9.563528 10.508791  9.375779
## [6231] 10.862203  6.435521 14.367314 12.916848 11.761089 13.477960 11.641862
## [6238]  7.933341  6.706285 11.548739 10.333620 13.750845  9.903389 12.272614
## [6245]  9.205201 11.432597 11.013732  7.072647 12.734812  9.868147  8.873525
## [6252]  9.894235  8.523172  8.719346 16.486307 10.881481 15.345850 16.937818
## [6259] 10.939823 12.326229  9.632088 10.531847 11.283489  8.679079 17.417882
## [6266] 13.311767  8.268945 10.055946  9.765684 12.613180 13.095468  8.944454
## [6273] 14.625093 16.818722  6.191307 10.829079 13.913884 11.207699  9.421121
## [6280]  6.571563 10.096308 14.876119  8.139604 10.938234 12.397804 13.767092
## [6287]  9.412709  8.308685 11.872503  6.876714  9.678157 13.309457  9.588849
## [6294] 16.933183 14.922851  6.896344 10.374241  9.472985  8.981756 11.341452
## [6301] 11.747718 15.677540 15.052863 12.203269 10.422127 11.232323 12.485983
```

```
## [6308] 12.499137  6.901083 10.439546  9.110346  8.695175 12.361128 13.142702
## [6315] 10.261477 13.714689  9.530547  8.202331  9.421900 13.163082 12.528229
## [6322] 13.133089 13.068654 10.442010  8.535681 12.589270  4.604489  8.232624
## [6329] 10.806108 17.290637  8.000912  5.375073 11.927529 11.979060  7.702387
## [6336] 10.548705  9.274429 10.181978 10.552647 11.189013 10.798988  7.650846
## [6343]  9.203940 14.257071 10.186960 13.109970 12.688468  9.370043 10.390611
## [6350] 12.988374  7.378511  6.651294  6.768717 10.378739 13.481508  8.670356
## [6357] 10.184195 14.524838 10.529169 13.731975  8.731318  8.456282 11.434780
## [6364] 13.730445 10.595193 10.428768  8.287616 12.415890 13.552063  9.409247
## [6371]  8.209296  9.968216  9.202674 11.595370 10.715306 12.270501 10.576709
## [6378] 11.405256 10.379232 10.073677  7.742087  9.073623 12.481006  7.249846
## [6385]  8.936490  9.848065  8.985546  9.871494 10.259682 15.612720 13.258241
## [6392]  8.467912 14.289625 12.511815 11.265079  7.168449  7.811011  9.941069
## [6399]  7.955469 11.335870 10.445578  8.722835  8.063987 11.760785  8.592307
## [6406]  8.622516  8.358859 14.383916  9.307619  8.676890 13.725333 11.728950
## [6413]  9.681668 11.734269  8.430406 11.552886  9.439631  7.646788 10.995810
## [6420] 11.229258 11.409231 10.160306 13.773937 10.166732 10.521059  9.638717
## [6427] 10.081323  9.787801  8.530816  8.812415 10.048919  9.915636 13.781417
## [6434] 16.345112 10.231699  9.311986  7.476053 13.068955 11.572433 10.218973
## [6441]  8.760557 13.077506 10.364364 13.244967 10.791189 12.606188  8.265863
## [6448]  9.534769 13.564867 14.353037 10.430727 15.431175 13.555321  8.973743
## [6455]  9.050013 10.361926 12.686441  7.808341 11.500090 14.343397 12.274136
## [6462]  9.941103 10.424510  9.936682  9.868540 10.784206 12.174164 11.428890
## [6469] 13.308300 10.135382 12.638071  9.301817  7.586706  6.742488 11.881246
## [6476]  9.525629  8.913920  8.803692  9.599279 13.756465  9.947566  9.578491
## [6483]  9.705459  9.879288 10.126592  9.713215  8.728656 13.292895 14.865147
## [6490]  7.625247 12.267732 14.758263  9.847868  9.609291 10.029083 10.679161
## [6497]  7.773820  5.437345  8.642959  7.502752  9.045709 15.170771 10.822986
## [6504] 11.610597 16.694910 11.761892  9.283123 10.515766  9.598455 11.834962
## [6511]  7.697594 10.326716  9.268410  9.203216 15.425799  9.304913 10.892008
## [6518]  9.464931 12.555222 10.557552 11.189384 12.649405  9.562662 14.163419
## [6525] 13.890969  8.613459 11.715790 11.109387 11.467417 12.678512 11.553192
## [6532]  8.732359 12.078563  9.588717 10.548087  9.982920  9.529097  7.822938
## [6539] 13.294124 11.468806 12.266597  8.551520 10.648516 11.016469 11.134377
## [6546]  9.421994 14.360807  7.959330 14.403174 10.134661  7.759617 12.575169
## [6553]  9.445820 12.814480 15.455439 11.312879  9.529703  9.388524  9.746949
## [6560] 11.057013  9.896776 11.306678 13.189371 12.997974 10.351168 11.423956
## [6567] 13.043395  7.546176 12.051458 12.867223 11.905083 10.362416  6.960401
## [6574]  7.103265 11.587676 10.943246 20.411046 10.092981  8.736244  9.948726
## [6581]  7.723020 12.479606  9.569475 10.449843  9.325889 14.085417  9.809858
## [6588] 11.172186 11.783122  9.219557  9.029833 11.430338  6.911384  9.954009
## [6595]  5.619042  9.155944 10.853819 13.045783  7.431261 10.377256  9.457582
## [6602] 13.358354  5.653547  7.926862 10.665633 13.408718 10.569667  9.434222
## [6609] 12.609766 11.825157 10.921291 11.890298  8.740016 12.238263  9.376473
## [6616] 10.586705 10.970133  8.837110  7.377120  9.285672 11.503161  8.647838
## [6623] 11.159213 10.038580 14.587980  9.148626  9.299902  7.926002 14.864497
## [6630] 13.425278  9.886348  7.396403 11.155654  9.753186  8.977849 18.320293
## [6637]  7.441310 15.097213 12.102655 13.377918 14.093038 12.249530 10.182450
## [6644]  7.622002 13.875520 12.710715 11.252332 11.629019 11.821361 13.830205
## [6651]  8.276287 16.473295  7.855984 11.545494 14.120221  8.406920 11.238945
## [6658] 10.803333 11.689016 10.132832  9.283240 15.233614 14.744646  9.147329
## [6665] 16.242997 11.394601 12.327976  7.774780  9.508377 12.636358  8.573160
## [6672] 10.130573  8.579688 10.989897  8.930088  5.583923  9.404173  7.796366
## [6679]  8.108649 12.695470 15.417666 10.029615  8.461445  6.226743 10.089198
```

```
## [6686]  8.509104 10.092160  8.911311 11.965703  7.964941 17.110323 13.177151
## [6693]  7.843036  9.968162 10.613511 10.901351 14.606705 13.606320 10.915744
## [6700] 14.514051  9.722991 12.652773 10.169211 11.688841 10.067000 10.858587
## [6707]  8.968607 12.227003 10.131557  8.302966 11.422660 12.476876  8.987884
## [6714]  7.792873  9.844971 12.020453  9.592423 11.466659 13.540183  9.872652
## [6721]  8.438588  9.648588 11.016725 10.006473 13.955399  9.541737 13.807174
## [6728]  7.980530  7.811344 12.532692 12.693793  8.932356  9.115865 12.134784
## [6735] 11.962155  6.658763  8.972347 13.467483 10.598123 12.722923  8.431973
## [6742] 10.371724 10.878028 12.656690  7.200095 13.092732 12.158448 10.172951
## [6749] 10.604132 11.295199 13.367659 12.700743  9.633805 11.810814 13.298785
## [6756]  8.818140  9.077240  9.263174 10.415561  7.859449  6.768489 14.115103
## [6763] 17.743951 17.087205 10.915260 11.767175  9.158693 13.354709  7.103266
## [6770] 15.997048 12.308414 14.974502 10.797324  7.802592  9.856034 10.771441
## [6777]  8.440511 14.380614 14.475029  9.799717 10.837784 12.146586 11.211873
## [6784]  6.708842 14.047634 13.605830 10.615094  8.180051 12.438819  9.625581
## [6791] 11.995283  7.281693  7.243476 11.721750  7.565215  7.850845  9.107797
## [6798] 12.584400 12.534876  9.521979 11.365796 15.583628 12.858529 13.211548
## [6805] 11.827727 10.956793 10.245055 12.184253  8.869733 10.057967 14.396965
## [6812] 17.878580  9.129335  9.203734 14.814821 12.044845 10.596458  9.946113
## [6819]  7.627415  7.757628 13.499850  9.107895 10.072474 10.897143  9.222675
## [6826]  7.346410 14.890116 10.318322  9.079471  9.075282  7.827001  8.631065
## [6833] 12.421795 18.078832 14.831870  7.087919  8.220891 12.462270  7.821535
## [6840] 12.755274  7.444239  8.201439  8.307113 10.294758 11.258797  9.485970
## [6847] 11.467764 11.067150  7.163888  8.986977 10.021563 11.726584  9.330911
## [6854]  9.462861  8.733491 11.424917  8.404342 13.877793 12.469443  8.833185
## [6861]  8.644881 11.310817  9.047033  9.533603 13.498209  8.299760 12.452719
## [6868]  9.114126 11.908796 11.313425  8.277052 15.116437  9.944015  8.076635
## [6875]  9.907502 12.583318  7.357895 13.360793 11.832048  9.617171 11.670169
## [6882] 10.272407 13.440398 10.250172 10.219324  9.495071 11.633286  7.255353
## [6889] 12.780153 15.877275 14.509192 10.889570 11.908997 12.383447  9.932363
## [6896] 13.049811 16.741069  9.533514  7.763032 12.483177  9.553839 10.298525
## [6903]  6.974673 12.391901  9.838492  8.766791 10.373781 12.806122  8.081298
## [6910] 11.114817 11.260081  7.810499  8.368332  9.211160 11.114034 14.110369
## [6917]  9.244065  8.034724  7.806542 12.092584  9.278165 12.610870 13.476273
## [6924]  8.729907 13.309648  6.483522 12.616314 12.027446 10.977348 11.992204
## [6931]  8.468549 14.774714 16.568446 13.834369 12.295124 12.661362  8.903983
## [6938]  8.447055 14.179480 12.434676 12.605561 12.430638 14.091368 11.480740
## [6945]  7.215685 15.537989  6.397060  7.517749 12.976707  9.072158  6.636692
## [6952]  8.668813  7.524000 12.660377  7.642186 12.386302 18.889498 10.205186
## [6959]  9.527470 10.419947 10.875260 15.377511 11.924200 12.382236  8.500487
## [6966] 13.534472  7.442206 13.551994 14.076437  7.117384 12.624180 10.513224
## [6973] 12.530706 10.025269 10.262847  9.784743 11.148535 12.270347  8.806240
## [6980] 11.533260 13.500571 14.056965 11.571332 10.258049 11.709020 10.272477
## [6987] 12.066808 16.241161 11.498351 11.327621  8.671158  7.856080 17.609311
## [6994]  9.555855 11.530660 13.821568 10.934433  9.900605  9.142303  8.213684
## [7001]  7.441857  8.287329  8.060833 10.555215  9.878674 12.722046  8.502618
## [7008]  9.745853  6.854042 11.520297  8.733034 12.382273 10.795169  9.152234
## [7015]  9.769151 10.235385 14.041555 12.415464  6.925235  8.039072  9.381387
## [7022] 11.717697 12.173794 11.318184  7.431319  8.307743  8.870800  6.348440
## [7029] 12.694045  6.642504 12.792372  8.548298  9.586822 15.967498  7.988090
## [7036] 10.872250 13.910742 13.048126  9.760994  6.162798 12.495425 15.584083
## [7043] 12.681419 11.936953  6.536339 10.062479 13.388831 11.752391  7.404611
## [7050] 12.056425 13.098493  8.881152 14.133628  7.978921  9.811466  9.302001
## [7057] 10.105501 13.510337 12.399728  7.086339  7.601007 12.751279  8.505675
```

```
##    [7064] 11.484792 12.249866 10.819920  6.681629  9.759089 15.461375  8.808183
##    [7071] 11.786573  7.864444 11.577542  9.843107  8.162393 11.897615  8.799316
##    [7078] 11.298569 11.887281 10.988556 12.477899  7.504649 12.099177 11.839430
##    [7085] 12.051327  8.658326 12.745495 10.000007 10.461137  9.810149  8.073020
##    [7092]  9.013407 15.590546 15.811172  9.356642  6.603352  8.640341 12.732164
##    [7099] 13.445121 13.424632  6.568423  8.145293 11.543796  9.965980  7.283257
##    [7106]  6.980486 14.032090  8.137041 11.327259  6.814149 12.263964  9.118024
##    [7113]  8.579011 10.750008  7.945542  9.831405  8.962293 11.468877 10.695946
##    [7120] 11.250845 11.390366  8.334991 10.288944  8.171835 13.086729  8.953284
##    [7127] 10.343426  8.574278  9.882024 13.630949 11.616568 10.193354 13.507224
##    [7134] 11.641244 13.988186  8.605016 10.557045  9.741677  7.360893  9.975404
##    [7141] 16.277916 13.481149 10.722662 11.783969 10.550979  7.624707 10.042474
##    [7148] 12.921981 13.348793  7.723375 16.793870 12.186233  8.489567 12.049159
##    [7155]  9.923292 13.570653 11.700015 14.154953  9.137660  7.010193  8.512836
##    [7162]  8.860714  9.241809  7.942787  5.852059  9.917933  7.932517  9.225364
##    [7169]  9.454416  7.978474 12.456593  9.885058 11.491174 14.889233  9.548693
##    [7176]  7.430929 10.292950 11.089884 16.571987 13.320140  7.542283 12.444119
##    [7183]  9.428169 13.316042 10.138638  8.302298  8.592567  5.232645  9.020752
##    [7190] 13.558846  8.577593  7.823562 15.961555 12.071144  9.783731  8.172958
##    [7197]  6.892666  9.356571  8.212122 16.268818  9.926906 11.394842 14.563436
##    [7204] 13.291551  9.302823 10.409846 14.111620 12.042187 13.594789  7.520844
##    [7211] 13.784827  9.430632 17.901210 11.410687 10.338508 12.067607  5.682577
##    [7218]  6.662044 10.428902 11.008043  8.673806  8.245933  8.622590 10.773171
##    [7225]  7.599852 10.772392  9.143229  6.377953 10.098192 14.174236 11.746807
##    [7232]  8.671444 11.066305 11.800207 11.901514 14.522514 10.150935 11.556298
##    [7239]  7.324688 14.999293 11.366352 11.273551 11.094925  9.841982  8.157274
##    [7246] 10.439138 11.725084 12.925866 13.662836 14.108222  6.304033 10.173641
##    [7253] 14.607124 12.111032 12.524878 11.733103 11.641333 13.131573  9.576579
##    [7260] 11.815018 12.032482 10.330452  6.081546 12.691672 13.216705 10.371003
##    [7267]  8.205283  9.463247 11.592952  9.208188  8.186101 12.720096 14.350434
##    [7274] 12.639507  8.510302 10.411101 11.581035  7.526219 19.426046 11.844988
##    [7281]  8.809910 11.232297  9.715277  7.837224 10.510269 10.627916 11.119855
##    [7288]  6.886783 10.868193  9.001666 13.125126 11.227915  7.951933 10.546189
##    [7295]  6.515010  7.729754  8.595416  9.400063  9.522602  9.093515 13.128100
##    [7302]  7.508844 11.614537 10.027055 11.474685  9.454021 10.766853 15.488083
##    [7309]  7.566362 16.782626  9.120694  8.545642 11.713788 17.371223 16.049994
##    [7316]  7.785994 10.139311 11.959634  6.576449 12.114048 11.423941 11.212976
##    [7323]  8.264494 10.920964 13.110136 15.908867 12.410892 12.573552  9.847205
##    [7330] 11.401417 11.970970  9.629642 13.709495 10.531393 10.247832 10.516262
##    [7337]  7.921402  7.422956 13.076765 10.870023 13.404058 11.259877 10.584459
##    [7344] 12.859289 10.600054 10.678105 10.477137  8.943607  8.634052 12.294510
##    [7351] 10.784492 11.248602  9.740140  9.322826 13.984830 10.914934 12.393854
##    [7358] 10.437729 10.301743  9.473715  9.456193 14.878264  7.807105  9.594792
##    [7365]  7.587759  8.773238 15.045303 14.097372 10.843127 12.447222  8.179551
##    [7372]  8.445669  8.707302  9.874674 10.641265 10.595817 19.671295 11.338780
##    [7379]  6.766291 11.222928  8.236511 10.814439  9.112106  7.820837 11.278708
##    [7386]  7.436700 15.190096 10.528153  9.115561 14.906607 10.657704 12.866714
##    [7393]  8.712229  9.827705 14.935635 10.126804  9.991870  7.669979  9.770578
##    [7400] 10.251284 13.961415 12.533030  9.278142 10.806322 12.355386 10.933239
##    [7407]  8.371457  7.880774 11.915569 16.366130  8.331937 10.966309 17.458262
##    [7414] 10.482030 13.135922  8.228327  9.366223  6.393790 11.990933  8.630410
##    [7421] 11.409147 11.522179 10.289672 10.971832  8.368056 13.935364 11.354125
##    [7428] 11.354716  9.537104 11.057754  7.738863 14.797195 12.551971  9.903363
##    [7435] 10.520382 11.847600 10.981967  9.047845 11.219149 11.627025 10.264606
```

```
## [7442] 10.449491 11.798551 13.611732 10.924316 10.039740 11.406308 14.478310
## [7449] 10.744726 10.028975 13.685031 10.505616  8.693473 10.976741  8.285666
## [7456] 10.113903 11.295776 11.498891  9.609092 11.961766 13.003246 11.590983
## [7463] 10.459242  8.410266  6.967209 11.896809  9.091784  7.469603 14.128194
## [7470] 14.258881 10.294014 19.405708 14.038920  6.744516 11.008242  9.046121
## [7477] 12.439219  7.948068 14.851694 10.135447 11.349990  6.580239 10.712861
## [7484]  9.191066 12.809069  8.845883 10.275110 11.212835  9.886041 13.630544
## [7491] 15.998074  6.068361  8.321444 10.578344 12.468434  9.357316 13.494206
## [7498]  6.580888 10.244725  6.907127  9.350142 11.041137  8.082443 12.379499
## [7505] 12.173262 13.742237  8.382069  6.233834 10.390262 11.407282 10.874044
## [7512] 11.173704  9.756052 10.155045 11.344915 10.018186  8.453460  9.747864
## [7519] 10.570495 11.401946  8.762300 10.040035 10.052194  9.732442 12.331092
## [7526]  8.737738 18.880909  7.404279 13.716869 12.056314  7.387303  5.749015
## [7533] 10.979529 10.933284  6.661827 13.629198 16.021805 10.026639 12.922519
## [7540]  9.551630  8.208597  7.251070  8.444022  9.001058  8.554220 10.289307
## [7547]  7.868584 10.071660  8.684376 14.371411 13.393138  8.970179  8.377212
## [7554]  7.911755  9.708190 16.749800  9.765447 12.115779 10.732728  8.519126
## [7561] 12.744040 10.478931  8.127684 12.223056 10.211057 12.363739  7.204810
## [7568] 13.886712  7.551790  9.962605 15.771060 12.870074  9.293995  9.045117
## [7575]  8.774758 12.846927 18.545803 12.439544 12.367935 10.766644  9.371518
## [7582]  7.545871 10.308167 11.524145 14.008252 14.093136 11.493242 13.443905
## [7589] 11.759748 13.239049  8.184593  8.729766 14.535328 10.478081 10.137086
## [7596]  8.739523 11.815139  8.560564 11.301409  9.503018 12.414376 15.267397
## [7603] 14.283112  9.496623 11.116755  6.678134 11.384646 11.602760 11.590415
## [7610]  9.499581 10.225510 12.789476  7.450405 10.381953 10.350549  8.946982
## [7617]  8.864950 17.660842  9.983366 12.467076 10.113844 11.843298  8.384300
## [7624]  9.028685  8.437425  9.077801 10.211473  6.300286 11.402189 16.301330
## [7631]  9.134712 13.769128  8.741770 12.379285  8.756141 11.371386  5.688662
## [7638] 10.278597  8.040128  7.224964 11.458938 13.589093  7.112410 11.520388
## [7645] 10.891653 12.544814  8.927401 13.988912 11.810158  8.280481  5.736518
## [7652]  8.895587 12.452952 12.237683  8.462499 14.367732  9.651467  8.341354
## [7659] 11.115134 15.870237 12.095370 11.297793  8.249250  9.136648 10.664189
## [7666]  8.755244  8.139368  8.799708 12.108804  8.636893  9.049985 12.405229
## [7673] 13.738448 11.368372 10.661705 11.457830  7.181939  9.637891 12.491065
## [7680] 17.134418 10.686166  9.454912 11.469595 13.242211  9.796615  8.840223
## [7687] 17.077628 11.128640  9.265478 10.686139 11.133069 10.040652  9.289300
## [7694]  8.916277 12.177682 12.117968  7.798216 14.716848 10.774194  9.999219
## [7701] 17.909034 15.867203  6.054953  5.242617 10.169490 10.155827 11.975867
## [7708] 11.492137  8.433339  9.550371  8.098287  8.569002  9.299214  5.820935
## [7715]  9.086457  8.775710 12.691407 13.219339 10.007621  8.489932  7.353744
## [7722]  9.699004 17.464433 13.887132  6.908800 15.900336 11.720323  7.834790
## [7729]  8.493686  7.101804 12.421046 10.353868 14.067467 11.704753 10.297563
## [7736] 17.607479 11.278212 13.449914 11.961364  9.306399 10.667148  8.381596
## [7743]  8.201547 10.275923  7.451687 20.814585 11.574455  8.118195 10.722056
## [7750]  9.905697  7.669498 11.045953  9.892362  9.113312  7.987458 11.570651
## [7757]  9.254704 10.053739 14.537516  9.504648  9.640832 10.242248  6.838272
## [7764] 10.233754  8.358544 11.334895 15.916700 12.168423 10.747783  8.564079
## [7771]  8.806143 11.974717 10.304071  8.683748  8.100704  8.811777 13.225996
## [7778]  8.749004 12.529468  8.242988  8.745684  7.607558 10.231351  9.027186
## [7785] 10.394536 13.001765  8.078401 10.341333 11.586765 10.710665 11.345237
## [7792] 14.175320 10.892300 11.118619  9.994290  5.757657 11.097796 10.734150
## [7799]  9.011745 14.780799 13.954610  8.146565 10.384563 11.397905  5.920698
## [7806] 14.272212 10.407499 13.487428 11.613609  7.244263 10.604187 12.001506
## [7813]  9.694135 15.819712 10.768758  9.769828 10.568623 17.225476 12.931559
```

```
##    [7820]  8.668776 11.773405  6.350596  9.775177 14.376257 11.052374 12.107069
##    [7827] 14.483604 11.406644  9.522719 11.812963 10.598450  9.494114  9.285735
##    [7834] 11.030265 11.235215 11.121656  9.111539 13.740830 11.148591  9.246707
##    [7841]  6.258740 13.262208  8.453151  5.921935 11.177799  7.022258 10.012779
##    [7848] 11.142891 10.944800 12.457994  7.634016 10.411663  9.493472 11.771811
##    [7855] 13.266160  6.532346  9.200646 11.389589 11.804389 10.545052  7.774053
##    [7862] 11.790465  5.823731  7.436420 10.086842 10.501743  8.723005  6.775870
##    [7869] 13.034911  9.181453 12.447240 11.348623  9.905425 12.677787 10.486385
##    [7876] 14.583886  9.980587 14.001518  7.679308 12.113939  9.533454  9.223263
##    [7883]  9.233116 11.831458 12.761278 11.317808 11.279866  8.265287 13.435548
##    [7890] 12.766252 10.399069  8.654877 12.459519  9.074266 14.516634 15.525576
##    [7897] 12.893025  8.228743  8.509075  9.662895 12.472988 11.537421  8.071236
##    [7904] 10.034634  6.336175 12.505362  9.742175 10.859109 12.246725 12.463911
##    [7911] 11.828239 12.130347 10.102170 10.283774 10.073474  6.289894 13.591523
##    [7918] 14.434333 10.491647 10.536830 11.276704  8.008835  9.747551 10.372395
##    [7925] 11.461967 12.799421  8.909719  8.335206 11.783549 12.463742 12.293476
##    [7932] 11.191395 12.518547  8.520931 12.240840 10.997858  9.964070 13.382644
##    [7939]  9.573365 14.265565 11.412190 16.184631 12.391552  8.623555  4.843455
##    [7946]  7.349700 11.406868 10.579438 12.139155 12.768538 12.461797  7.631589
##    [7953]  9.516847 10.700066  8.562388  8.507251  9.513239 10.382345 13.700869
##    [7960]  9.740535 13.825796 16.015628  7.276281 12.096340 13.716954  9.646060
##    [7967]  9.292157  9.327131 11.481654  9.854569  9.079154 12.681503 14.749130
##    [7974] 13.130035  9.577330 15.273206  9.757884 13.268778 24.147922  8.062796
##    [7981]  9.927212 12.880080 11.604498  8.414479 11.067993 12.918712  9.599845
##    [7988]  8.913445 11.753220 10.935810  6.754749 13.442823 14.846605 13.857135
##    [7995]  9.512354  9.888478  9.584621 10.024411  8.870289 13.663403 12.002234
##    [8002]  7.304257 13.370648 12.661325  7.596700 13.165611 13.218434 12.495886
##    [8009]  8.083834 11.288851  8.128079 14.436378 12.927296 11.643615 12.163269
##    [8016] 10.185132  7.595853 14.541557 12.371371  8.621287 10.923889  8.799181
##    [8023] 10.533201 14.429721  7.151238  8.000458 13.368744  8.897071  6.974870
##    [8030]  9.253375 13.145317  8.060891 10.289624 10.781791 10.771519 10.223865
##    [8037]  8.808659 10.499501  7.900829 13.260903  6.694381  9.249142 17.813971
##    [8044]  6.354068  8.559117 10.874892 13.750173 12.529509  9.808128 10.386420
##    [8051] 10.674569 12.515590  9.863702  7.704583 10.841269  8.514104  9.196238
##    [8058]  8.620212 11.307752 11.267585 11.640322  9.356956  5.405535 10.762957
##    [8065] 10.658018 13.860417  8.030138 10.020900  9.648324 14.564827 11.968944
##    [8072]  8.740743  6.073078 11.920050 10.986601 11.172798  7.072435 11.049990
##    [8079] 12.812483 12.661322  7.951328  9.685253  9.108103 10.743364 11.357825
##    [8086] 12.081803 11.179824  8.984766 11.137417  7.726360 12.330541 12.007829
##    [8093]  9.132377  7.053273 13.544960  9.994286  6.965344  6.578746 13.441497
##    [8100] 12.708640 12.705997  8.453970  9.101134  7.514934  6.931570  7.143552
##    [8107] 11.379625 10.416055  9.730240  9.496538 15.194518 10.334994 10.984299
##    [8114] 11.695829 10.202584 11.854678  5.477294 10.909042  6.807568 10.083772
##    [8121]  8.820340 13.048843 10.266187  8.782520  7.857184 11.987694 11.096565
##    [8128] 21.723062 10.435505 14.089450 12.935790 13.694748 11.296639  5.438610
##    [8135] 10.224437 13.876112 10.014334 11.037939 11.009965 11.947497 10.140630
##    [8142]  9.850891 12.410207  9.972867 16.861375  6.857995  6.612120  8.533909
##    [8149] 11.994077 10.742050 12.954434 11.279163  7.158020 11.417987  6.593422
##    [8156] 11.778688 11.237204 13.911693  7.419559 12.492061 11.756362 11.461959
##    [8163]  6.622138 11.810545 12.195674 11.301435 15.665710 12.484531  8.305873
##    [8170]  9.835210 10.676650 11.526111  7.466020 11.550654 10.774894  8.386111
##    [8177] 14.384725 10.847056  9.788372  5.312460 18.712166 12.435506  8.263578
##    [8184] 11.618933 11.785221 13.081651 11.960805 11.092875  9.793246 15.245075
##    [8191] 10.494257 10.641022 12.190549 15.320060  9.768179 10.779970  7.488133
```

```
## [8198]  9.431470  7.185467  9.169790 10.646551  7.007283 11.885713  7.451692
## [8205]  8.741348  7.762910 10.133313  7.090144 10.507679  6.374049  7.981152
## [8212] 10.822535  7.878092  5.544723 11.420651 11.390751  9.964124  7.773586
## [8219] 10.951135  8.924673  6.081111 13.144779  9.611766 10.564172  8.922673
## [8226] 11.260441  8.351833 10.129325  7.447685  6.664875 10.015458 11.956588
## [8233]  9.829817  9.331353 11.966499 14.349918 14.534937 18.515444 10.187926
## [8240]  8.204260 10.762354 11.987668  9.253592 12.432310 10.401671 13.016132
## [8247] 10.582276  7.349909 12.435571  7.696871 15.600205  7.859047 14.008693
## [8254] 11.934161 11.311073  8.133700  7.835271 10.079541  9.575380 12.619050
## [8261]  7.970553  9.713202 10.308756 14.180242 12.266019 11.565847 14.745570
## [8268]  7.424246 15.004062 12.250349 10.758552  9.081660 12.027429  8.401917
## [8275]  9.816454  8.762919  8.026123 11.871792 10.429220  6.602708 10.681474
## [8282]  8.799590 12.231238 10.225883  9.777360  7.429982  9.635182 10.723498
## [8289] 12.513600  9.262070 11.143910 10.445330 10.357131 13.631175 10.137364
## [8296] 13.974848  7.997994  6.911286  9.523383 11.862812  8.836861  8.132084
## [8303] 14.324773 10.347067  8.766228 13.951040  8.472603 11.908937  9.788362
## [8310] 10.917783  9.987096 10.193712 12.840164  7.402542 11.404775 12.976818
## [8317] 12.883230  9.846480 11.522323 12.697487 12.773574  7.071435  8.290024
## [8324]  8.005207  8.707062 10.939444 10.784917  7.853394  7.519570  7.817585
## [8331] 11.612797 11.945628 10.340118 12.500255  9.693594 11.279602 11.729767
## [8338]  9.068368  7.338282 10.901007 11.407896  8.244107  8.821761 11.476258
## [8345]  8.673769 10.473824 11.605987 11.117176 10.090303  9.339894 16.871677
## [8352]  9.036244  9.961488  7.363061  8.838272  8.713357 15.418874 11.088746
## [8359]  8.489906  7.254772  8.006254  5.846376 13.508211 12.223569  9.578862
## [8366] 10.052987  7.227697 12.614197 10.760191  9.066373 11.365571  9.261646
## [8373] 16.382951  9.160236 10.257562 13.080362  7.209095 14.513117  9.087254
## [8380]  8.410335 12.419530 14.155979 10.618112  5.715348  9.876980 14.776460
## [8387] 14.688709  9.591078  8.910349 11.815598  7.114580  9.963460  9.971687
## [8394] 12.349107 10.990164  9.473243 11.474086 14.201138 13.167628  9.112381
## [8401]  8.063846 10.823598 10.673115 11.281076  6.620147 12.567161  9.074477
## [8408] 11.030524 15.246999  6.991458 11.692987  5.908495 10.150269 14.289691
## [8415]  7.928761 16.362813 10.128674  8.801118 11.193284 12.373816  6.618402
## [8422]  9.161331 10.610073 14.085518  6.585732 15.155545  9.490016  6.886156
## [8429] 10.575041 11.153072  9.736606  8.341715 10.698464 16.838576  6.074093
## [8436]  8.869643 13.392324  8.427103  8.693116 12.936377 12.269161  9.934289
## [8443] 11.414709 12.536988 14.259041 10.165478  9.168604  8.666383 11.451520
## [8450] 13.543293  7.097889 11.769896  6.393616 13.017446 12.657360 15.148933
## [8457]  7.111371  9.800017 13.642782 12.363532 10.891730 11.945703 10.823852
## [8464]  9.242129  6.484896 11.787048  8.625259  9.671370 15.469823 11.381547
## [8471] 12.190123 12.764594  7.413211 15.095372 12.132675 11.782170 11.157306
## [8478] 13.764040 13.146963 11.167158  7.391843 11.513346  6.898148 15.699749
## [8485]  8.720387 13.189094 12.094648  8.722355 10.321441  6.453132  7.717168
## [8492] 11.168924  7.681075 11.504375 12.869665  6.132343  7.185102 11.418212
## [8499] 13.722641 10.849215  9.896349 11.923179 12.054921 11.261784 11.086378
## [8506]  7.018975 10.784441  9.332557 10.549853 11.202038  9.876542 11.106220
## [8513] 10.629579 12.332901  5.816906 10.493968 11.116191  8.823348  7.535838
## [8520]  8.584017 11.610909 10.593588  9.503311 10.433472  5.860810  8.350399
## [8527]  7.365792 11.401474  8.885653  6.890172 15.677816 10.253930 11.142141
## [8534]  7.631322  7.198203  8.486234  6.179086 14.300843  9.949303 13.043759
## [8541] 12.030983  8.706245  7.454574 18.073974  7.786580 12.491892  7.093420
## [8548] 13.865645 13.080680  8.798134 10.786103 10.085069 12.298726 11.319375
## [8555]  9.253779 13.537189  9.871709 15.363791 10.587405  9.799857 13.865941
## [8562] 13.163236  9.779843  8.579639  8.439963  8.483513 12.975697  9.202000
## [8569]  8.022445 12.254255 14.817110 11.032709 11.233487 14.102258  9.977441
```

```
## [8576]  8.605164 15.592762 10.626282  7.378310 10.269661  7.618026 11.491594
## [8583] 12.196178 11.290247 12.581162  9.011473  8.720258  6.923224  9.930127
## [8590]  6.584665 12.789730  9.183715  7.440399  9.636789  8.397282 15.923156
## [8597] 11.701997  9.581171 12.081496 10.909291 10.296080  8.396875  9.823750
## [8604]  8.491714 13.266635 11.687085  7.658836 13.888772 12.548878  9.711937
## [8611] 10.880542  9.601812 11.990249  8.879421 11.555473  8.381028 11.922135
## [8618]  9.799201 14.175260 13.350418  8.562030 12.441907 12.292329 11.262855
## [8625] 12.123839 12.197119 11.660795  9.629175  9.356312 12.541930 10.490175
## [8632]  9.271410  6.270348 18.284935 10.569467 11.467477  8.693015  6.664602
## [8639]  9.680452  8.920064  8.817199 10.804675 13.913360 13.695345  7.518421
## [8646]  8.686635 10.107369 12.029755 11.509789 10.305007 12.886280 11.830953
## [8653]  7.973022  5.170677  9.776099 12.268897 12.647915 11.461300 12.584252
## [8660]  8.293717 10.890073 10.775444 12.026712 18.362474 14.270643 11.934358
## [8667] 14.884509 10.666547 13.932604  6.229338  8.301402  8.618280 16.832572
## [8674] 14.762046 11.800731  8.373604 10.163708 12.059307 14.057690 11.776391
## [8681]  7.154543  8.658265 11.201683 12.490007 10.901714  7.191957  5.928874
## [8688] 14.765315  6.650703  8.029917 14.120685  8.823992 12.445633  9.885691
## [8695]  7.663285 13.700463 12.107791 12.557041 14.127973  8.518462 10.370296
## [8702] 11.096070 14.306651 10.778252 11.996367 11.289036 15.983448  7.415879
## [8709]  7.877236 19.635232  8.113018  9.016914  9.587696  8.503237 10.828094
## [8716] 11.496910  9.842883 10.520830 12.806586 11.966716 14.624762  6.794882
## [8723]  8.734621 16.045448  7.411691 10.783963  8.939090 14.466437  7.338975
## [8730] 10.224826 14.255598 10.482863 10.891251  8.471585  9.066783 11.202441
## [8737] 10.864551 13.488784 11.222094 15.343441 11.672695  8.517106 12.383503
## [8744]  7.552701 13.142956 12.526763  9.075616 10.327094 11.394338  8.536179
## [8751] 10.839560 10.150384 11.705263 11.199285  8.187797 12.499134 11.444518
## [8758]  9.558398 10.783508 10.944307  8.467622 11.501832 14.573549  8.682812
## [8765]  7.145367  9.645877 11.400489 12.032822 14.673076 14.690665  9.451267
## [8772]  7.962294 12.575442  9.245650  6.995030 12.433347  9.424553  7.449405
## [8779]  9.126316 11.649301  9.878050 15.023344  8.226688  9.364860  9.714382
## [8786]  4.673308 11.847536 13.334187 13.552974 11.717956 12.252717  8.607797
## [8793]  8.985029 12.136330 10.770899 19.132470 11.085566  7.812296 12.517694
## [8800] 11.270398 10.839942 13.686061  8.349711 12.058521 10.148535 14.531098
## [8807] 11.046270 14.044548  7.994216 10.682622 13.144921  9.318684  7.203015
## [8814]  8.580406  9.175506 10.132104 12.099738 10.235478  9.394211 13.305240
## [8821] 14.570729 11.872900 10.291273  8.438955 11.375055  5.516002 13.924185
## [8828] 12.621273  7.531410 11.226552  9.401990 10.972274 12.392472 16.802361
## [8835] 10.877117 12.009474  9.612517  8.495901 16.376405 11.595464  7.568418
## [8842] 14.215604 10.611991  7.856329 10.465865 10.328637 14.476516  6.433179
## [8849]  8.929081 12.963373  8.456895 11.756933 15.639629 13.324156  6.034457
## [8856]  9.966964 11.810806 12.009232 10.743768 10.476582  7.723477  8.020758
## [8863] 10.982597 12.847120  7.478679  7.806297 14.432710 11.527445  9.795170
## [8870]  7.139663  9.968824 11.890159  8.127327 10.108904 11.929058 12.385932
## [8877]  7.607065  8.316355  9.136582  7.745546 10.063143 12.462615 11.559329
## [8884] 13.340507 10.186061 10.824709 10.333816  7.872081  6.586062 12.789568
## [8891] 10.713879 13.513298 15.176314  9.634224 12.127183 11.542901 14.515141
## [8898] 11.942709  9.234154 10.807529 12.059472  6.489929 10.259080 11.227490
## [8905] 10.757654 11.095572  8.191057  7.873066 10.816929  7.288956 13.006250
## [8912] 13.027231 10.720715  9.173398 10.372899  6.866135 13.059435  9.332963
## [8919] 11.906997  8.664319  8.109811  8.435974  9.582367  8.676820 13.055004
## [8926]  8.584010 10.435932  8.738258  4.746862 12.160048 12.643519 12.972842
## [8933] 12.207640  6.819899 10.808405 10.610112  9.112164  6.269599 10.264406
## [8940] 10.171023 14.917232 12.783840 12.550073  7.426680 11.835018 11.076330
## [8947]  8.628072 10.972505  8.900415 11.004924 10.838886 12.868506  8.289262
```

```
##  [8954] 13.639875 10.950982 14.332826 16.243350  9.254550  7.918350 14.660483
##  [8961]  8.834783 15.055919  9.650760  8.549405  7.911668 12.739976  7.310520
##  [8968]  9.706455 12.755357  7.302736 10.612011 14.695626 12.620116  8.423484
##  [8975]  6.864872 13.683524  7.303029  8.086849 12.458143 11.096398 10.787081
##  [8982] 13.411233 12.867570 10.550082  9.001271 11.717183 11.197222 10.871285
##  [8989] 12.613412  7.880955 12.219272 12.820806 11.425016  8.409237  7.949467
##  [8996]  8.385767  9.745693 10.332178  8.093203 12.733767 10.135680 14.654459
##  [9003]  9.346195 11.665885  7.052250 11.375817  9.844429 12.766863  9.734862
##  [9010]  8.760780 14.701690 11.538331  7.040256  7.056280  8.382308 12.964933
##  [9017] 12.221337  6.903670 10.052653  9.025536  8.016365  8.010553 12.235098
##  [9024] 12.038346  8.449994 10.545282  9.669852  9.882415 11.979411  8.758206
##  [9031]  8.256461 14.444683  6.849776  9.140819 10.298825 12.419387  7.775434
##  [9038]  8.080501  6.833066 12.408161 12.505959 10.916439 13.737264 11.313271
##  [9045] 10.957959 13.214048  8.657283  8.775402  9.867355 10.783492  9.961915
##  [9052]  9.987730 15.787037 12.043424 15.903012  7.915948  6.572269  8.481708
##  [9059]  8.626940 10.713587  9.760593  9.755336 12.119972 11.217350  8.910181
##  [9066] 11.244288 13.413715  5.635995  9.386994 15.814357 11.306301 12.934584
##  [9073]  5.669721 12.283230 10.709328 10.637374  9.814636  8.015187 10.304188
##  [9080] 14.545822  8.177543 10.842577  8.584398  8.334580 11.130221 11.299080
##  [9087] 10.602217 10.624711  9.348508 12.656839  8.895388 10.302055 17.045885
##  [9094] 10.302094  7.030215 11.137429 16.099883 11.997396  7.453457 10.592332
##  [9101] 13.135909  9.968725  7.533183 12.824426  7.262557 10.821041  9.517299
##  [9108] 10.401498 14.949166 17.467906  9.858706  6.441079  9.956642 11.483158
##  [9115]  7.986611 11.440379  7.976899  9.599141 11.860776  9.238422 12.149969
##  [9122] 10.406041 11.068905  8.867152  9.569350 10.844013 14.409931 11.183860
##  [9129] 11.711927 11.588705  9.882427  9.612962 12.235108  9.076544  8.731840
##  [9136] 11.851624  5.078104  8.180386 11.449542 14.689279 11.755209  6.821933
##  [9143] 13.364916 11.989185  9.015534 12.126222  7.772331 13.972768 12.367273
##  [9150]  7.557578 11.106262 11.803257 15.609839 10.423097  9.828177 10.438828
##  [9157] 14.354591 12.892422  9.244317  9.814603  8.424871  9.758880 11.524825
##  [9164]  7.088906  8.782855 10.217879  9.939582 10.933410  6.776608 12.262665
##  [9171]  8.756302 11.814028  6.857217  9.053459  8.163309 14.392165  8.407937
##  [9178] 13.056384  8.416933 11.726314 12.051573  9.690605 10.233907 15.007480
##  [9185]  9.857069  9.462682  9.380094 12.012659  9.634842 10.997370  6.650524
##  [9192]  9.588491 11.392961  9.076519  7.765809  6.634475 11.113498 11.273646
##  [9199]  9.232302  5.981513 10.253961 12.491857  9.861230 10.816529 11.449057
##  [9206] 11.208550 11.177323 13.905330 11.692089  6.031362 10.178932  8.461469
##  [9213]  9.785891  7.631107  7.079991 12.952561  9.672335  9.008991  8.015377
##  [9220] 11.665264  8.192333 13.445070 11.994000 17.331988 10.041194  8.126369
##  [9227]  9.226303 12.101124  8.988359 10.822658  5.446920 10.216286 12.329476
##  [9234] 14.469386 14.370982  9.730877  9.960948 10.026041  7.033651  6.637293
##  [9241] 12.056733 14.454488 12.098374 11.262892 13.822772 11.243340 15.238689
##  [9248]  9.424862 16.029842  9.859376 12.006062 13.173342  7.665251  7.767490
##  [9255] 12.252433 11.693297  8.075019 10.018185  7.468015 10.435206  7.176193
##  [9262]  8.365268 14.253915 10.022563 11.933566  9.018663  9.146024  8.519390
##  [9269] 10.767623  9.250061  6.352138  6.581956  7.663282  9.527901 14.268306
##  [9276]  8.094882  8.454398 10.203520 11.897392  8.792046  8.503628 11.081049
##  [9283] 11.917839 10.609090 10.480947 11.269516 16.699703 12.101431  8.708630
##  [9290] 10.664579  8.711289  8.123893 14.515421 11.964120  8.935175  9.811884
##  [9297] 11.677876 14.154155  7.045156  7.385825 13.368323 10.142006 14.260335
##  [9304]  9.743987 15.049638 10.615729 10.340728 11.921366  9.833367  6.548354
##  [9311] 12.054807  9.428954  7.974650  8.011661  9.217070  7.612696  8.863713
##  [9318] 11.715777 11.351908 10.701278  9.760529 11.553089 13.541378 12.720299
##  [9325]  7.712853 16.731702  8.310478  8.759343  7.972032  9.544371 10.594277
```

```
## [9332] 10.999126  7.582571 10.704601  6.880621  9.792194  7.460412 11.909733
## [9339]  8.874173  9.732203 12.826705 10.500422 10.660473  7.257623  9.135614
## [9346] 10.780412 14.149968 11.574010 10.517798 10.198452  7.671726  9.232288
## [9353] 14.795345  8.169225 12.213380 10.803000 11.766487 13.958751 10.488928
## [9360]  9.830405 14.819523 12.133286 11.663241 12.990854  6.508047 10.421183
## [9367] 11.506467 12.070360 11.314773 13.526693  9.809997 10.035320  8.652478
## [9374]  6.757240  8.383378 11.447410  9.614673  8.164524  9.241072  7.905639
## [9381]  9.950447  6.986374  8.983535 11.307366 14.141012 11.453860 12.988025
## [9388] 12.316439  9.996040 12.164934  7.923678  8.520266 14.323982  9.070768
## [9395]  8.831086 10.450400  8.752553 16.628810  9.589063  8.785295  8.632859
## [9402]  7.984668 12.025087  9.220511 14.665547 10.346046 10.352866 13.689320
## [9409] 14.177440 10.018294 15.281343  8.584565 12.463854 11.618763 11.579734
## [9416]  8.823746  8.104083 12.136155  9.645176 12.046695 11.762437  8.982794
## [9423]  9.757203  6.325826  9.360127  8.583001 10.462238 10.580263 11.175647
## [9430]  9.358421 15.508308 11.070356 11.161721  9.362710  8.850854  8.901503
## [9437]  9.840327  9.006155 17.205908 17.506028  5.727051 10.808678 12.352311
## [9444] 10.893123  8.599856  8.152233  9.790323 10.591308  9.605405 10.950660
## [9451]  7.174865 14.023343 10.650351  9.068327  9.734850 12.064158 10.274741
## [9458]  9.451824 17.043890  9.284146 15.105896 14.521299 15.067377  8.035110
## [9465] 10.121324 12.838856  6.619187 10.758935 10.861957  6.285019  8.061514
## [9472]  8.968876  7.845963 10.159723 10.653828 10.960958 11.033168 13.451934
## [9479]  9.876797  8.504421  7.334953 11.949707 10.236687 11.265027  6.698129
## [9486]  8.458051 10.665003  5.961753 12.886029 10.060486 11.300233  9.835419
## [9493]  6.557579  9.954495  9.772601  9.029453 12.497684  8.793714  9.952077
## [9500] 10.454762  7.577043 11.867187  9.361702 14.642096 10.938927 12.513864
## [9507] 13.922882 10.187876  7.169398  7.908145  8.821044 11.408140 14.732973
## [9514] 14.245961 10.029567  9.271495  9.173636  8.594501 11.637573  8.346669
## [9521] 12.558588  9.902291 12.129227 11.537760 11.264859 15.888933  9.072023
## [9528]  8.410861 10.528768  8.711445  9.982660 14.445607 12.956766  7.748250
## [9535] 13.060486  8.552317  9.004267 12.467153  7.220819  7.328086  9.173176
## [9542] 11.833517  9.854355 14.011591 17.471122 11.427113 11.502180 14.437642
## [9549] 11.755711 12.120269 10.426882  9.138373 10.825901  9.529279 14.250365
## [9556] 10.669266 11.503616  8.731905 10.504010 11.796734  9.935183 15.920972
## [9563]  8.047957  6.506867 13.159846  9.847290  9.578273 15.264753 17.921179
## [9570]  7.019316 13.822943 10.313371 11.209036 10.678620  8.922972 11.321671
## [9577] 10.529550 12.603703 15.628543 12.383448  7.736975  8.947639  9.109517
## [9584]  9.067798  8.979963 11.290334 14.053630 11.899971  5.378251 16.620353
## [9591]  9.769991  7.612665 11.932786  9.970473 11.824456 11.948540  7.065685
## [9598]  9.859018 12.799904  7.101455 11.472293 10.459747  8.895257 14.782991
## [9605]  8.418845  7.572288 12.795572 10.869131 10.311290  8.310632  4.389439
## [9612] 10.169343 12.718477 12.500005 13.974425 10.461256 13.497935 10.841796
## [9619] 12.170222  6.842108 11.647949  9.556816 11.673701  7.166075 12.344466
## [9626] 13.172746  7.461504  8.879375 11.335145 14.337443 11.834021  9.093683
## [9633] 13.241404 11.081675 11.057108  8.010462 10.760252  9.347752 12.487898
## [9640] 13.098246 14.744491 15.492202 14.096498  8.727725  7.239107  8.400332
## [9647] 14.518934  6.301688 11.355659 11.204049 12.856712 10.451426  9.113454
## [9654] 13.343539 16.673801 10.758288 12.194644  8.511556 15.080690 10.184298
## [9661] 11.668926 10.893287  9.064612 12.324155 10.206160  8.111640 10.269021
## [9668] 11.303774  8.739687 11.620973  9.448196 13.394061  5.496908 11.797894
## [9675]  7.875527  7.165039 10.502438 12.445761  7.218717 13.583203 13.599015
## [9682] 13.954531 10.300914 14.979054 14.809251  8.212817 15.555271 11.847557
## [9689]  9.644716  9.683976 12.611797  8.032749  9.658360  7.703704 13.212190
## [9696] 13.653221  8.720989 14.571791 13.660990 14.293874 17.246767 10.681722
## [9703] 10.158506 12.716706 14.800795  7.487782 11.808367  8.485203 12.376565
```

```
##  [9710] 10.314405 10.272563 11.667946  9.616591  9.173670  5.668861 13.255814
##  [9717] 12.544232 14.662796  6.805304 10.776311  7.413610 10.157807 13.681466
##  [9724] 11.241760 12.540633 10.834151  7.449736  9.571842  9.184484  9.202227
##  [9731]  7.556285  9.723020 11.375912 14.971892 10.337496 12.957249  8.952292
##  [9738]  9.932633  8.428513 11.792138  9.726588  9.264773 11.523512 10.145758
##  [9745]  7.054973 12.471290  9.494417  8.883820 20.831479  5.843339  9.366083
##  [9752] 10.921819 10.628026 12.351456  8.651128 10.311169 11.602341 12.297452
##  [9759]  7.714714  6.143130 15.304923  9.576067 10.133498 11.716177  8.077320
##  [9766]  7.424964  8.868571 12.689580  7.158977  7.476630 14.020110 12.621043
##  [9773]  6.808262 11.664908 14.016525 10.724666  8.776336 11.136633  8.490902
##  [9780]  9.049848 12.730341  7.018425 10.460202 11.640976 13.228525 19.534507
##  [9787]  9.911997 10.570708 11.959665  9.050783  7.850929  7.612624  6.728165
##  [9794] 10.046752 10.022683 13.571001 11.808858  7.304494 11.254858 13.405456
##  [9801]  8.607637  9.183958  8.498793  8.835079  6.625481  7.653614  9.001931
##  [9808] 10.844267  9.098532 11.439299  8.582547 11.279879  9.666114 10.898129
##  [9815]  8.430913  8.961296 12.633743  8.913726 11.018698  9.422290  9.031384
##  [9822] 14.822523 11.309309  9.765298  7.109623  8.699181 13.178904 13.442545
##  [9829] 11.310734 11.533199  9.748511 12.459820  7.850891 10.954319 10.539854
##  [9836]  9.308638  9.937744 11.256035  9.266035 10.301184  9.808376 10.265895
##  [9843]  8.939022 12.972531  9.595585 13.167449  9.830471 10.236351 10.984852
##  [9850] 11.489578  7.322607 10.568704 17.661718 11.934928 11.127198 15.309130
##  [9857]  9.589875 13.514919 10.704036  8.167392 10.490086  7.146267 14.079766
##  [9864] 10.917591 10.474293 11.648145 14.011557  9.902857  7.112953 11.105183
##  [9871]  7.967892  8.921617 14.221736  9.246357  7.575324 11.576276 10.477735
##  [9878] 10.701324  8.795060 15.519415  9.266748  8.121958  9.302125 15.374709
##  [9885] 14.740350 10.286685 10.714372  7.918391 10.363301  9.810998 17.640968
##  [9892] 12.580306 10.678086 16.477609  5.919670 10.118540  9.589090 12.577306
##  [9899]  8.307079 13.082017 12.475283  8.849948 10.042457 16.816224 13.633523
##  [9906] 11.486871 12.545412 11.972173 10.456078 12.097158  8.994643  8.710547
##  [9913]  9.083397  8.534899 12.913787 11.911924 11.135317 11.174259  9.616890
##  [9920]  8.571082 10.487571 12.804509  8.954752 10.275685 11.360846 10.122477
##  [9927]  9.279372  8.581798  9.153183  9.436900  7.843281  9.938014 11.912864
##  [9934] 12.178884 11.114902 10.944113 10.182076 15.577359  8.948289  5.410097
##  [9941]  8.913815 16.101285  9.328647 13.617774 10.393494  9.009761  9.210412
##  [9948]  9.285750 13.153012  7.300861 10.386645  9.406469 13.087802 11.418824
##  [9955]  9.658334  9.474832  6.514655 12.020473 11.560697 12.976736 10.120057
##  [9962] 11.527398 10.314103 10.340221 12.733936  9.462496 11.848234 12.691200
##  [9969] 14.065886  9.976986  7.590248  7.251338 13.102826 13.366568 13.036220
##  [9976] 18.557540 10.845910  8.257237 12.084692 12.650369  9.984619 10.692373
##  [9983] 15.391979  9.536281 14.253832  8.630287 11.442555 11.609497 10.698622
##  [9990] 11.031284 12.743109  6.864116  9.391278  7.604453 12.022395 11.839553
##  [9997] 10.030519 12.030873 15.229160  6.058428
```

```r
mean(a)
```

```
## [1] 10.649
```
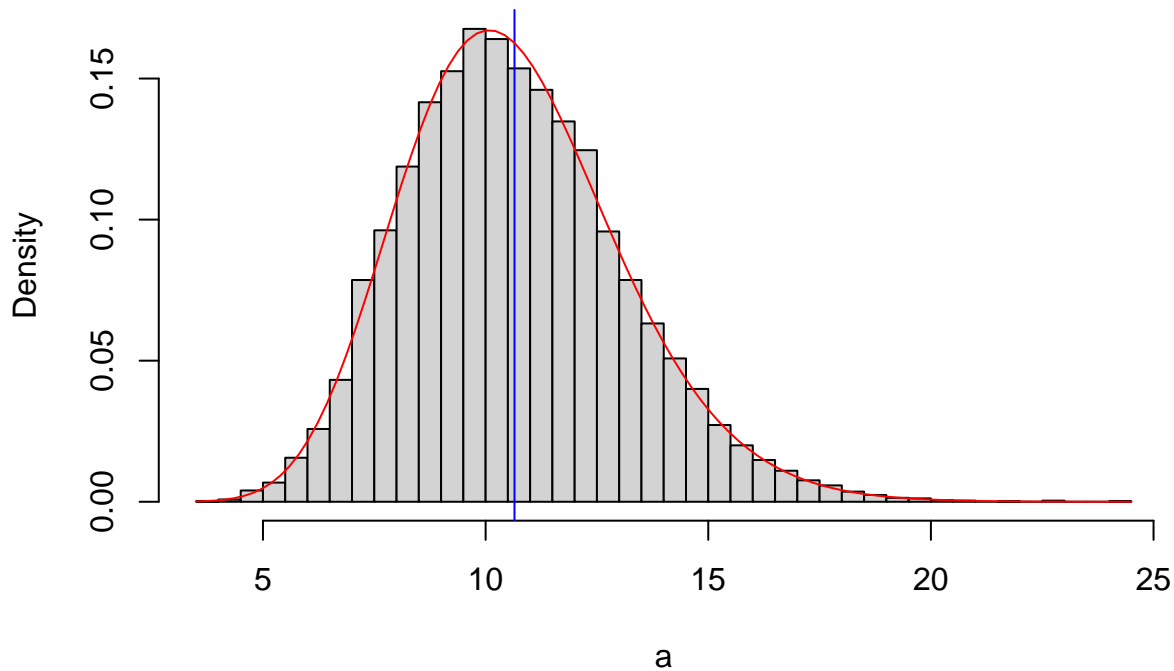
```r
var(a)
```

```
## [1] 6.03029
```

4. Plot the histogram of the random values, and add the curve of the theoretical probability density function.

```r
hist(a, probability = TRUE, n=31)
abline(v=mean(a), col='blue')
```

```r
curve(dgamma(x,shape=19, scale=.56), add=TRUE, col="Red")
```

Histogram of a

5. Apply your `gamma.est` function to your random sample. Report the estimated parameters and how far they are from the true values.

```r
gamma.est(a)
```

```
##       shape       scale
## 18.8052821   0.5662773
```

```r
Shape_True_Val<-19
Scale_True_Val<-.56
discrepancy_shape<-abs(Shape_True_Val-18.8052821)
discrepancy_shape
```

```
## [1] 0.1947179
```

```r
discrepancy_Scale<-abs(Scale_True_Val-.5662773)
discrepancy_Scale
```

```
## [1] 0.0062773
```

6. Write a function, `gamma.est.se`, to calculate the standard error of your estimates of the gamma parameters, on simulated data drawn from the gamma distribution. It should take the following arguments: true shape parameter `shape` (or a), true scale parameter `scale` (or s), size of each sample `n`, and number of repetitions at that sample size `B`. It should return two standard errors, one for the shape parameter a and one for the scale parameter s. (These can be either in a vector or in a list, but should be named clearly.) It should call a function `gamma.est.sim` which takes the same arguments as `gamma.est.se`, and returns an array with two rows and B columns, one row holding shape estimates and the other row scale estimates. Your `gamma.est.se` function should not, itself, estimate any parameters or generate any random values

```
gamma.est.se <- function (shape, scale, n, B) {
    se.shape <- sd(gamma.est.rep(shape, scale, n, B)[1,])
    se.scale <- sd(gamma.est.rep(shape, scale, n, B)[2,])
    return(c(se.shape, se.scale))
}
```

Part II - Testing with a stub

To check that `gamma.est.se` works properly, write a *stub* or *dummy* version of `gamma.est.sim`, which takes the correct arguments and returns an array of the proper size, but whose entries are fixed so that it's easy for us to calculate what `gamma.est.se` ought to do.

7. Write `gamma.est.sim` so that the entries in the first row of the returned array alternate between `shape` and `shape+1`, and those in the second row alternate between `scale` and `scale+n`. For example `gamma.est.sim(2,1,10,10)` should return (row names are optional)

```
##         [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10]
## shapes    2    3    2    3    2    3    2    3    2     3
## scales    1   11    1   11    1   11    1   11    1    11
```

and `gamma.est.sim(2,8,5,7)` should return

```
##      [,1] [,2] [,3] [,4] [,5] [,6] [,7]
## [1,]    2    3    2    3    2    3    2
## [2,]    8   13    8   13    8   13    8
```

```
gamma.est.rep <- function(shape, scale, n, B) {
    res.shape <- c()
    res.scale <- c()
    for (i in 1:B) {
        if (i%%2 != 0) {
            res.shape <- c(res.shape, shape)
            res.scale <- c(res.scale, scale)
        }
        else {
            res.shape <- c(res.shape, shape + 1)
            res.scale <- c(res.scale, scale + n)
        }
    }
    return(rbind(res.shape, res.scale))
}
```

8. Calculate the standard deviations of each *row* in the two arrays above.

```
apply(gamma.est.rep(2,1,10,10), 1, sd)
```

```
## res.shape res.scale
## 0.5270463 5.2704628
```

```
apply(gamma.est.rep(2,8,5,7), 1, sd)
```

```
## res.shape res.scale
## 0.5345225 2.6726124
```

9. Run your `gamma.est.se`, with this version of `gamma.est.sim`. Do its standard errors match the standard deviations you just calculated? Should they?

```r
gamma.est.se(2,1,10,10)
```

```
## [1] 0.5270463 5.2704628
```

```r
gamma.est.se(2,8,5,7)
```

```
## [1] 0.5345225 2.6726124
```

Yes,Yes

Part III - Replacing the stub

10. Write the actual `gamma.est.sim`. Each of the B columns in its output should be the result of applying `gamma.est` to a vector of `n` random numbers generated by a different call to `rgamma`, all with the same shape and scale parameters.

```r
gamma.est.rep <- function(shape,scale,n,B) {
    return(replicate(B, gamma.est(rgamma(n, shape = shape, scale = scale))))
}
```

11. Run `gamma.est.se`, calling your new `gamma.est.sim`, with shape=2, scale=1, n=10 and B=1e5. Check that the standard error for `shape` is approximately 1.6 and that for `scale` approximately 0.54. Explain why your answers are not exactly 1.6 and 0.54.

```r
gamma.est.se(shape = 2, scale = 1, n = 10, B = 1e5)
```

```
## [1] 1.6094726 0.5429386
```

```r
estimates.F <- gamma.est(subset(cats, cats$Sex == "F")$Hwt)
se.F <- gamma.est.se(shape = estimates.F["shape"], scale = estimates.F["scale"], n = length(subset(cats
se.F
```

```
## [1] 10.49371354  0.04227087
```

```r
estimates.M <- gamma.est(subset(cats, cats$Sex == "M")$Hwt)
se.M <- gamma.est.se(shape = estimates.M["shape"], scale = estimates.M["scale"], n = length(subset(cats
se.M
```

```
## [1] 3.04130301 0.08545066
```

```r
se.diff.shape <- sqrt(se.F[1]^2 + se.M[1]^2)
se.diff.shape
```

```
## [1] 10.92555
```

```r
se.diff.scale <- sqrt(se.F[2]^2 + se.M[2]^2)
se.diff.scale
```

```
## [1] 0.09533437
```

```r
ratio.shape <- (se.F[1] - se.M[1])/se.diff.shape
ratio.shape
```

```
## [1] 0.6821088
```

```r
ratio.scale <- (se.F[2] - se.M[2])/se.diff.scale
ratio.scale
```

```
## [1] -0.45293
```