Lab 1

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You should have RStudio installed to edit this file. You will write code in places marked "TO-DO" to complete the problems. Most of this will be a pure programming assignment but there are some questions that instead ask you to "write a few sentences". This is a W class! The tools for the solutions to these problems can be found in the class practice lectures. I prefer you to use the methods I taught you. If you google and find esoteric code you don't understand, this doesn't do you too much good.

To "hand in" the homework, you should first download this file. The best way to do this is by cloning the class repository then copying this file from the folder of that clone into the folder that is your personal class repository. Then do the assignment by filling in the TO-DO's. After you're done, compile this file into a PDF (use the "knit to PDF" button on the submenu above). This PDF will include output of your code. Then push the PDF and this Rmd file by the deadline to your github repository in a directory called "labs".

Basic R Skills

Print out the numerical constant pi with ten digits after the decimal point using the internal constant pi.

```
print(pi, digits = 10)
```

```
## [1] 3.141592654
```

Sum up the first 103 terms of the series 1 + 1/2 + 1/4 + 1/8 + …

```
sum(1/(2^(0:103)))
```

```
## [1] 2
```

Find the product of the first 37 terms in the sequence 1/3, 1/6, 1/9 …

```
prod(1/(3*(1:37)))
```

```
## [1] 1.613529e-61
```

Find the product of the first 387 terms of 1 * 1/2 * 1/4 * 1/8 * …

```
prod(1/(2^(0:386)))
```

```
## [1] 0
```

Is this answer *exactly* correct?

No, this answer is not exactly correct as it is a numerical underflow which means that the number is too small for R to actually store it.

Figure out a means to express the answer more exactly. Not compute exactly, but express more exactly.

```
-log(2)*sum((0:386))
```

```
## [1] -51771.86
```

Create the sequence x = [Inf, 20, 18, ..., -20].

```
c(Inf, seq(from = 20,to = -20, by = -2))
```

```
##  [1] Inf  20  18  16  14  12  10   8   6   4   2   0  -2  -4  -6  -8 -10 -12 -14
## [20] -16 -18 -20
```

Create the sequence x = [log_3(Inf), log_3(100), log_3(98), ... log_3(-20)].

```
x=log(c(Inf, seq(from = (100),to =(-20), by = -2)), base =3)
```

```
## Warning: NaNs produced
```

```
x
```

```
##  [1]       Inf 4.1918065 4.1734173 4.1546488 4.1354851 4.1159093 4.0959033
##  [8] 4.0754476 4.0545216 4.0331033 4.0111687 3.9886925 3.9656473 3.9420034
## [15] 3.9177289 3.8927893 3.8671470 3.8407614 3.8135881 3.7855785 3.7566796
## [22] 3.7268330 3.6959745 3.6640330 3.6309298 3.5965770 3.5608768 3.5237190
## [29] 3.4849796 3.4445178 3.4021735 3.3577628 3.3110736 3.2618595 3.2098317
## [36] 3.1546488 3.0959033 3.0331033 2.9656473 2.8927893 2.8135881 2.7268330
## [43] 2.6309298 2.5237190 2.4021735 2.2618595 2.0959033 1.8927893 1.6309298
## [50] 1.2618595 0.6309298      -Inf       NaN       NaN       NaN       NaN
## [57]       NaN       NaN       NaN       NaN       NaN       NaN
```

Comment on the appropriateness of the non-numeric values.

NAN occurs because you cannot take the log of a negative number. -Inf occurs when you take the log of 0.

Create a vector of booleans where the entry is true if x[i] is positive and finite.

```
x>0 & is.finite(x)
```

```
##  [1] FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
 TRUE
## [13]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
 TRUE
## [25]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
 TRUE
## [37]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
 TRUE
## [49]  TRUE  TRUE  TRUE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
FALSE
## [61] FALSE FALSE
```

Locate the indices of the non-real numbers in this vector. Hint: use the which function. Don't hesitate to use the documentation via ?which.

```
which(is.nan(x) | is.infinite(x))
```

```
##  [1]  1 52 53 54 55 56 57 58 59 60 61 62
```

Locate the indices of the infinite quantities in this vector.

```
which(is.infinite(x))
```

```
## [1]  1 52
```

Locate the indices of the min and max in this vector. Hint: use the which.min and which.max functions.

```
which.min(x)
```

```
## [1] 52
```

```
which.max(x)
```

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

Count the number of unique values in x.

```
length(unique(x))
```

```
## [1] 53
```

Cast x to a factor. Do the number of levels make sense?

```
factor(x)
```

```
##  [1] Inf              4.19180654857877  4.1734172518943   4.15464876785729
##  [5] 4.13548512895119  4.11590933734319  4.09590327428938  4.07544759935851
##  [9] 4.05452163806914  4.03310325630434  4.01116871959141  3.98869253500376
## [13] 3.96564727304425  3.94200336638929  3.91772888178973  3.89278926071437
## [17] 3.86714702345081  3.84076143030548  3.81358809221559  3.78557852142874
## [21] 3.75667961082847  3.72683302786084  3.69597450568212  3.66403300987579
## [25] 3.63092975357146  3.59657702661571  3.56087679500731  3.52371901428583
## [29] 3.48497958377173  3.44451784578705  3.40217350273288  3.3577627814323
## [33] 3.31107361281783  3.26185950714291  3.20983167673402  3.15464876785729
## [37] 3.09590327428938  3.03310325630434  2.96564727304425  2.89278926071437
## [41] 2.8135880922156   2.72683302786084  2.63092975357146  2.52371901428583
## [45] 2.40217350273288  2.26185950714291  2.09590327428938  1.89278926071437
## [49] 1.63092975357146  1.26185950714291  0.630929753571457 -Inf
## [53] NaN             NaN             NaN             NaN
## [57] NaN             NaN             NaN             NaN
## [61] NaN             NaN
## 53 Levels: -Inf 0.630929753571457 1.26185950714291 ... NaN
```

Cast x to integers. What do we learn about R's infinity representation in the integer data type?

```
as.integer(x)
```

```
## Warning: NAs introduced by coercion to integer range
```

```
##  [1] NA  4  4  4  4  4  4  4  4  4  4  3  3  3  3  3  3  3  3  3  3  3  3
## [26]  3  3  3  3  3  3  3  3  3  3  3  3  2  2  2  2  2  2  2  2  1  1  1
## [51]  0 NA NA NA NA NA NA NA NA NA NA NA
```

```
# We learn that R uses -Inf and Inf to represent negative and positive infinity and it doesn't display so in the integer data type.
```

Use x to create a new vector y containing only the real numbers in x.

```
y=x[which(!is.nan(x) & is.finite(x))]
y
```

```
##  [1] 4.1918065 4.1734173 4.1546488 4.1354851 4.1159093 4.0959033 4.0754476
##  [8] 4.0545216 4.0331033 4.0111687 3.9886925 3.9656473 3.9420034 3.9177289
## [15] 3.8927893 3.8671470 3.8407614 3.8135881 3.7855785 3.7566796 3.7268330
## [22] 3.6959745 3.6640330 3.6309298 3.5965770 3.5608768 3.5237190 3.4849796
## [29] 3.4445178 3.4021735 3.3577628 3.3110736 3.2618595 3.2098317 3.1546488
## [36] 3.0959033 3.0331033 2.9656473 2.8927893 2.8135881 2.7268330 2.6309298
## [43] 2.5237190 2.4021735 2.2618595 2.0959033 1.8927893 1.6309298 1.2618595
## [50] 0.6309298
```

Use the left rectangle method to numerically integrate x^2 from 0 to 1 with rectangle width size 1e-6.

```
sum(((seq(from=0,to=1-1e-7,by=1e-7))^2))*1e-7
```

```
## [1] 0.3333333
```

```
# Ysed 1e -7 instead to have it be closer to 0.333333.
```

Calculate the average of 100 realizations of standard Bernoullis in one line using the sample function.

```
mean(sample(c(0,1),size=100,replace=TRUE))
```

```
## [1] 0.49
```

Calculate the average of 500 realizations of Bernoullis with p = 0.9 in one line using the sample and mean functions.

```
mean(sample(c(0,1),size=500,replace=TRUE, prob=c(0.1,0.9)))
```

```
## [1] 0.878
```

Calculate the average of 1000 realizations of Bernoullis with p = 0.9 in one line using rbinom.

```
mean(rbinom(n=1000,size=1,prob=0.9))
```

```
## [1] 0.898
```

In class we considered a variable x_3 which measured "criminality". We imagined L = 4 levels "none", "infraction", "misdimeanor" and "felony". Create a variable x_3 here with 100 random elements (equally probable). Create it as a nominal (i.e. unordered) factor.

```
x_3=as.factor(sample(c("none","infraction","misdimeanor","felony"),size=100, replace=TRUE))
x_3
```

```
##   [1] felony      infraction  felony      felony      misdimeanor infraction
##   [7] none        none        felony      felony      infraction  misdimeanor
##  [13] misdimeanor none        infraction  misdimeanor felony      felony
##  [19] infraction  felony      none        felony      infraction  misdimeanor
##  [25] felony      none        infraction  felony      misdimeanor felony
##  [31] infraction  felony      infraction  misdimeanor none        felony
##  [37] misdimeanor felony      felony      infraction  misdimeanor none
##  [43] infraction  felony      infraction  felony      misdimeanor felony
##  [49] infraction  infraction  felony      none        infraction  felony
##  [55] misdimeanor felony      infraction  felony      none        none
##  [61] infraction  misdimeanor misdimeanor none        felony      felony
##  [67] infraction  infraction  misdimeanor misdimeanor none        infraction
##  [73] felony      felony      infraction  misdimeanor infraction  misdimeanor
##  [79] none        felony      infraction  none        none        none
##  [85] none        none        none        infraction  felony      none
##  [91] infraction  felony      none        none        none        felony
##  [97] felony      misdimeanor felony      felony
## Levels: felony infraction misdimeanor none
```

Use x_3 to create x_3_bin, a binary feature where 0 is no crime and 1 is any crime.

```
x_3_bin=x_3!="none"
x_3_bin
```

```
##   [1]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE  TRUE  TRUE  TRUE
 TRUE
##  [13]  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE
 TRUE
##  [25]  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE
 TRUE
##  [37]  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE
 TRUE
##  [49]  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE
FALSE
##  [61]  TRUE  TRUE  TRUE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE
 TRUE
##  [73]  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE  TRUE  TRUE FALSE FALSE
FALSE
##  [85] FALSE FALSE FALSE  TRUE  TRUE FALSE  TRUE  TRUE FALSE FALSE FALSE
 TRUE
##  [97]  TRUE  TRUE  TRUE  TRUE
```

```
as.numeric(x_3_bin)
```

```
##   [1] 1 1 1 1 1 1 0 0 1 1 1 1 1 0 1 1 1 1 1 1 0 1 1 1 1 0 1 1 1 1 1 1 1 1 1 0 1 1
##  [38] 1 1 1 1 0 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 0 0 1 1 1 0 1 1 1 1 1 1 1 0 1 1 1
##  [75] 1 1 1 1 0 1 1 0 0 0 0 0 0 1 1 0 1 1 0 0 0 1 1 1 1 1
```

Use x_3 to create x_3_ord, an ordered factor variable. Ensure the proper ordinal ordering.

```
x_3_ord=factor(x_3,levels=c("none","infraction","misdimeanor","felony"), ordered=TRUE)
x_3_ord
```

```
##   [1] felony      infraction  felony      felony      misdimeanor infraction
##   [7] none        none        felony      felony      infraction  misdimeanor
##  [13] misdimeanor none        infraction  misdimeanor felony      felony
##  [19] infraction  felony      none        felony      infraction  misdimeanor
##  [25] felony      none        infraction  felony      misdimeanor felony
##  [31] infraction  felony      infraction  misdimeanor none        felony
##  [37] misdimeanor felony      felony      infraction  misdimeanor none
##  [43] infraction  felony      infraction  felony      misdimeanor felony
##  [49] infraction  infraction  felony      none        infraction  felony
##  [55] misdimeanor felony      infraction  felony      none        none
##  [61] infraction  misdimeanor misdimeanor none        felony      felony
```

```
## [67] infraction infraction misdimeanor misdimeanor none      infraction
## [73] felony     felony     infraction misdimeanor infraction misdimeanor
## [79] none       felony     infraction none       none       none
## [85] none       none       none       infraction felony     none
## [91] infraction felony     none       none       none       felony
## [97] felony     misdimeanor felony     felony
## Levels: none < infraction < misdimeanor < felony
```

Convert this variable into three binary variables without any information loss and put them into a data matrix.

```
x = matrix(nrow = length(x_3), ncol = 3)
x[,1]= as.numeric(x_3 == "infraction")
x[,2]= as.numeric(x_3 == "misdemeanor")
x[,3]= as.numeric(x_3 == "felony")
x
```

```
##       [,1] [,2] [,3]
##  [1,]    0    0    1
##  [2,]    1    0    0
##  [3,]    0    0    1
##  [4,]    0    0    1
##  [5,]    0    0    0
##  [6,]    1    0    0
##  [7,]    0    0    0
##  [8,]    0    0    0
##  [9,]    0    0    1
## [10,]    0    0    1
## [11,]    1    0    0
## [12,]    0    0    0
## [13,]    0    0    0
## [14,]    0    0    0
## [15,]    1    0    0
## [16,]    0    0    0
## [17,]    0    0    1
## [18,]    0    0    1
## [19,]    1    0    0
## [20,]    0    0    1
## [21,]    0    0    0
## [22,]    0    0    1
## [23,]    1    0    0
## [24,]    0    0    0
## [25,]    0    0    1
## [26,]    0    0    0
## [27,]    1    0    0
## [28,]    0    0    1
## [29,]    0    0    0
## [30,]    0    0    1
## [31,]    1    0    0
## [32,]    0    0    1
## [33,]    1    0    0
## [34,]    0    0    0
## [35,]    0    0    0
## [36,]    0    0    1
## [37,]    0    0    0
## [38,]    0    0    1
## [39,]    0    0    1
## [40,]    1    0    0
## [41,]    0    0    0
## [42,]    0    0    0
## [43,]    1    0    0
## [44,]    0    0    1
## [45,]    1    0    0
## [46,]    0    0    1
## [47,]    0    0    0
## [48,]    0    0    1
## [49,]    1    0    0
## [50,]    1    0    0
## [51,]    0    0    1
## [52,]    0    0    0
## [53,]    1    0    0
## [54,]    0    0    1
## [55,]    0    0    0
## [56,]    0    0    1
## [57,]    1    0    0
## [58,]    0    0    1
## [59,]    0    0    0
## [60,]    0    0    0
## [61,]    1    0    0
```

```
## [62,]   0   0   0
## [63,]   0   0   0
## [64,]   0   0   0
## [65,]   0   0   1
## [66,]   0   0   1
## [67,]   1   0   0
## [68,]   1   0   0
## [69,]   0   0   0
## [70,]   0   0   0
## [71,]   0   0   0
## [72,]   1   0   0
## [73,]   0   0   1
## [74,]   0   0   1
## [75,]   1   0   0
## [76,]   0   0   0
## [77,]   1   0   0
## [78,]   0   0   0
## [79,]   0   0   0
## [80,]   0   0   1
## [81,]   1   0   0
## [82,]   0   0   0
## [83,]   0   0   0
## [84,]   0   0   0
## [85,]   0   0   0
## [86,]   0   0   0
## [87,]   0   0   0
## [88,]   1   0   0
## [89,]   0   0   1
## [90,]   0   0   0
## [91,]   1   0   0
## [92,]   0   0   1
## [93,]   0   0   0
## [94,]   0   0   0
## [95,]   0   0   0
## [96,]   0   0   1
## [97,]   0   0   1
## [98,]   0   0   0
## [99,]   0   0   1
## [100,]   0   0   1
```

What should the sum of each row be (in English)?

The sum of each row should be 0 or 1.

Verify that.

```
rowSums(x)
##   [1] 1 1 1 1 0 1 0 0 1 1 1 0 0 0 1 0 1 1 1 1 0 1 1 0 1 0 1 1 0 1 1 1 1 0 0 1 0
##  [38] 1 1 1 0 0 1 1 1 1 0 1 1 1 1 0 1 1 0 1 1 1 0 0 1 0 0 0 1 1 1 1 0 0 0 1 1 1
##  [75] 1 0 1 0 0 1 1 0 0 0 0 0 0 1 1 0 1 1 0 0 0 1 1 0 1 1
```

How should the column sum look (in English)?

It should be between 0 and 100.

Verify that.

```
colSums(x)
## [1] 25  0 34
```

Generate a matrix with 100 rows where the first column is realization from a normal with mean 17 and variance 38, the second column is uniform between -10 and 10, the third column is poisson with mean 6, the fourth column in exponential with lambda of 9, the fifth column is binomial with n = 20 and p = 0.12 and the sixth column is a binary variable with exactly 24% 1's dispersed randomly. Name the rows the entries of the fake_first_names vector.

```
fake_first_names = c(
 "Sophia", "Emma", "Olivia", "Ava", "Mia", "Isabella", "Riley",
 "Aria", "Zoe", "Charlotte", "Lily", "Layla", "Amelia", "Emily",
 "Madelyn", "Aubrey", "Adalyn", "Madison", "Chloe", "Harper",
 "Abigail", "Aaliyah", "Avery", "Evelyn", "Kaylee", "Ella", "Ellie",
 "Scarlett", "Arianna", "Hailey", "Nora", "Addison", "Brooklyn",
 "Hannah", "Mila", "Leah", "Elizabeth", "Sarah", "Eliana", "Mackenzie",
 "Peyton", "Maria", "Grace", "Adeline", "Elena", "Anna", "Victoria",
 "Camilla", "Lillian", "Natalie", "Jackson", "Aiden", "Lucas",
 "Liam", "Noah", "Ethan", "Mason", "Caden", "Oliver", "Elijah",
 "Grayson", "Jacob", "Michael", "Benjamin", "Carter", "James",
 "Jayden", "Logan", "Alexander", "Caleb", "Ryan", "Luke", "Daniel",
 "Jack", "William", "Owen", "Gabriel", "Matthew", "Connor", "Jayce",
```

```
 "Jack", "William", "Owen", "Gabriel", "Matthew", "Connor", "Jayce",
 "Isaac", "Sebastian", "Henry", "Muhammad", "Cameron", "Wyatt",
 "Dylan", "Nathan", "Nicholas", "Julian", "Eli", "Levi", "Isaiah",
 "Landon", "David", "Christian", "Andrew", "Brayden", "John",
 "Lincoln"
)
n=100
y = matrix(NA, nrow = n, ncol = 6)
rownames(x) = fake_first_names
y[,1] = rnorm(n, 17, sqrt(38))
y[,2] = runif(n,-10,10)
y[,3] = rpois(n,6)
y[,4] = rexp(n, 1/9)
y[,5] = rbinom(n, size = 20, prob = rep(.12,20))
y[,6] = sample(c(rep(0,76),rep(1,24)))
y
##             [,1]        [,2] [,3]        [,4] [,5] [,6]
##   [1,] 18.9307865 -8.17039310    6  1.95727693    2    0
##   [2,] 20.1057846  4.46765218    8  6.83653349    2    0
##   [3,]  8.2248212  2.28832108    9  6.98949441    4    1
##   [4,] 16.6250165  1.17532155    7 11.01134331    2    0
##   [5,] 22.7658874 -8.93198462    4  0.29870264    1    0
##   [6,] 21.6454971 -6.02495824    8  9.71305267    0    0
##   [7,] -0.2768735 -1.68533107    5 10.36163994    1    0
##   [8,] 18.9035005 -5.58395618    8  7.03490679    0    0
##   [9,] 16.7384113 -0.05140215    6  3.74561228    4    0
##  [10,] 13.0275485  5.34367813    5  0.25280339    0    0
##  [11,] 22.5577882 -0.46570398    5 24.21406746    7    1
##  [12,] 21.3073919  5.29700161    7 16.08525014    3    1
##  [13,] 23.9976794 -4.17949287    4  4.55011358    0    0
##  [14,] 18.3312959  3.62213862    3 10.58801486    1    1
##  [15,] 25.1250066  3.71268490    8  6.07576921    2    1
##  [16,] 13.3103956  1.29831477    3  4.78691084    2    0
##  [17,] 20.7345715 -7.71206352    4  6.05218787    5    1
##  [18,]  8.1434408 -5.74618702    9  2.61164122    0    0
##  [19,] 22.6340644  8.77767872    4  1.40407442    4    0
##  [20,] 17.1807424 -3.05339273    6  0.52905269    3    0
##  [21,] 14.6472028  7.72241740    7 15.91430564    2    1
##  [22,] 29.1872532 -4.30402284    6  2.59012358    2    0
##  [23,] 15.1491171 -7.82104388   10  2.54292624    2    1
##  [24,]  8.3097837 -8.69508238    5  7.90788232    5    0
##  [25,] 13.0775896  1.07865967    5 16.15820239    1    0
##  [26,] 21.9471778 -6.06247863    9  8.19377243    2    0
##  [27,] 17.7697486  0.30213623    9  6.95896896    2    0
##  [28,] 22.3021810 -9.98265691    3  0.15878052    4    0
##  [29,] 18.9112499  6.84478080    7  8.32778754    1    1
##  [30,] 26.4689328  6.82910628    3  0.69180146    3    1
##  [31,] 20.6194914 -0.91360709    5  3.24627303    0    0
##  [32,] 20.2611287  0.25699873    5  7.93622303    1    1
##  [33,] 19.5008604 -6.89593188    4 43.52466209    6    0
##  [34,] 16.8553970  2.35597667    8 24.99659302    3    1
##  [35,] 23.7978193 -9.28423915    7  1.94149688    1    1
##  [36,] 12.2674620 -3.59152747   12 11.70761380    3    0
##  [37,]  9.7090250 -0.94195827    7  4.14485417    6    1
##  [38,]  8.4008842 -7.45051784    9  0.31398728    0    0
##  [39,] 27.8296052  0.50546975    2  2.44974774    0    0
##  [40,] 15.2963559 -8.73622641    9 10.90285533    4    0
##  [41,]  8.9084791 -3.47027671    4  0.48930370    1    0
##  [42,] 11.9067739 -7.75918438    4  7.66125763    0    0
##  [43,] 14.0807623 -5.80415209    2  8.78069844    3    1
##  [44,] 14.6943169  0.74401514    8 13.67026559    1    0
##  [45,] 25.2720591  9.22008693    7 15.48379650    1    1
##  [46,] 13.0025492 -6.69970230    8  3.66198742    4    0
##  [47,] 11.8537339 -6.50151385    7  8.96498440    1    1
##  [48,] 12.1847543 -7.84545010    8  1.97037053    4    0
##  [49,] 13.9614174 -4.33209428    7  0.12936233    2    0
##  [50,]  5.3599822 -3.84244550    9  5.24542099    0    0
##  [51,] 27.0303561  9.37126390    3 27.90085691    2    1
##  [52,] 21.5848651 -7.73281400    8  0.91400203    5    0
##  [53,] 19.5903532 -0.94434310    8  4.58126521    6    0
##  [54,] 26.6908800 -7.97893138    6  0.42178003    0    0
##  [55,] 22.3351917 -6.72276761    7  3.49842881    3    0
##  [56,] 20.4500568  2.68564343    4  0.07031399    2    0
##  [57,] 15.7665171  9.21783407    2  1.97048379    2    0
##  [58,] 24.6812479  4.08168200    5  5.44978109    4    0
##  [59,] 25.3028298  4.42330596    6  2.57357778    3    0
```

```
##  [60,] 12.3605657  4.96228885    7 14.47639097    1    1
##  [61,]  8.5368538  4.65232183    5 15.14386103    0    0
##  [62,] 14.3348896 -1.02838465    5  1.99853234    1    0
##  [63,] 18.7420671  6.25705979    6 13.76241841    1    0
##  [64,] 13.6525743  2.32935080    3  3.10924334    4    0
##  [65,]  7.9485998 -9.35195155    7  6.41218144    1    0
##  [66,] 11.5399229  6.43379376    4  3.60855881    3    0
##  [67,] 12.7589324  2.83447547    3 14.06971540    3    0
##  [68,] 27.7542110 -1.65633817    2 20.51633287    1    0
##  [69,] 16.0158669  1.45913682   10 41.85282700    5    0
##  [70,] 20.2187020  4.52997596    4  2.20923819    6    0
##  [71,] 22.0298628 -4.79733252    7 22.54096509    3    0
##  [72,] 14.6085029 -3.06968187   11 15.70968107    1    0
##  [73,] 15.3600002 -6.80387173    3  1.54726415    4    0
##  [74,] 22.3321994  8.70164135    4  6.34795786    4    0
##  [75,] 33.1304299  7.77393036    2  0.15498853    1    0
##  [76,] 15.0559283  0.85991936    6  8.56677711    6    0
##  [77,] 11.6429747  0.69303208    4  0.77604973    5    1
##  [78,] 22.5276180 -3.51193645    5 21.87357734    3    0
##  [79,] 14.7120144 -3.38300685    7 25.51302727    1    1
##  [80,] 24.5095951 -0.23516277    6  2.33391135    2    0
##  [81,] 11.1466290  8.38526845    7 13.65413296    3    0
##  [82,] 17.5660355  9.02421709    7  2.77986598    0    0
##  [83,] 28.1009565 -8.70070586    5  6.85782578    3    0
##  [84,] 11.4983501 -2.87826696    4  0.74539262    4    0
##  [85,]  9.3354608 -6.18761083    5  2.93363205    3    0
##  [86,] 16.7950026 -4.12997475    4  2.73346375    2    0
##  [87,] 21.6503864  5.04895457    5  0.65285970    2    1
##  [88,] 13.6159642 -1.93765988    6 40.68772502    3    0
##  [89,] 12.2260132  1.52098848    4  3.68796451    1    1
##  [90,] 16.1490442 -0.97782707    1  5.66433632    1    0
##  [91,] 25.7978028 -7.73678374    7  2.50293855    3    0
##  [92,] 16.9746185 -2.03898142    3 27.83974425    2    0
##  [93,] 20.5761850  6.59269109    3  2.79581759    1    1
##  [94,] 17.6728153  6.95679010    5 11.78949017    3    0
##  [95,] 14.7465173  0.98578396    3 13.00479875    3    0
##  [96,] 21.5115770  8.18119011    5 27.44019703    3    0
##  [97,] 19.7179515  6.48290146   12 16.79676662    4    0
##  [98,] 13.7580453  7.63798419    5 11.22638479    6    0
##  [99,] 16.8494451  2.69990896   10  2.60419854    5    0
## [100,] 16.7191889  6.18191614   10 11.98425594    1    0
```

Create a data frame of the same data as above except make the binary variable a factor "DOMESTIC" vs "FOREIGN" for 0 and 1 respectively. Use RStudio's View function to ensure this worked as desired.

```
df = data.frame(y)
df$X6 = factor(df$X6, labels = c("DOMESTIC","FOREIGN"))
df
##            X1          X2 X3         X4 X5       X6
## 1   18.9307865 -8.17039310  6  1.95727693  2 DOMESTIC
## 2   20.1057846  4.46765218  8  6.83653349  2 DOMESTIC
## 3    8.2248212  2.28832108  9  6.98949441  4  FOREIGN
## 4   16.6250165  1.17532155  7 11.01134331  2 DOMESTIC
## 5   22.7658874 -8.93198462  4  0.29870264  1 DOMESTIC
## 6   21.6454971 -6.02495824  8  9.71305267  0 DOMESTIC
## 7   -0.2768735 -1.68533107  5 10.36163994  1 DOMESTIC
## 8   18.9035005 -5.58395618  8  7.03490679  0 DOMESTIC
## 9   16.7384113 -0.05140215  6  3.74561228  4 DOMESTIC
## 10  13.0275485  5.34367813  5  0.25280339  0 DOMESTIC
## 11  22.5577882 -0.46570398  5 24.21406746  7  FOREIGN
## 12  21.3073919  5.29700161  7 16.08525014  3  FOREIGN
## 13  23.9976794 -4.17949287  4  4.55011358  0 DOMESTIC
## 14  18.3312959  3.62213862  3 10.58801486  1  FOREIGN
## 15  25.1250066  3.71268490  8  6.07576921  2  FOREIGN
## 16  13.3103956  1.29831477  3  4.78691084  2 DOMESTIC
## 17  20.7345715 -7.71206352  4  6.05218787  5  FOREIGN
## 18   8.1434408 -5.74618702  9  2.61164122  0 DOMESTIC
## 19  22.6340644  8.77767872  4  1.40407442  4 DOMESTIC
## 20  17.1807424 -3.05339273  6  0.52905269  3 DOMESTIC
## 21  14.6472028  7.72241740  7 15.91430564  2  FOREIGN
## 22  29.1872532 -4.30402284  6  2.59012358  2 DOMESTIC
## 23  15.1491171 -7.82104388 10  2.54292624  2  FOREIGN
## 24   8.3097837 -8.69508238  5  7.90788232  5 DOMESTIC
## 25  13.0775896  1.07865967  5 16.15820239  1 DOMESTIC
## 26  21.9471778 -6.06247863  9  8.19377243  2 DOMESTIC
## 27  17.7697486  0.30213623  9  6.95896896  2 DOMESTIC
```

```
## 28  22.3021810 -9.98265691  3  0.15878052  4 DOMESTIC
## 29  18.9112499  6.84478080  7  8.32778754  1  FOREIGN
## 30  26.4689328  6.82910628  3  0.69180146  3  FOREIGN
## 31  20.6194914 -0.91360709  5  3.24627303  0 DOMESTIC
## 32  20.2611287  0.25699873  5  7.93622303  1  FOREIGN
## 33  19.5008604 -6.89593188  4 43.52466209  6 DOMESTIC
## 34  16.8553970  2.35597667  8 24.99659302  3  FOREIGN
## 35  23.7978193 -9.28423915  7  1.94149688  1  FOREIGN
## 36  12.2674620 -3.59152747 12 11.70761380  3 DOMESTIC
## 37   9.7090250 -0.94195827  7  4.14485417  6  FOREIGN
## 38   8.4008842 -7.45051784  9  0.31398728  0 DOMESTIC
## 39  27.8296052  0.50546975  2  2.44974774  0 DOMESTIC
## 40  15.2963559 -8.73622641  9 10.90285533  4 DOMESTIC
## 41   8.9084791 -3.47027671  4  0.48930370  1 DOMESTIC
## 42  11.9067739 -7.75918438  4  7.66125763  0 DOMESTIC
## 43  14.0807623 -5.80415209  2  8.78069844  3  FOREIGN
## 44  14.6943169  0.74401514  8 13.67026559  1 DOMESTIC
## 45  25.2720591  9.22008693  7 15.48379650  1  FOREIGN
## 46  13.0025492 -6.69970230  8  3.66198742  4 DOMESTIC
## 47  11.8537339 -6.50151385  7  8.96498440  1  FOREIGN
## 48  12.1847543 -7.84545010  8  1.97037053  4 DOMESTIC
## 49  13.9614174 -4.33209428  7  0.12936233  2 DOMESTIC
## 50   5.3599822 -3.84244550  9  5.24542099  0 DOMESTIC
## 51  27.0303561  9.37126390  3 27.90085691  2  FOREIGN
## 52  21.5848651 -7.73281400  8  0.91400203  5 DOMESTIC
## 53  19.5903532 -0.94434310  8  4.58126521  6 DOMESTIC
## 54  26.6908800 -7.97893138  6  0.42178003  0 DOMESTIC
## 55  22.3351917 -6.72276761  7  3.49842881  3 DOMESTIC
## 56  20.4500568  2.68564343  4  0.07031399  2 DOMESTIC
## 57  15.7665171  9.21783407  2  1.97048379  2 DOMESTIC
## 58  24.6812479  4.08168200  5  5.44978109  4 DOMESTIC
## 59  25.3028298  4.42330596  6  2.57357778  3 DOMESTIC
## 60  12.3605657  4.96228885  7 14.47639097  1  FOREIGN
## 61   8.5368538  4.65232183  5 15.14386103  0 DOMESTIC
## 62  14.3348896 -1.02838465  5  1.99853234  1 DOMESTIC
## 63  18.7420671  6.25705979  6 13.76241841  1 DOMESTIC
## 64  13.6525743  2.32935080  3  3.10924334  4 DOMESTIC
## 65   7.9485998 -9.35195155  7  6.41218144  1 DOMESTIC
## 66  11.5399229  6.43379376  4  3.60855881  3 DOMESTIC
## 67  12.7589324  2.83447547  3 14.06971540  3 DOMESTIC
## 68  27.7542110 -1.65633817  2 20.51633287  1 DOMESTIC
## 69  16.0158669  1.45913682 10 41.85282700  5 DOMESTIC
## 70  20.2187020  4.52997596  4  2.20923819  6 DOMESTIC
## 71  22.0298628 -4.79733252  7 22.54096509  3 DOMESTIC
## 72  14.6085029 -3.06968187 11 15.70968107  1 DOMESTIC
## 73  15.3600002 -6.80387173  3  1.54726415  4 DOMESTIC
## 74  22.3321994  8.70164135  4  6.34795786  4 DOMESTIC
## 75  33.1304299  7.77393036  2  0.15498853  1 DOMESTIC
## 76  15.0559283  0.85991936  6  8.56677711  6 DOMESTIC
## 77  11.6429747  0.69303208  4  0.77604973  5  FOREIGN
## 78  22.5276180 -3.51193645  5 21.87357734  3 DOMESTIC
## 79  14.7120144 -3.38300685  7 25.51302727  1  FOREIGN
## 80  24.5095951 -0.23516277  6  2.33391135  2 DOMESTIC
## 81  11.1466290  8.38526845  7 13.65413296  3 DOMESTIC
## 82  17.5660355  9.02421709  7  2.77986598  0 DOMESTIC
## 83  28.1009565 -8.70070586  5  6.85782578  3 DOMESTIC
## 84  11.4983501 -2.87826696  4  0.74539262  4 DOMESTIC
## 85   9.3354608 -6.18761083  5  2.93363205  3 DOMESTIC
## 86  16.7950026 -4.12997475  4  2.73346375  2 DOMESTIC
## 87  21.6503864  5.04895457  5  0.65285970  2  FOREIGN
## 88  13.6159642 -1.93765988  6 40.68772502  3 DOMESTIC
## 89  12.2260132  1.52098848  4  3.68796451  1  FOREIGN
## 90  16.1490442 -0.97782707  1  5.66433632  1 DOMESTIC
## 91  25.7978028 -7.73678374  7  2.50293855  3 DOMESTIC
## 92  16.9746185 -2.03898142  3 27.83974425  2 DOMESTIC
## 93  20.5761850  6.59269109  3  2.79581759  1  FOREIGN
## 94  17.6728153  6.95679010  5 11.78949017  3 DOMESTIC
## 95  14.7465173  0.98578396  3 13.00479875  3 DOMESTIC
## 96  21.5115770  8.18119011  5 27.44019703  3 DOMESTIC
## 97  19.7179515  6.48290146 12 16.79676662  4 DOMESTIC
## 98  13.7580453  7.63798419  5 11.22638479  6 DOMESTIC
## 99  16.8494451  2.69990896 10  2.60419854  5 DOMESTIC
## 100 16.7191889  6.18191614 10 11.98425594  1 DOMESTIC
```

Print out a table of the binary variable. Then print out the proportions of “DOMESTIC” vs “FOREIGN”.

```
print(y[ ,6])
##  [1] 0 0 1 0 0 0 0 0 0 0 1 1 0 1 1 0 1 0 0 0 1 0 1 0 0 0 0 0 1 1 0 1 0 1 1 0 1
## [38] 0 0 0 0 0 1 0 1 0 1 0 0 0 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## [75] 0 0 1 0 1 0 0 0 0 0 0 0 1 0 1 0 0 0 1 0 0 0 0 0 0 0
table(y[ ,6])
##
##  0  1
## 76 24
```

Print out a summary of the whole dataframe.

```
summary(y)
##        V1               V2               V3            V4
##  Min.   :-0.2769   Min.   :-9.9827   Min.   : 1.00   Min.   : 0.07031
##  1st Qu.:13.2522   1st Qu.:-5.7607   1st Qu.: 4.00   1st Qu.: 2.48964
##  Median :16.9150   Median :-0.3504   Median : 6.00   Median : 6.06398
##  Mean   :17.4916   Mean   :-0.4154   Mean   : 5.86   Mean   : 8.80051
##  3rd Qu.:21.7246   3rd Qu.: 4.4832   3rd Qu.: 7.00   3rd Qu.:12.23939
##  Max.   :33.1304   Max.   : 9.3713   Max.   :12.00   Max.   :43.52466
##        V5              V6
##  Min.   :0.00   Min.   :0.00
##  1st Qu.:1.00   1st Qu.:0.00
##  Median :2.00   Median :0.00
##  Mean   :2.44   Mean   :0.24
##  3rd Qu.:4.00   3rd Qu.:0.00
##  Max.   :7.00   Max.   :1.00
```

Let n = 50. Create a n x n matrix R of exactly 50% entries 0's, 25% 1's 25% 2's. These values should be in random locations.

```
R=matrix(data=sample(c(rep(0,50),rep(1,25),rep(2,25))),nrow=50,ncol=50,byrow=FALSE,dimnames=NULL)
R
##       [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
##  [1,]    2    0    2    0    2    0    2    0    2    0    2    0    2
##  [2,]    0    0    0    0    0    0    0    0    0    0    0    0    0
##  [3,]    0    1    0    1    0    1    0    1    0    1    0    1    0
##  [4,]    0    0    0    0    0    0    0    0    0    0    0    0    0
##  [5,]    2    2    2    2    2    2    2    2    2    2    2    2    2
##  [6,]    0    0    0    0    0    0    0    0    0    0    0    0    0
##  [7,]    1    1    1    1    1    1    1    1    1    1    1    1    1
##  [8,]    0    0    0    0    0    0    0    0    0    0    0    0    0
##  [9,]    2    0    2    0    2    0    2    0    2    0    2    0    2
## [10,]    1    0    1    0    1    0    1    0    1    0    1    0    1
## [11,]    0    1    0    1    0    1    0    1    0    1    0    1    0
## [12,]    0    2    0    2    0    2    0    2    0    2    0    2    0
## [13,]    0    1    0    1    0    1    0    1    0    1    0    1    0
## [14,]    0    0    0    0    0    0    0    0    0    0    0    0    0
## [15,]    0    0    0    0    0    0    0    0    0    0    0    0    0
## [16,]    0    2    0    2    0    2    0    2    0    2    0    2    0
## [17,]    1    2    1    2    1    2    1    2    1    2    1    2    1
## [18,]    1    2    1    2    1    2    1    2    1    2    1    2    1
## [19,]    0    2    0    2    0    2    0    2    0    2    0    2    0
## [20,]    1    0    1    0    1    0    1    0    1    0    1    0    1
## [21,]    0    0    0    0    0    0    0    0    0    0    0    0    0
## [22,]    2    0    2    0    2    0    2    0    2    0    2    0    2
## [23,]    0    0    0    0    0    0    0    0    0    0    0    0    0
## [24,]    0    1    0    1    0    1    0    1    0    1    0    1    0
## [25,]    2    1    2    1    2    1    2    1    2    1    2    1    2
## [26,]    0    1    0    1    0    1    0    1    0    1    0    1    0
## [27,]    2    0    2    0    2    0    2    0    2    0    2    0    2
## [28,]    2    0    2    0    2    0    2    0    2    0    2    0    2
## [29,]    2    0    2    0    2    0    2    0    2    0    2    0    2
## [30,]    0    0    0    0    0    0    0    0    0    0    0    0    0
## [31,]    0    0    0    0    0    0    0    0    0    0    0    0    0
## [32,]    2    2    2    2    2    2    2    2    2    2    2    2    2
## [33,]    2    1    2    1    2    1    2    1    2    1    2    1    2
## [34,]    2    0    2    0    2    0    2    0    2    0    2    0    2
## [35,]    1    0    1    0    1    0    1    0    1    0    1    0    1
## [36,]    0    1    0    1    0    1    0    1    0    1    0    1    0
## [37,]    0    2    0    2    0    2    0    2    0    2    0    2    0
## [38,]    1    2    1    2    1    2    1    2    1    2    1    2    1
## [39,]    0    0    0    0    0    0    0    0    0    0    0    0    0
## [40,]    0    0    0    0    0    0    0    0    0    0    0    0    0
## [41,]    2    1    2    1    2    1    2    1    2    1    2    1    2
## [42,]    0    1    0    1    0    1    0    1    0    1    0    1    0
## [43,]    0    0    0    0    0    0    0    0    0    0    0    0    0
## [44,]    1    1    1    1    1    1    1    1    1    1    1    1    1
```

```
## [44,]  1  2  1  2  1  2  1  2  1  2  1  2  1
## [45,]  1  2  1  2  1  2  1  2  1  2  1  2  1
## [46,]  1  1  1  1  1  1  1  1  1  1  1  1  1
## [47,]  2  2  2  2  2  2  2  2  2  2  2  2  2
## [48,]  0  0  0  0  0  0  0  0  0  0  0  0  0
## [49,]  1  2  1  2  1  2  1  2  1  2  1  2  1
## [50,]  0  1  0  1  0  1  0  1  0  1  0  1  0
##       [,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24] [,25]
## [1,]     0     2     0     2     0     2     0     2     0     2     0     2
## [2,]     0     0     0     0     0     0     0     0     0     0     0     0
## [3,]     1     0     1     0     1     0     1     0     1     0     1     0
## [4,]     0     0     0     0     0     0     0     0     0     0     0     0
## [5,]     2     2     2     2     2     2     2     2     2     2     2     2
## [6,]     0     0     0     0     0     0     0     0     0     0     0     0
## [7,]     1     1     1     1     1     1     1     1     1     1     1     1
## [8,]     0     0     0     0     0     0     0     0     0     0     0     0
## [9,]     0     2     0     2     0     2     0     2     0     2     0     2
## [10,]    0     1     0     1     0     1     0     1     0     1     0     1
## [11,]    1     0     1     0     1     0     1     0     1     0     1     0
## [12,]    2     0     2     0     2     0     2     0     2     0     2     0
## [13,]    1     0     1     0     1     0     1     0     1     0     1     0
## [14,]    0     0     0     0     0     0     0     0     0     0     0     0
## [15,]    0     0     0     0     0     0     0     0     0     0     0     0
## [16,]    2     0     2     0     2     0     2     0     2     0     2     0
## [17,]    2     1     2     1     2     1     2     1     2     1     2     1
## [18,]    2     1     2     1     2     1     2     1     2     1     2     1
## [19,]    2     0     2     0     2     0     2     0     2     0     2     0
## [20,]    0     1     0     1     0     1     0     1     0     1     0     1
## [21,]    0     0     0     0     0     0     0     0     0     0     0     0
## [22,]    0     2     0     2     0     2     0     2     0     2     0     2
## [23,]    0     0     0     0     0     0     0     0     0     0     0     0
## [24,]    1     0     1     0     1     0     1     0     1     0     1     0
## [25,]    1     2     1     2     1     2     1     2     1     2     1     2
## [26,]    1     0     1     0     1     0     1     0     1     0     1     0
## [27,]    0     2     0     2     0     2     0     2     0     2     0     2
## [28,]    0     2     0     2     0     2     0     2     0     2     0     2
## [29,]    0     2     0     2     0     2     0     2     0     2     0     2
## [30,]    0     0     0     0     0     0     0     0     0     0     0     0
## [31,]    0     0     0     0     0     0     0     0     0     0     0     0
## [32,]    2     2     2     2     2     2     2     2     2     2     2     2
## [33,]    1     2     1     2     1     2     1     2     1     2     1     2
## [34,]    0     2     0     2     0     2     0     2     0     2     0     2
## [35,]    0     1     0     1     0     1     0     1     0     1     0     1
## [36,]    1     0     1     0     1     0     1     0     1     0     1     0
## [37,]    2     0     2     0     2     0     2     0     2     0     2     0
## [38,]    2     1     2     1     2     1     2     1     2     1     2     1
## [39,]    0     0     0     0     0     0     0     0     0     0     0     0
## [40,]    0     0     0     0     0     0     0     0     0     0     0     0
## [41,]    1     2     1     2     1     2     1     2     1     2     1     2
## [42,]    1     0     1     0     1     0     1     0     1     0     1     0
## [43,]    0     0     0     0     0     0     0     0     0     0     0     0
## [44,]    1     1     1     1     1     1     1     1     1     1     1     1
## [45,]    2     1     2     1     2     1     2     1     2     1     2     1
## [46,]    1     1     1     1     1     1     1     1     1     1     1     1
## [47,]    2     2     2     2     2     2     2     2     2     2     2     2
## [48,]    0     0     0     0     0     0     0     0     0     0     0     0
## [49,]    2     1     2     1     2     1     2     1     2     1     2     1
## [50,]    1     0     1     0     1     0     1     0     1     0     1     0
##       [,26] [,27] [,28] [,29] [,30] [,31] [,32] [,33] [,34] [,35] [,36] [,37]
## [1,]     0     2     0     2     0     2     0     2     0     2     0     2
## [2,]     0     0     0     0     0     0     0     0     0     0     0     0
## [3,]     1     0     1     0     1     0     1     0     1     0     1     0
## [4,]     0     0     0     0     0     0     0     0     0     0     0     0
## [5,]     2     2     2     2     2     2     2     2     2     2     2     2
## [6,]     0     0     0     0     0     0     0     0     0     0     0     0
## [7,]     1     1     1     1     1     1     1     1     1     1     1     1
## [8,]     0     0     0     0     0     0     0     0     0     0     0     0
## [9,]     0     2     0     2     0     2     0     2     0     2     0     2
## [10,]    0     1     0     1     0     1     0     1     0     1     0     1
## [11,]    1     0     1     0     1     0     1     0     1     0     1     0
## [12,]    2     0     2     0     2     0     2     0     2     0     2     0
## [13,]    1     0     1     0     1     0     1     0     1     0     1     0
## [14,]    0     0     0     0     0     0     0     0     0     0     0     0
## [15,]    0     0     0     0     0     0     0     0     0     0     0     0
## [16,]    2     0     2     0     2     0     2     0     2     0     2     0
## [17,]    2     1     2     1     2     1     2     1     2     1     2     1
```

```
## [18,]    2    1    2    1    2    1    2    1    2    1    2    1
## [19,]    2    0    2    0    2    0    2    0    2    0    2    0
## [20,]    0    1    0    1    0    1    0    1    0    1    0    1
## [21,]    0    0    0    0    0    0    0    0    0    0    0    0
## [22,]    0    2    0    2    0    2    0    2    0    2    0    2
## [23,]    0    0    0    0    0    0    0    0    0    0    0    0
## [24,]    1    0    1    0    1    0    1    0    1    0    1    0
## [25,]    1    2    1    2    1    2    1    2    1    2    1    2
## [26,]    1    0    1    0    1    0    1    0    1    0    1    0
## [27,]    0    2    0    2    0    2    0    2    0    2    0    2
## [28,]    0    2    0    2    0    2    0    2    0    2    0    2
## [29,]    0    2    0    2    0    2    0    2    0    2    0    2
## [30,]    0    0    0    0    0    0    0    0    0    0    0    0
## [31,]    0    0    0    0    0    0    0    0    0    0    0    0
## [32,]    2    2    2    2    2    2    2    2    2    2    2    2
## [33,]    1    2    1    2    1    2    1    2    1    2    1    2
## [34,]    0    2    0    2    0    2    0    2    0    2    0    2
## [35,]    0    1    0    1    0    1    0    1    0    1    0    1
## [36,]    1    0    1    0    1    0    1    0    1    0    1    0
## [37,]    2    0    2    0    2    0    2    0    2    0    2    0
## [38,]    2    1    2    1    2    1    2    1    2    1    2    1
## [39,]    0    0    0    0    0    0    0    0    0    0    0    0
## [40,]    0    0    0    0    0    0    0    0    0    0    0    0
## [41,]    1    2    1    2    1    2    1    2    1    2    1    2
## [42,]    1    0    1    0    1    0    1    0    1    0    1    0
## [43,]    0    0    0    0    0    0    0    0    0    0    0    0
## [44,]    1    1    1    1    1    1    1    1    1    1    1    1
## [45,]    2    1    2    1    2    1    2    1    2    1    2    1
## [46,]    1    1    1    1    1    1    1    1    1    1    1    1
## [47,]    2    2    2    2    2    2    2    2    2    2    2    2
## [48,]    0    0    0    0    0    0    0    0    0    0    0    0
## [49,]    2    1    2    1    2    1    2    1    2    1    2    1
## [50,]    1    0    1    0    1    0    1    0    1    0    1    0
##      [,38] [,39] [,40] [,41] [,42] [,43] [,44] [,45] [,46] [,47] [,48] [,49]
## [1,]    0    2    0    2    0    2    0    2    0    2    0    2
## [2,]    0    0    0    0    0    0    0    0    0    0    0    0
## [3,]    1    0    1    0    1    0    1    0    1    0    1    0
## [4,]    0    0    0    0    0    0    0    0    0    0    0    0
## [5,]    2    2    2    2    2    2    2    2    2    2    2    2
## [6,]    0    0    0    0    0    0    0    0    0    0    0    0
## [7,]    1    1    1    1    1    1    1    1    1    1    1    1
## [8,]    0    0    0    0    0    0    0    0    0    0    0    0
## [9,]    0    2    0    2    0    2    0    2    0    2    0    2
## [10,]    0    1    0    1    0    1    0    1    0    1    0    1
## [11,]    1    0    1    0    1    0    1    0    1    0    1    0
## [12,]    2    0    2    0    2    0    2    0    2    0    2    0
## [13,]    1    0    1    0    1    0    1    0    1    0    1    0
## [14,]    0    0    0    0    0    0    0    0    0    0    0    0
## [15,]    0    0    0    0    0    0    0    0    0    0    0    0
## [16,]    2    0    2    0    2    0    2    0    2    0    2    0
## [17,]    2    1    2    1    2    1    2    1    2    1    2    1
## [18,]    2    1    2    1    2    1    2    1    2    1    2    1
## [19,]    2    0    2    0    2    0    2    0    2    0    2    0
## [20,]    0    1    0    1    0    1    0    1    0    1    0    1
## [21,]    0    0    0    0    0    0    0    0    0    0    0    0
## [22,]    0    2    0    2    0    2    0    2    0    2    0    2
## [23,]    0    0    0    0    0    0    0    0    0    0    0    0
## [24,]    1    0    1    0    1    0    1    0    1    0    1    0
## [25,]    1    2    1    2    1    2    1    2    1    2    1    2
## [26,]    1    0    1    0    1    0    1    0    1    0    1    0
## [27,]    0    2    0    2    0    2    0    2    0    2    0    2
## [28,]    0    2    0    2    0    2    0    2    0    2    0    2
## [29,]    0    2    0    2    0    2    0    2    0    2    0    2
## [30,]    0    0    0    0    0    0    0    0    0    0    0    0
## [31,]    0    0    0    0    0    0    0    0    0    0    0    0
## [32,]    2    2    2    2    2    2    2    2    2    2    2    2
## [33,]    1    2    1    2    1    2    1    2    1    2    1    2
## [34,]    0    2    0    2    0    2    0    2    0    2    0    2
## [35,]    0    1    0    1    0    1    0    1    0    1    0    1
## [36,]    1    0    1    0    1    0    1    0    1    0    1    0
## [37,]    2    0    2    0    2    0    2    0    2    0    2    0
## [38,]    2    1    2    1    2    1    2    1    2    1    2    1
## [39,]    0    0    0    0    0    0    0    0    0    0    0    0
## [40,]    0    0    0    0    0    0    0    0    0    0    0    0
## [41,]    1    2    1    2    1    2    1    2    1    2    1    2
## [42,]    1    0    1    0    1    0    1    0    1    0    1    0
```

```
## [42,]    1    0    1    0    1    0    1    0    1    0    1    0    0
## [43,]    0    0    0    0    0    0    0    0    0    0    0    0    0
## [44,]    1    1    1    1    1    1    1    1    1    1    1    1    1
## [45,]    2    1    2    1    2    1    2    1    2    1    2    1    1
## [46,]    1    1    1    1    1    1    1    1    1    1    1    1    1
## [47,]    2    2    2    2    2    2    2    2    2    2    2    2    2
## [48,]    0    0    0    0    0    0    0    0    0    0    0    0    0
## [49,]    2    1    2    1    2    1    2    1    2    1    2    1    1
## [50,]    1    0    1    0    1    0    1    0    1    0    1    0    0
##       [,50]
##  [1,]     0
##  [2,]     0
##  [3,]     1
##  [4,]     0
##  [5,]     2
##  [6,]     0
##  [7,]     1
##  [8,]     0
##  [9,]     0
## [10,]     0
## [11,]     1
## [12,]     2
## [13,]     1
## [14,]     0
## [15,]     0
## [16,]     2
## [17,]     2
## [18,]     2
## [19,]     2
## [20,]     0
## [21,]     0
## [22,]     0
## [23,]     0
## [24,]     1
## [25,]     1
## [26,]     1
## [27,]     0
## [28,]     0
## [29,]     0
## [30,]     0
## [31,]     0
## [32,]     2
## [33,]     1
## [34,]     0
## [35,]     0
## [36,]     1
## [37,]     2
## [38,]     2
## [39,]     0
## [40,]     0
## [41,]     1
## [42,]     1
## [43,]     0
## [44,]     1
## [45,]     2
## [46,]     1
## [47,]     2
## [48,]     0
## [49,]     2
## [50,]     1
```

Randomly punch holes (i.e. NA) values in this matrix so that an each entry is missing with probability 30%.

```
n = 100
X = matrix(rnorm(n^2), nrow = n, ncol = n)
for (i in 1 : n){
 for (j in 1 : n){
  if (runif(1) < 0.3){
   X[i,j] = NA
  }
 }
}
X
##             [,1]       [,2]        [,3]         [,4]       [,5]
##   [1,]        NA         NA  0.649401005 -0.6046016771         NA
##   [2,]  1.10664156  1.07977638  1.066599095  1.4107906717  0.25203131
##   [3,]  0.19903425  1.74541358  1.576651593           NA         NA
```

```
##  [3,] -0.19905425 -1.74541558 -1.5760515595          NA          NA
##  [4,]          NA -2.58684464  0.448615072 -0.6982244555  0.59162270
##  [5,]  0.26076555  1.90895951  0.245211549  0.3745342587  1.38203107
##  [6,]          NA          NA           NA  0.3945888521  0.29561962
##  [7,]          NA  1.08802290           NA -0.5538138209  1.34343462
##  [8,]          NA          NA -0.115778031  0.3059133984 -1.05539454
##  [9,]          NA  1.17018448 -1.296451770 -1.4758081228 -1.47056924
## [10,]          NA          NA  0.093024585           NA -0.07109819
## [11,]          NA          NA           NA  0.4921685881  0.10318230
## [12,]  0.03807644  0.31283385 -0.906225616           NA -1.00627827
## [13,]  0.61726539  0.95734639 -0.009340373  0.2455402399  1.23195897
## [14,] -0.06083725 -0.40125542           NA -2.3929943308 -0.94853810
## [15,]  0.11799568  1.55863905  0.722674956 -0.1239834933  0.06682821
## [16,]          NA -0.74836412 -0.419846407 -0.8401878364  0.08378720
## [17,]  0.04677099 -0.60277652 -0.313484929  1.1139197598 -0.28007761
## [18,]  0.91652522          NA  2.176951725 -0.7511555170  0.33002851
## [19,]  0.68889585  0.47477106  0.333213400           NA          NA
## [20,]          NA  0.06336163           NA           NA  1.31336030
## [21,] -0.71212642  0.74116724  1.177972993  1.1638147696          NA
## [22,] -1.95756647  0.40135846           NA  1.1229144424 -1.38901247
## [23,] -1.33701036 -0.25504652           NA -1.2940627850 -0.74254238
## [24,]          NA          NA -0.333943027  0.5634595550          NA
## [25,] -0.41464210  1.96755331           NA -1.0295820092          NA
## [26,]          NA  1.52416817           NA -1.2647580395 -1.99157553
## [27,]  2.01841670  0.65676466 -1.523151152  0.4464125804 -1.24125865
## [28,]          NA  1.20919487           NA  0.0794381741  0.35289885
## [29,] -0.53323391 -0.17295560  1.938317569  0.3629359684          NA
## [30,]  0.88025702          NA -0.867073785           NA -0.39289347
## [31,]          NA  1.96551688           NA  0.7142016463          NA
## [32,]          NA -0.18405051 -1.834683577  1.4781963878          NA
## [33,] -0.65363570          NA -0.768129671  2.4080694741 -0.16386095
## [34,]          NA  0.72824055           NA -0.4912659288          NA
## [35,] -1.50780273          NA -0.310673684 -0.0006182022 -0.49490742
## [36,] -0.24821881          NA -0.296982340  2.0446556732          NA
## [37,] -1.25395636  0.03869211           NA           NA  0.89673833
## [38,]          NA -0.22236102           NA           NA  0.52315642
## [39,]          NA  0.56770196           NA           NA          NA
## [40,] -1.48434795 -0.94287441 -1.241969862 -0.7070134923          NA
## [41,]          NA -0.30661678  1.183944139  0.3565731156 -1.37426963
## [42,]          NA          NA  1.078287851  1.4196523274          NA
## [43,] -1.11129013          NA           NA           NA -0.77947438
## [44,]          NA          NA  0.426509569  2.2012411148          NA
## [45,] -1.58602291 -0.62209516           NA -0.7800835607  2.00058441
## [46,]  0.85325458  1.30662281  0.769999295           NA  0.47885456
## [47,]  0.40663858  0.99380443 -1.407841098           NA -1.15225390
## [48,]          NA  1.90087968 -1.303195919           NA          NA
## [49,]          NA -1.00344420 -0.684591018 -0.2009265081 -0.20430804
## [50,]          NA  1.83201771 -1.098695085 -0.2468299136 -1.56111765
## [51,]          NA -0.19564452  0.440059783           NA          NA
## [52,]  0.66496617  2.14134075  1.835770103 -1.6333844404  0.62799093
## [53,] -2.07549234 -1.30359862 -0.308932042           NA  1.08694633
## [54,]          NA          NA -1.384655422  1.3080174413          NA
## [55,]  0.29976148 -2.32421376           NA -1.5781172182          NA
## [56,]  1.50680265          NA  0.300722745  0.2792868395 -1.18846296
## [57,]          NA          NA  0.328587751  1.2995866634  0.31233219
## [58,]          NA          NA           NA           NA -0.44271070
## [59,] -1.55255843 -0.36510031           NA -0.5943483208  0.68928912
## [60,]  0.55638457 -0.16555097 -0.356367720           NA -0.46028874
## [61,]  0.12035967  1.80747372  1.232592364  1.0312851320  0.06804566
## [62,] -0.40420553 -0.12028186  1.330919432 -0.3047652706  0.27886437
## [63,] -1.35318781  1.49014532           NA  0.0416758741          NA
## [64,]  0.21349342          NA          NA -1.5727371252  0.10928170
## [65,] -1.31805587          NA -1.164744769  0.9296089937          NA
## [66,] -0.23425278 -1.06683025 -0.773392630 -0.5287347941 -0.80257706
## [67,]  0.49611162  0.11140634 -1.594342394           NA  0.11220191
## [68,] -0.20728845 -0.52150540  2.015490213 -0.4573453179  0.99694841
## [69,] -0.91605253  1.11255121           NA          NA -0.81197577
## [70,] -0.75511664 -1.47685692 -0.085739419           NA  1.16098617
## [71,]  0.31208454          NA  0.281152858          NA -0.67344023
## [72,]  0.51839221  0.79073130 -0.399040590  0.4283748629  2.32169424
## [73,] -2.37955529  0.28911940  3.131642329           NA          NA
## [74,] -1.52699986  1.40716839  1.464935701  0.3477299326 -1.33491567
## [75,]          NA          NA -1.828166597          NA -0.82101254
## [76,] -0.61395759 -1.55648348  1.781420549  0.5654089422  1.72779194
## [77,]          NA          NA           NA -0.5259255432 -3.09147235
## [78,] -0.21889027          NA  1.035159954 -0.3550202413 -1.50209517
```

```
##  [79,] -0.33824426 -0.31722901 -1.272404914 -0.3057559320  1.54343347
##  [80,]          NA -0.18395477 -2.520419447 -0.4403438086  0.98033741
##  [81,]  0.18088663          NA          NA -1.6056151105 -0.65902548
##  [82,]          NA          NA          NA -0.2990944841 -0.84417490
##  [83,]  2.14992592          NA -1.040286438  0.3459232626 -0.33735374
##  [84,]          NA          NA  0.693493058 -0.1027537917  1.28104478
##  [85,] -0.84405081 -0.40660028  0.987750361  1.0099062531 -1.34484421
##  [86,] -0.72506738  1.17909322 -2.437176914           NA          NA
##  [87,]          NA -0.31118042  0.089083088           NA          NA
##  [88,]  1.04201129 -0.16068573          NA           NA          NA
##  [89,]  0.72079277          NA -0.001033845           NA          NA
##  [90,]  0.33521081  0.57664436          NA           NA  0.59569929
##  [91,]          NA -1.32131581  0.472480936  0.1420983037 -0.65964693
##  [92,]          NA -1.06956955  0.322901151 -1.2229572995  1.50915191
##  [93,] -0.77923959  0.27555041 -1.047949822           NA -1.05449147
##  [94,]  0.36883853          NA          NA -0.2049506305          NA
##  [95,]  0.13623389  0.42638847          NA  0.4248195043          NA
##  [96,]          NA          NA -0.549048329  0.8243183582  0.11352301
##  [97,]          NA          NA  2.336790347  0.6382780952  0.46659383
##  [98,]  1.13660459 -0.38407357  0.669420492  0.2779243477          NA
##  [99,]  1.36933659  0.14415169          NA -0.4271882102  1.30164358
## [100,] -1.63377299          NA -1.254794214 -0.5648102298 -0.93587445
##                [,6]        [,7]        [,8]        [,9]       [,10]       [,11]
##   [1,]  1.516892874 -0.56684594  0.22166558  0.53222559 -0.37673042 -2.33834950
##   [2,] -0.745106930          NA  0.08831275          NA          NA -2.55393757
##   [3,] -0.178859149 -1.29707361  0.38633637 -3.49991596  0.28539831  0.40536830
##   [4,]  1.347039395 -1.32059025 -1.51406218 -2.00261502 -1.20096893  0.93843889
##   [5,] -2.131288718          NA  0.79028026  1.11045776  1.21075197  0.08077248
##   [6,] -0.565842920 -0.33005765 -1.04965163  0.04067846 -2.13249778  0.61983146
##   [7,] -1.258527886  0.35564183 -0.48520048          NA -0.63544636          NA
##   [8,]          NA -1.19493894          NA  0.31325278 -0.39889003  0.63148043
##   [9,] -1.638624903  0.06997424  1.01844694  0.18563256          NA          NA
##  [10,]          NA  0.32712204 -0.61183144 -0.08107401  0.17621997          NA
##  [11,]          NA  1.47304402          NA  0.20146558          NA          NA
##  [12,]  0.152251402  0.08374673 -0.77684680          NA          NA  2.48220133
##  [13,]  0.156777461  0.42540550 -0.29331043          NA -0.14721937  0.26828247
##  [14,] -0.325965425 -0.85556017          NA  1.60242224          NA  1.04188320
##  [15,]          NA  0.36793500  0.85726241          NA -0.63780571          NA
##  [16,] -0.086764141 -1.52869877 -0.86821695          NA -1.31292253  1.72894861
##  [17,]          NA  2.39332288          NA -1.12866694  0.13015086          NA
##  [18,]          NA          NA          NA -2.16425055 -0.89285193  1.65757535
##  [19,]  0.081934719 -0.25380238          NA  0.35789855 -1.12247356 -2.59536731
##  [20,] -0.094260062 -0.17557702          NA          NA  0.72313905  0.67595722
##  [21,]          NA          NA -1.53281637  0.27470014 -0.85993884  1.46083519
##  [22,]          NA          NA -0.48416422 -1.47240556  1.18305463          NA
##  [23,]  0.009742344          NA  0.86687677          NA -0.52886272  0.71489040
##  [24,]  0.206817454          NA          NA -1.41507145  1.50559243 -0.88281682
##  [25,] -1.085558793          NA          NA -0.65568372          NA          NA
##  [26,]  0.985482832 -1.73106139 -0.53687563 -1.66580170          NA          NA
##  [27,] -0.544057234          NA          NA  2.11922938          NA  0.68709765
##  [28,]          NA -0.20584280 -1.58702395 -0.03309006  0.73960570 -0.71643480
##  [29,]  2.048941601 -1.22647163 -0.60586549  0.88061159 -1.71782630  1.25007417
##  [30,]  1.023060267 -1.28776276  0.61382799          NA  1.87739934  0.03986390
##  [31,]          NA          NA -0.17344849 -0.71921731          NA  0.55300141
##  [32,] -0.005328357          NA  1.01164162  0.16631046 -0.58641966 -1.46612727
##  [33,] -0.042641971          NA -0.86932650  2.01638547  0.80707701 -0.34016380
##  [34,]  0.434020822          NA          NA -0.30420152  0.95106108          NA
##  [35,] -1.033420948          NA -0.35707773  0.24119682  3.25339137 -0.40248088
##  [36,]          NA  0.61561214          NA  0.55162738          NA          NA
##  [37,] -0.605582266  1.67587425          NA  1.19223600 -0.35456031 -0.18968362
##  [38,]          NA          NA -0.60969630 -0.73614904 -0.43496660  1.25114109
##  [39,]  0.742686664          NA          NA  0.32990897  0.41411053  1.41330548
##  [40,] -0.344146426  0.60904007 -0.33468008          NA          NA          NA
##  [41,]          NA -0.28169157 -0.22260253          NA          NA -2.35703183
##  [42,] -0.773948690 -0.38214512          NA  1.36919856          NA  0.29813819
##  [43,]          NA -0.78673445  0.13109948  2.17999117          NA  0.27499894
##  [44,]          NA -0.04982969 -1.10456347  0.14877004          NA          NA
##  [45,]  1.367069481          NA  0.78931625          NA  0.22924218          NA
##  [46,]          NA -2.70225391  0.78011310  0.61741932          NA  0.46996132
##  [47,]  0.363268278          NA  1.81219797  0.47096952          NA          NA
##  [48,]          NA -1.00296973 -0.01659096  1.21483055 -0.07209282 -0.25785068
##  [49,]  1.310924325          NA  0.46161322          NA -0.35494949 -0.45966158
##  [50,] -0.300884344 -0.34809205          NA  0.60867505  0.06820836 -1.32430055
##  [51,] -1.731399016          NA -0.05534161 -0.45611713          NA          NA
##  [52,]  1.459678893 -1.42420945 -0.21932442 -0.57836738 -1.95801172          NA
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## [53,]  0.091703082  0.59718145 -1.72795219  0.03940845 -1.40131503  0.29336934
## [54,]           NA  0.59914529 -0.24097656          NA          NA          NA
## [55,] -0.014402744 -0.37140326          NA  0.87076521  0.61378829          NA
## [56,]  0.882430804 -0.33602090  0.25828580  0.59470511  1.19448583 -0.80587180
## [57,]  0.436898264          NA          NA -1.09184377 -0.12461154 -2.03807745
## [58,]           NA  2.93960862  0.28245931  0.40222898  0.27184511 -0.29427533
## [59,] -0.180103055 -2.04348450 -0.35787715 -0.62046588 -0.15264498  1.78347760
## [60,]  0.872710837          NA -0.64108616 -0.45672744          NA  0.39287618
## [61,]           NA  1.01611562  0.03779387  0.40678443 -0.70036567  0.87144385
## [62,]  0.713364440 -1.08281759 -0.57769623          NA          NA -1.35566216
## [63,]           NA  1.48537280          NA -0.31196493 -0.22702820 -0.69193563
## [64,]           NA          NA  0.44468046 -0.68434753 -0.27567182          NA
## [65,] -0.768099923  0.10972551  0.39704474  0.22288922          NA          NA
## [66,]  0.703072967 -0.38332109          NA -0.39587267 -0.21449692 -0.71881055
## [67,]  0.747881176          NA          NA          NA          NA -0.80205936
## [68,] -0.531204992  0.76004304  0.12028661  1.56302967          NA  0.37959324
## [69,]  0.068188377  1.44971786  1.23801320 -1.44583776 -0.97705103          NA
## [70,] -0.020993923 -3.17748576 -0.10236199  0.20943813  0.09571074  1.08515469
## [71,] -0.005542145 -0.43173071  2.57050314  0.05987621          NA -0.24354729
## [72,] -0.484303939 -1.26987479          NA -1.19983361  0.42410170          NA
## [73,]           NA -0.25226500  0.78565294          NA  0.26112990  0.90473517
## [74,]  0.175432649          NA  0.40365454 -0.71055447  1.30782459  0.12040198
## [75,]  0.169807525 -1.22750798          NA  0.39311140          NA          NA
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## [77,] -0.038989387          NA  1.05662756  0.37650655  1.71680279  1.36399760
## [78,]           NA  0.34652820  1.22889060  1.45791069  0.46934241          NA
## [79,] -1.203921507          NA          NA          NA -1.32682262  0.10024769
## [80,] -1.375783007          NA  1.37116526  0.55629716 -0.65692563  0.25931153
## [81,] -0.281114697 -0.62993587          NA  1.72504972 -0.63486227  0.81389544
## [82,] -1.457448254 -1.38638029 -0.66285704          NA          NA          NA
## [83,]  0.692178698  1.85126448          NA -0.14229074 -1.63307717 -0.85315558
## [84,]           NA  0.95591115  0.60716396  2.04037953 -0.79534430  0.18247475
## [85,] -0.981877555 -1.75409898 -1.04498965 -0.24611498  1.48481513          NA
## [86,]  0.752642590 -1.85952202  0.82741898          NA -1.09885153  0.15068535
## [87,]  1.192818109 -0.75963394  1.72718604 -0.69185190  2.07736388 -1.26792275
## [88,]           NA -1.85313024  2.30257806  2.04283391 -0.06694004 -0.99620646
## [89,] -0.526265486  1.72754525          NA          NA -0.27855437          NA
## [90,]  0.119769838          NA          NA -0.04161067 -0.22881827 -0.62720291
## [91,]           NA          NA -1.22883264 -1.68441784          NA          NA
## [92,] -0.913544651  0.33397042 -0.39954392          NA          NA -0.54676151
## [93,] -0.321186949 -0.26046461          NA -0.88792848  0.73055765 -1.73693047
## [94,]           NA -0.12576823 -0.17452907  1.09510518  0.55572397          NA
## [95,]  1.006834351 -0.31033899          NA  0.48576724 -0.26854911 -0.17171116
## [96,]  0.434602143          NA -0.13649902          NA -2.22010762          NA
## [97,] -0.081732310 -1.11484235 -0.26298837 -0.97988047 -1.27100267 -0.06965679
## [98,] -0.013535484 -0.08909794  0.98165583 -0.06826806 -1.31051203  0.93783417
## [99,]  1.569832872          NA  0.13451898          NA  1.56164290  0.46979559
## [100,] -0.143466839  0.31733734  0.69596295          NA  2.03169281          NA
##              [,12]       [,13]       [,14]       [,15]       [,16]
##   [1,]  0.63902822  0.767377587  0.660400713  0.713695689  1.40621407
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##   [3,]  0.51913322 -1.210987978          NA -0.012194317 -1.88296309
##   [4,]  1.77683585          NA  1.352230413 -0.172874837  0.95393455
##   [5,]          NA -0.338425778  0.528761092          NA -0.07168426
##   [6,] -1.11223053          NA          NA          NA  1.22216517
##   [7,]          NA  0.395233253          NA -0.322170956          NA
##   [8,] -0.51819423  0.452315116 -0.155072532  1.220926486          NA
##   [9,]  0.53457657          NA          NA          NA  0.96204097
##  [10,] -0.74507027 -0.383422755 -0.495177297          NA -0.26289053
##  [11,]  0.10177502  0.224465373  0.503299560          NA          NA
##  [12,]  0.05757879          NA  1.099462578 -1.152606017 -1.67909291
##  [13,]          NA  2.801286312          NA -1.108665047          NA
##  [14,]  0.04943941 -0.829719012  1.209986783          NA  0.08715851
##  [15,] -0.41872508 -0.364304543  0.878410372  0.734744592          NA
##  [16,] -0.12684141          NA          NA -0.184358920 -0.61606248
##  [17,] -1.03138805 -0.255793400  0.748276044 -0.576445381          NA
##  [18,]          NA          NA -0.131794247  0.366678103 -0.25026263
##  [19,]          NA  0.323951716  0.657028585          NA          NA
##  [20,]          NA -1.933733402          NA          NA -0.08952635
##  [21,]  0.21985603          NA  0.336557027  1.629140636 -0.16519722
##  [22,]          NA          NA -2.930766687 -0.324455991  1.15072769
##  [23,] -0.29580722          NA -0.313382500 -0.554807765 -1.13786683
##  [24,] -0.03668022 -0.076050385 -1.688603402  1.115122570          NA
##  [25,] -0.38532930 -0.789777618  1.063883291 -0.127563800          NA
##  [26,]          NA  2.471414631 -0.488122321          NA          NA
##  [27,]          NA  0.367029232          NA          NA  2.15214983
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##  [28,] -1.00291529  0.884205142 -0.852861952 -0.324661016  0.07544228
##  [29,] -1.10794931 -0.284318583  0.231530260          NA  0.17548292
##  [30,]  0.01902682 -0.498912816          NA          NA          NA
##  [31,] -0.86309145 -0.556957638  0.193573259  0.553363166          NA
##  [32,] -1.82226070 -1.287664887  0.009642362 -0.604875394          NA
##  [33,]  0.51081216          NA          NA  1.371905154  0.04838642
##  [34,]          NA -1.407124574 -0.754004341  0.353317782  0.61862497
##  [35,]          NA          NA -0.829226734  0.144494499          NA
##  [36,]  0.24652089          NA  0.829852396  1.041307527 -0.57410852
##  [37,] -0.43416431 -0.084727665          NA -1.015442081          NA
##  [38,] -1.19748498          NA  1.435510338  0.419886851  0.56671653
##  [39,]          NA  0.663523714          NA  1.214944164 -1.52601661
##  [40,] -0.96354953          NA -1.033546340          NA  0.20701886
##  [41,]  0.48249845 -0.487279527  0.212334894          NA -0.07469396
##  [42,] -0.39891410          NA -0.147950486          NA  1.26290426
##  [43,] -0.65050477  0.570468961 -0.627510782          NA          NA
##  [44,]          NA  0.582519431          NA          NA  0.72484261
##  [45,]  0.05935154 -1.187409847  0.170045566          NA -1.77343240
##  [46,]          NA  0.427803113  1.720403359 -0.540701359  0.98047644
##  [47,] -0.23627590 -1.165388693  0.115804393          NA  0.15661231
##  [48,]          NA -0.594105955          NA -1.661521345  0.18662620
##  [49,]          NA -0.466729167  0.546146566          NA  1.42012527
##  [50,] -0.25254397 -1.380369266  0.271280830  0.008682849          NA
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##  [52,] -1.51778343 -0.703427516 -0.013585157 -0.088800943 -0.78425494
##  [53,] -0.53038044 -0.319840678          NA          NA  0.51329548
##  [54,] -0.17832294 -0.193816472  0.772878257          NA  1.02692178
##  [55,]          NA          NA          NA          NA -0.45455761
##  [56,]  0.95612072  1.715297689 -0.002010729 -0.218860347 -0.07245863
##  [57,]          NA -0.164156051          NA -0.409141484  0.10084404
##  [58,]          NA  0.693232162  0.877949462 -0.179130299 -1.22349786
##  [59,]  0.75333074  1.305052755  0.307700455          NA  0.19504189
##  [60,]  1.64634050  1.088342657  0.754832937  0.508443617  2.61165398
##  [61,]  0.97022090  0.696246621 -1.018007900 -0.700346960 -0.64055118
##  [62,]          NA -0.219509759  0.213059746 -0.684577403  0.28017456
##  [63,] -0.74174043          NA -0.252920733  0.888167631          NA
##  [64,]  0.46650787          NA          NA          NA  0.15799125
##  [65,]  1.22228758  1.992203001 -0.633470434          NA  0.57113394
##  [66,] -0.90988787 -0.147935013 -0.584194838 -0.418812565  0.56904682
##  [67,] -0.55631355          NA -0.155766158 -0.791695387  0.17420757
##  [68,] -0.62234299  0.924950032 -1.009976886          NA -0.07755225
##  [69,]          NA          NA -1.436816279  0.513111397  3.09909766
##  [70,]  0.74215934  0.420940037          NA -0.357771280 -1.39387399
##  [71,] -1.23188235  0.613218600          NA -0.390725197          NA
##  [72,]          NA  0.030567258 -0.856906478          NA  1.20429328
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##  [74,]          NA  0.633896433          NA  0.669269352          NA
##  [75,]  1.38434241  0.007273184  0.648283282 -0.844872878 -1.28829913
##  [76,]  0.15175292  0.309936830  0.638417383 -0.022226732 -1.07134794
##  [77,]  0.91367693          NA  0.683875977 -0.456245801 -0.37324188
##  [78,]          NA -0.133368969 -1.447744698          NA          NA
##  [79,] -0.41908232 -0.163421007          NA  0.902549838  0.22056021
##  [80,] -0.85256150          NA          NA          NA -0.15375128
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##  [82,] -1.64077552  0.883799011          NA          NA          NA
##  [83,]  0.17894885          NA  0.394260135 -0.479185545          NA
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##  [86,]  0.09751654  0.535352414          NA -0.077431446 -0.05445515
##  [87,] -0.33282519 -0.581295039  0.522361693  1.091234521 -0.65419768
##  [88,]  1.17456515  0.497797889 -1.392299586  0.041681458          NA
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##  [90,]          NA  1.675726938  0.082306982          NA  1.90195010
##  [91,]  0.15919660  0.652901939 -0.536490611  1.607208648 -0.98126520
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##  [96,]          NA -1.304848368 -0.997329842          NA  1.41331927
##  [97,]  1.67392797 -0.248562943  0.973580997  0.071076180  0.76589906
##  [98,]  0.80963798          NA -2.097701636          NA -0.37255817
##  [99,]          NA  1.943485645 -1.094981223          NA  0.44886059
## [100,]  1.82760884 -0.854370543          NA -0.968321596          NA
##             [,17]      [,18]      [,19]       [,20]      [,21]      [,22]
##   [1,]  1.911620031 -1.7084248 -0.03600917 -0.099542082  0.19764253          NA
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##   [2,]  0.458163615 -0.7834378  0.68489956  0.845939237          NA  0.32942132
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##   [4,]           NA -1.9629154 -1.19149656  1.941185956 -0.32739265  1.14703649
##   [5,] -1.934968056          NA  1.78717674  0.591594985          NA          NA
##   [6,]  0.152156561 -0.8954061  0.44960334 -0.610732809          NA -0.52549705
##   [7,] -0.866633579  1.0025158 -0.28449285           NA          NA          NA
##   [8,]  0.063797457 -1.0204012 -0.35716725 -1.124321402 -0.16097032  0.26080362
##   [9,]  0.891461396  0.6425218  1.11251842  1.266873760          NA  2.59158287
##  [10,]  2.083899662  0.5922891 -0.19750109 -0.115544865 -0.53835217  0.52477432
##  [11,] -2.018866354  0.4497096  0.27494639  1.230458151          NA -1.72537725
##  [12,]  1.927570212 -0.4923163  0.97580610  0.811121121  0.29726987 -0.65595794
##  [13,]  1.034928930          NA -0.20567591           NA -0.12434987          NA
##  [14,]  0.460792226  0.2420066 -0.97615468           NA -0.30074425  1.05023318
##  [15,]           NA -0.8371018          NA          NA          NA          NA
##  [16,]  1.398221968 -0.9276699          NA  0.697228696 -0.29887679  0.59517143
##  [17,]           NA          NA  0.78292710  1.151603580 -2.02507226          NA
##  [18,] -1.131837175  0.1916702          NA  0.221501683 -0.91558258          NA
##  [19,]  0.697626007 -0.8798859  0.18091645  1.092242291  1.58669250  0.59710453
##  [20,] -1.050263546  0.3855999  0.28525086 -1.325887069  0.63282416 -0.32474433
##  [21,]           NA  1.7320329 -0.64999900           NA          NA -0.67520450
##  [22,]           NA -1.0692148 -0.48395720  0.831817694  0.89011248  0.05339456
##  [23,] -1.533883019 -0.1545447 -0.03635934  0.660330847 -0.17154467          NA
##  [24,]  0.299802466          NA          NA -0.348233946 -2.56904494          NA
##  [25,] -0.743395592  1.4045399  1.36754877 -2.101157646 -0.79190734 -1.81645058
##  [26,]           NA          NA  0.10237982           NA -0.34563983          NA
##  [27,]  0.329359741 -0.3366966          NA  0.282419487          NA -0.28003900
##  [28,]           NA          NA -0.36849271 -0.492340913          NA -0.02944445
##  [29,]           NA  0.9479518 -0.05640837           NA -0.22340867          NA
##  [30,] -0.468451592          NA  0.76061474  0.364392352 -0.37202105          NA
##  [31,] -0.348731865  0.1438023  1.13477064 -2.463927810  0.46090066  0.41950197
##  [32,] -0.053807713  1.1947563 -0.66793579           NA -0.30406831  1.94301868
##  [33,] -0.006870907  1.2210938          NA -0.558654016 -0.33443929          NA
##  [34,]  1.328450570  0.9125298 -1.09915271  1.102304800 -0.39829531 -2.37823057
##  [35,]  2.061717986          NA          NA -1.079863079  0.13923942 -0.02840196
##  [36,] -0.023016415 -1.1603963  0.43062132 -0.982362882 -1.11838530  1.06004678
##  [37,]           NA  1.3962801          NA  0.376185716          NA -0.05475248
##  [38,]           NA -0.4998637 -0.43994863  0.723811270 -0.12470040 -1.68333186
##  [39,]  0.431108517          NA  1.29066247  0.085342262  1.65264175 -1.73505374
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##  [41,]           NA          NA  0.96716854  0.381869724  0.85028609          NA
##  [42,]  0.216423287 -0.5889402  0.55071073           NA          NA  0.09485306
##  [43,]           NA  0.8542218          NA  0.514259748          NA          NA
##  [44,]           NA -1.0268399 -0.11571156  0.426892807 -0.61178208  1.07285665
##  [45,] -2.330573620          NA          NA           NA          NA -0.97266375
##  [46,]           NA -0.3626112  0.90193459  0.279167551          NA          NA
##  [47,]  1.152893726 -0.2581254 -0.41762595 -0.216414911          NA          NA
##  [48,]  0.009449549          NA  0.24931701           NA          NA          NA
##  [49,] -0.388483576          NA -1.09334547  0.795160734  0.44077966  0.84094188
##  [50,]           NA  0.3569687 -0.31257756 -0.726854144 -0.56172501  0.86287667
##  [51,]           NA  0.5000134          NA          NA -0.15648137 -0.23328206
##  [52,]  0.052402811 -1.7055964  1.13335702 -0.525162045 -0.26386621          NA
##  [53,]           NA -0.1127077          NA  0.549144535          NA  1.60464973
##  [54,] -0.248027409 -1.2210384          NA  0.579722578 -0.27156476  1.80834142
##  [55,] -0.297208013          NA -0.87767979  0.951893580          NA  1.14843782
##  [56,]  0.738307161 -0.9378680          NA          NA          NA  0.11837418
##  [57,]  0.798816439 -0.4832800          NA -0.118841004 -0.28281419  0.84475325
##  [58,] -1.836246890  1.6246786 -0.41313614 -1.513631425          NA -1.17859013
##  [59,]           NA  1.4171096          NA          NA  0.64531864          NA
##  [60,]  0.289391715  0.7479498  1.83663693  1.206565308 -0.69903970 -0.63470747
##  [61,] -0.440763166 -0.8407554          NA -0.005151918          NA          NA
##  [62,]           NA -1.1002377  1.12025576  0.228297898 -1.39495894          NA
##  [63,]  0.903488497  0.5082550          NA          NA          NA -0.20357510
##  [64,] -0.911295088  0.4378102          NA          NA  0.60092901 -0.23190355
##  [65,]  0.942758390          NA          NA          NA -0.04617169 -0.02347156
##  [66,]           NA  0.3696815  0.89378800 -0.317296995 -1.12997813          NA
##  [67,]           NA  0.2479818          NA -0.017162316          NA -0.55815411
##  [68,] -0.237971479          NA  0.23499624           NA  0.50030154 -0.74354011
##  [69,] -1.004875397 -0.7730126          NA  1.175661964          NA          NA
##  [70,] -0.513779374          NA -1.16403516           NA -0.73304794 -0.12479963
##  [71,]           NA  1.6364002  0.08264592 -0.987066628          NA -0.24495810
##  [72,]  0.604680593          NA  0.39570143  0.219722280  0.43105513 -1.29888522
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##  [74,] -1.383745674          NA          NA           NA  1.49483756 -0.12554048
##  [75,]  0.185641822 -0.1917856 -0.20122872  0.409410636          NA          NA
##  [76,]  0.828959201 -0.3773248  1.21355482           NA  0.62640826 -0.88097484
##  [77,]  0.160725281  1.2919609  0.65313911  0.507514096  0.60409551  0.57198837
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## [77,] 0.160725281 -1.2919609 -0.65313911  0.507514096 -0.60409331  0.37198837
## [78,] -0.096559903 -2.4894318  0.90543123 -0.917957037          NA -0.12632437
## [79,] -0.170202925 -1.0941441          NA  0.234769007  1.02274927 -1.24723899
## [80,]  0.244192661          NA          NA  0.094035562  0.10817268          NA
## [81,] -1.414387599          NA  0.31040737           NA          NA -0.98699524
## [82,]  1.522090163          NA -1.51268183  0.042758751 -0.06419509  1.36714625
## [83,] -1.193121920          NA -0.57954505          NA  0.64303438          NA
## [84,]  0.099743617  0.3560667  0.64024847 -1.858880449          NA          NA
## [85,] -0.345656231 -0.4760386          NA -0.792583604 -1.48656869 -1.05746647
## [86,] -0.470606116          NA  2.06705129          NA          NA  1.37898060
## [87,]  1.035202223 -0.1932146          NA  1.177340143  1.38157331 -1.27970755
## [88,]          NA  0.8857906 -0.04602255 -0.026072444          NA -0.07564147
## [89,]          NA  1.4636987  0.24093254          NA  0.37315187 -1.64822469
## [90,]          NA          NA          NA  1.271663115  0.70527384  0.87340180
## [91,] -0.430206129  0.6851221          NA  1.401337375  0.29618610          NA
## [92,]  0.933615987          NA          NA  2.262020037 -0.65554110 -0.61113783
## [93,]  0.473694990          NA -0.85759593 -1.057010082          NA          NA
## [94,] -0.794439745          NA -0.48985162          NA  0.65306198          NA
## [95,]          NA  0.5127656  0.39734165          NA  0.20532537          NA
## [96,]  0.617444911 -0.1740488 -0.77664288  0.670542863 -0.33810581  0.91672158
## [97,]          NA  1.1829227 -1.41898336 -0.397920656          NA  0.62099438
## [98,]  1.007295672  0.2752079 -0.49291575  0.313221308          NA -0.28214230
## [99,]  0.487729825 -0.3306570          NA -0.108145602          NA -0.83616197
## [100,]  0.092251842          NA  0.15782775 -1.761069040  1.68297247 -2.04497658
##             [,23]       [,24]       [,25]       [,26]       [,27]
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##   [2,]          NA          NA -0.351659553  0.99713096 -0.277130935
##   [3,] -0.79118951  0.81758082 -0.229249323          NA  1.240637254
##   [4,]          NA -0.98909857 -2.076988987  0.59317396 -2.689498606
##   [5,] -0.37707653          NA          NA  1.17988580  0.443463587
##   [6,]          NA -0.76808802  0.506965800  1.04540722  1.143190517
##   [7,]  0.27342901          NA -0.794911166          NA  0.527657647
##   [8,]  0.05380131  0.10792276          NA -1.55108792  0.661303407
##   [9,] -1.35864503 -0.01481870          NA  0.67807824 -0.133009028
##  [10,] -1.09664134          NA -1.900623183  1.01096266 -0.540994732
##  [11,]          NA -1.71848094  0.649910639  0.53125798 -0.830721149
##  [12,] -1.80777746          NA          NA          NA  1.714521342
##  [13,]          NA  1.71069946 -0.473654063 -0.07832463  1.509628962
##  [14,]          NA          NA -0.689577677  1.41822224 -0.283872360
##  [15,] -1.60081325          NA  1.483442401 -1.02698133 -0.604566310
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##  [17,]          NA          NA          NA  1.00329191          NA
##  [18,]  0.43732996          NA  0.355692236  2.60749650          NA
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##  [20,]          NA          NA          NA  0.61921607  0.056588511
##  [21,]  1.46478790 -1.25188553          NA -2.14586474  0.589727136
##  [22,] -0.08871318          NA -1.008134742          NA          NA
##  [23,] -0.64822130          NA -0.748989069  0.59969257  1.339623487
##  [24,]          NA  1.16737251  0.524498379          NA          NA
##  [25,]  1.67961251          NA  0.104489413 -1.41175527 -0.655253850
##  [26,]          NA  1.09553714  1.015572340  0.61424638          NA
##  [27,]          NA -0.91365771 -0.714582107  0.76586339 -0.697814632
##  [28,] -0.29769312 -0.16768523  0.601657859          NA -0.319622359
##  [29,]  0.54902696  0.05972591 -0.811178244  0.21349241  0.025610915
##  [30,]  0.57065749 -0.51754954  0.228319727  0.45770232  1.391406309
##  [31,] -0.61626861          NA  0.206469728 -0.83884864          NA
##  [32,]  1.20388699 -1.82102150  0.156533641 -0.38985887  0.323541330
##  [33,]  0.57354783  0.18529106          NA  1.00645968 -1.024348602
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##  [36,] -0.23784834 -1.07440528          NA -0.26233983          NA
##  [37,]          NA          NA -1.056092241          NA          NA
##  [38,] -0.55060630 -0.14083187  1.394439692 -0.46077259 -1.219146909
##  [39,] -1.93668830  0.79553360  1.280474298  1.71598957 -0.511491355
##  [40,]  1.36356178 -0.56262817 -1.076474561  0.05513673 -1.994229898
##  [41,] -0.66961609 -0.10215763 -0.182038751          NA -0.536651631
##  [42,]  1.49433138          NA  0.788127287 -1.98482954  0.741908460
##  [43,]  0.27956764  0.18090777          NA          NA          NA
##  [44,] -0.07024293  0.20886585 -0.577686815 -0.21980535 -0.187017410
##  [45,] -0.48043564          NA  2.824232811          NA          NA
##  [46,]  0.29938474 -1.22054874 -1.022295081          NA  0.049187816
##  [47,] -1.30965405  0.04303915          NA          NA -1.337126530
##  [48,]  0.54909936          NA  1.221420537          NA -0.836046057
##  [49,]  0.22200557 -0.22896841 -0.774512309  1.26625631  2.799713948
##  [50,]  0.55325220  0.89263624 -0.465112552  0.62871827 -0.465094545
##  [51,]          NA          NA          NA  0.78559266          NA
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##  [52,]          NA  0.03835598          NA          NA  0.789216491
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##  [55,]  1.08313333  0.80854738          NA  1.12871702  0.952748463
##  [56,]  1.09766452  0.77942754  0.094510639 -0.97351686          NA
##  [57,]  0.26778772  0.93575281 -0.323732079          NA  0.515916760
##  [58,] -0.61904066  0.69938748  1.015784351 -0.84009681  0.621950438
##  [59,]          NA  0.49340526 -1.416194264  0.01618109  0.900272988
##  [60,]  0.25865075  0.12008247 -0.264009801  0.97479244          NA
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##  [63,] -0.43126071 -0.26463909  0.915407807  0.17591489  0.357163777
##  [64,]  0.20500459 -0.19427078          NA -0.79425874 -0.240084244
##  [65,]          NA          NA  1.367354189          NA  1.303195414
##  [66,] -0.61152124  2.46532900          NA -0.15448888  0.725773615
##  [67,]  0.31101262          NA          NA -0.25611727          NA
##  [68,]  0.18062568          NA          NA          NA  2.555580627
##  [69,]          NA  0.99307901  0.313338076  0.96414712 -1.067505100
##  [70,]  0.47042178 -1.53693791 -1.226195011  1.32440027  0.375640426
##  [71,]          NA          NA          NA  0.79344940          NA
##  [72,]          NA -0.17904729 -0.156256738 -0.72998195          NA
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##  [75,]  2.56584639          NA  0.872412923  0.40816747 -0.053015130
##  [76,]  1.36063917  0.42200061  0.001765508 -2.01735106 -0.513483840
##  [77,]  0.83045608          NA          NA  0.15148600  0.324490579
##  [78,] -0.54942080  0.90759246 -0.119206874          NA  0.695013790
##  [79,] -0.08727447          NA -1.314594679 -0.40121994          NA
##  [80,]          NA          NA -0.210183738  0.74865081 -2.411149126
##  [81,]  1.32133061  0.82673061  1.278763858 -0.65907606 -1.012593078
##  [82,] -0.96778609  0.37339121          NA  0.56227698 -1.321827243
##  [83,]          NA -0.20161207 -0.092904186 -0.70054526          NA
##  [84,]  1.10663584  0.75043775  0.864795057 -1.22436098  0.207482338
##  [85,]          NA  0.34200463  0.584025349 -1.16762215          NA
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##  [87,]          NA -1.35105107          NA          NA -0.372166671
##  [88,]  1.22344053          NA -1.283030254  0.84377914  1.152595335
##  [89,]          NA -0.37489298  0.161241058 -0.45795338  0.508197214
##  [90,]  0.15256782          NA          NA  1.19868392  0.784996510
##  [91,]          NA          NA  0.077643713          NA -0.408863610
##  [92,] -0.08682132  1.15204252  0.138355939  0.79501404  2.186512897
##  [93,] -0.02266352 -1.32297036  0.738591586 -1.16228703  0.106122223
##  [94,] -0.90465434  0.81001869          NA  0.20784786 -0.486052369
##  [95,] -0.08634874 -1.29341384  0.263322599 -0.61378355  1.581216235
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##  [97,]  1.20274418  1.31100041 -0.343736448 -0.34262417  2.001576746
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## [100,]          NA  0.90922315  0.971242594 -0.48326883 -1.781493396
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##   [3,]  0.1532378842 -0.045693954  0.79573079          NA -1.338620728
##   [4,]  1.0541919714 -0.365534596 -0.64849114  0.80847880  1.221312608
##   [5,] -0.5565824325  0.193106050  1.39908691 -1.12030841  0.277828145
##   [6,] -0.3083309115  0.425181471 -0.55313443 -0.25206692  0.080089260
##   [7,]  2.2487080216 -0.784865316  1.55947348 -0.76232501 -1.194416514
##   [8,]  1.2984245331 -0.088359865          NA -1.82682318 -0.211517930
##   [9,] -1.1206792459          NA -0.38861308 -1.46225078          NA
##  [10,]  0.3060072860 -0.499738062          NA -1.54905762 -0.213593327
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##  [14,] -2.3082912438 -1.076750560  0.29377120          NA          NA
##  [15,] -0.5746711611          NA  0.22489539 -2.03310792  0.440893759
##  [16,]  0.8081734019  0.950335130          NA  0.58388196          NA
##  [17,]  0.9220235992          NA          NA -0.07858791 -0.989827354
##  [18,] -1.0281543517          NA -0.73689090 -2.98098706 -1.489242473
##  [19,]          NA          NA  0.45613624          NA -0.904043874
##  [20,] -0.8293050085  0.534016093 -0.46018394  0.55084349 -0.582005178
##  [21,] -0.9587806703  1.597233805  0.89031521  0.05416218  0.414206471
##  [22,]  0.2490003890 -2.301454065 -0.08481667          NA -0.434702476
##  [23,] -0.9283428164          NA  1.28020766 -0.47384681          NA
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##  [35,]           NA  0.676941711  1.59105034          NA          NA
##  [36,]           NA  0.631352206 -1.35381992  0.89985144  1.140879812
##  [37,]           NA -0.743718957  1.17237534  0.44039933 -0.755293100
##  [38,]  0.7985414895          NA -0.19729074          NA -0.428460655
##  [39,]           NA -1.590427228 -0.27022921  0.39700481  1.590019231
##  [40,]  0.0142337986 -1.320767791          NA  0.82176154 -0.350716100
##  [41,] -0.1693710448 -0.209488889 -0.34922062  1.23117078  0.363858321
##  [42,]  1.4873943884          NA  0.45501106  0.51271663  0.168203176
##  [43,]           NA -2.013448780 -1.36940003 -1.91668926  0.970318277
##  [44,] -2.1264874232 -0.763289604  0.32718827 -0.69530904          NA
##  [45,]  0.0369246012 -1.269131524 -0.63749468  1.20833090  1.067005316
##  [46,]           NA          NA  0.50912848  0.01105807 -1.256503741
##  [47,] -0.4800381694  1.482640723          NA -0.40230876 -0.614039318
##  [48,]  0.0745386473  0.911193653 -0.11649752 -1.01384476          NA
##  [49,]           NA  0.070472143  0.35463166          NA  0.782637405
##  [50,]           NA          NA  1.22194855  0.35003110  0.616323629
##  [51,] -0.2174234583  0.555126843  0.33195198          NA -0.785549794
##  [52,]  0.2706541852 -0.915371598 -0.48080976          NA  0.275351426
##  [53,]  0.2662605416 -1.231173421  0.22194291 -0.48506832          NA
##  [54,] -1.3590702431  1.048661526          NA          NA          NA
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##  [56,]           NA -0.868862878          NA -0.04777896 -2.288257189
##  [57,]  1.1203389695 -2.358231666          NA  0.24675020          NA
##  [58,] -2.0979710129          NA          NA          NA          NA
##  [59,]           NA          NA          NA  0.51857181 -0.162517319
##  [60,]  2.7838106511          NA -1.42157829  1.15063341  0.424593687
##  [61,]  1.9413050985  1.648916125  0.12138533 -0.06648079          NA
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##  [63,]           NA  0.378130946 -0.44689774          NA -0.209884807
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##  [66,]  0.9118275190 -0.300404656  0.33887873  1.09751236          NA
##  [67,]  0.0271778198  0.843393549          NA          NA          NA
##  [68,] -0.2513008192  0.748785217          NA -2.02936176 -0.616941421
##  [69,] -0.2156360348 -0.615827814          NA          NA -1.055624891
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##  [71,]           NA -0.692176528          NA  0.75300587          NA
##  [72,]  0.2498670318 -0.006097645  0.79886737 -0.88958985 -1.115555376
##  [73,]  0.3510892112          NA  0.10497853          NA  1.167398853
##  [74,]           NA          NA -1.82495144          NA  0.775495197
##  [75,]           NA -0.984725970 -0.45366402 -0.19336095          NA
##  [76,]  1.0972917350 -1.213356800          NA  0.31957670 -0.563839294
##  [77,]  1.8261946015 -0.092859269 -1.32149344 -0.63939564 -0.291804787
##  [78,]           NA  1.791598041 -1.39085438          NA          NA
##  [79,]           NA  1.055566951  0.33108853 -0.10537364 -1.019597600
##  [80,]  0.3027469213  0.477154513 -1.23994154  1.17323817 -1.110536032
##  [81,]           NA  0.699839420  0.78130635          NA -2.057580507
##  [82,]           NA -0.845807645 -0.24849680  1.36568914          NA
##  [83,] -2.3549899589          NA -0.01243584  0.58129960 -0.518888382
##  [84,] -0.0293140990          NA -0.61602338          NA          NA
##  [85,]  2.1252930620 -0.025755952 -1.55144666 -0.85932622  0.229078224
##  [86,]           NA  0.542241825  0.07027401          NA  1.580514178
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##  [89,]           NA          NA  0.81933201          NA -0.708677670
##  [90,]  1.1439302084  0.680472798  0.40888625  0.09719676  0.351651340
##  [91,] -0.2795497699          NA  0.53458104  0.89238701 -0.838907122
##  [92,]  0.5318630748 -0.890870132          NA -0.94691621 -0.541927194
##  [93,]           NA  0.265827226 -1.09487477 -0.69150730          NA
##  [94,]           NA -0.179096536          NA  0.25213694 -0.522994037
##  [95,]  3.5407119621  0.166831564          NA  1.25856334  0.315880285
##  [96,] -2.5526045143 -0.422707354 -2.67363744          NA -0.345757835
##  [97,]           NA          NA          NA -0.89108656 -0.100695870
##  [98,]           NA  0.084283756 -0.35732194 -1.57567558  0.715070074
##  [99,]  0.0425513875  1.141271652          NA -0.18462111 -0.871657010
## [100,]           NA  0.312925650          NA          NA          NA
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## [3,] -1.528419820  0.6862331191 -0.171078228          NA -1.96150460
## [4,] -1.280790817           NA          NA          NA          NA
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## [6,] -0.505918945  0.3959511624 -0.846037702          NA  0.19171561
## [7,] -1.455842325  0.8411756845          NA          NA          NA
## [8,] -0.463578056           NA  2.029884319          NA          NA
## [9,] -0.327695163  1.0442466435 -1.084320243  1.12161446 -1.04230861
## [10,]          NA -1.3962479847 -1.481056002  0.39603338          NA
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## [12,]  0.067889001 -0.3943518991  0.278676586          NA          NA
## [13,]          NA  0.1004290100  0.768963014          NA -0.75998480
## [14,]          NA  0.8048276669  0.969252334          NA  1.12757326
## [15,]  0.346396037          NA -0.525839132 -1.03581529 -0.99821657
## [16,] -0.704177322 -1.2243308224  0.143886272          NA  2.28962895
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## [30,]          NA -0.3991145345 -0.194267533  0.39739618          NA
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## [43,]  0.131510373          NA -0.983040225  0.12206930  0.71562202
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## [45,]          NA  0.8841414386          NA -0.20026782          NA
## [46,]          NA          NA -0.850641508          NA -1.79300971
## [47,] -1.267394464          NA          NA          NA  0.42222400
## [48,]          NA  0.0027572385          NA          NA          NA
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## [50,] -0.765316142  0.2374567439 -0.935033857          NA          NA
## [51,] -0.802531621          NA -1.566337503          NA  0.77414082
## [52,]  0.606706674  1.0248114863 -0.078534689  0.47567430          NA
## [53,] -1.043357594 -0.7101977978          NA  1.25611947          NA
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## [55,]  0.370461825  0.4885823699          NA          NA  1.44063340
## [56,]  0.572795771 -1.3795956297  0.920052710  2.22265904  0.32395401
## [57,] -0.634145329          NA  0.251928252 -0.90116385  0.47445112
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## [61,]          NA  1.8006013520          NA  0.45110233          NA
## [62,]  0.342167305 -1.2342590676 -0.580231701  1.86300526          NA
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## [64,]  1.202556286 -1.6214867619          NA          NA -1.93630540
## [65,]  0.221796364 -0.1389832984 -1.991751693          NA          NA
## [66,]          NA  0.0001909585 -0.248978683  0.95732133  0.31835946
## [67,]  0.706523326  0.6116281940  0.502051810 -0.44189100  1.81634341
## [68,] -0.949869661          NA  2.097896073          NA          NA
## [69,]  1.447585536 -0.6033553475          NA -1.01426554          NA
## [70,] -1.093077852          NA  0.528103256 -1.17865380  0.22053794
## [71,] -0.464583088          NA  1.409773904 -0.36850906  1.65633148
## [72,]          NA -0.3028954171 -0.732956704 -0.31043703          NA
## [73,]  0.284036157          NA -0.600555829  0.31435374  0.23760527
## [74,] -0.633291531 -0.7196834019          NA  0.59284198  0.36183735
## [75,]  0.891472767          NA -0.189547126 -0.23800923          NA
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##  [78,] -0.089643965 -0.0576832863 -0.977367357 -0.41419512 -0.58923421
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##  [80,]          NA           NA  1.405906053          NA          NA
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##  [85,] -0.116778715 -1.0382411979  2.275747922          NA  0.90337971
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##  [87,]          NA           NA  0.582892745 -0.98034721          NA
##  [88,]          NA           NA          NA -0.51608881  0.21269282
##  [89,]  0.111303123 -0.2403660418 -1.066652783          NA          NA
##  [90,] -1.493142598 -1.8122930151 -0.321130043          NA  0.22837602
##  [91,] -0.626722090 -1.3110092941 -1.329435887  0.67198878          NA
##  [92,]  0.720449171  0.3595417168          NA          NA  0.13862990
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##  [94,]  0.815979605           NA          NA -1.53948262 -0.95798351
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##  [97,]  0.035708646 -1.4542496770 -2.675431340  0.12478094  2.10669120
##  [98,] -1.328560610 -1.7523312693  0.176083335  1.68661238 -2.39825246
##  [99,]          NA           NA          NA  1.79675873          NA
## [100,] -0.433576171 -0.4160762998  0.367783449          NA -0.30288164
##              [,38]       [,39]       [,40]       [,41]       [,42]       [,43]
##   [1,] -0.16703292 -0.46850511          NA  0.27582909          NA -0.09452977
##   [2,]  0.08275608  1.30329277          NA  0.45272871 -0.73915327          NA
##   [3,]  0.32675547          NA          NA          NA          NA          NA
##   [4,]          NA  0.57699669 -1.13610965          NA          NA          NA
##   [5,]  0.45281947          NA          NA  1.43512722 -1.96108107          NA
##   [6,]  1.51755794  1.42357141          NA  0.40654855  0.01875498 -1.25572274
##   [7,] -0.27251328          NA  1.42886156 -0.30250209 -0.06247735  1.51296959
##   [8,]  0.34608092 -0.17931187 -2.16605372  1.02593984          NA          NA
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##  [12,]  0.42572828  1.21471647          NA  0.21408070  0.15189285          NA
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##  [15,] -0.72403083  0.08139526 -0.85813854          NA          NA          NA
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##  [18,] -0.08488438  1.27492399 -0.58837285 -0.58688438 -0.28686116  1.82288509
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##  [20,]  1.34104193 -0.46302168          NA -0.57777158 -1.53068122          NA
##  [21,]          NA          NA          NA  0.57030456          NA          NA
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##  [46,]          NA  0.79608458  1.35656419          NA -0.16104141  1.31920548
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##  [59,] -0.14217414 -0.12771420          NA          NA -0.10437607  0.08147400
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##  [63,] -1.36753093          NA  1.13453313  0.11759778  1.12077468 -0.58400385
##  [64,] -1.15283166 -0.93674410          NA  0.39007540          NA          NA
##  [65,]  1.00323247  0.85389119 -2.26801974          NA  0.21296529 -0.46627566
##  [66,] -1.72983579  0.69707224          NA  0.61646771 -0.46372451          NA
##  [67,]  0.68830067          NA -0.90210245 -1.63687960 -1.47990913  0.30294367
##  [68,] -1.19627262 -1.32774633          NA  1.99766397  0.47215779 -0.03205362
##  [69,]          NA          NA  1.15012200  0.83843203  0.44165229          NA
##  [70,] -0.53164675 -0.31044001 -1.38404384  1.33202331  1.11072696          NA
##  [71,] -0.67736549  0.14659081 -0.42147917          NA          NA  0.56652588
##  [72,]          NA  1.31275519          NA          NA  1.54240064          NA
##  [73,]          NA -1.15711971  1.84502834  1.22670667  1.64404744          NA
##  [74,] -0.25252375  0.02901431 -1.79695231  0.61318333  0.97409659  0.34656962
##  [75,]  0.75521842          NA          NA  0.16395507  0.74125600  0.07524356
##  [76,]  0.66479816          NA -0.93616683          NA          NA  0.73790887
##  [77,] -0.65924723          NA -0.62864319 -1.61646796  1.06331600          NA
##  [78,] -0.47872112  1.26838436          NA  1.38843463 -2.13346007  1.58082786
##  [79,]          NA          NA          NA          NA  0.58117494          NA
##  [80,]          NA  0.72141242 -0.80290052 -2.08381435  0.86249422  1.02723128
##  [81,] -1.06330790  0.27307286  1.09543426 -0.93515965 -0.48908698  0.17474955
##  [82,]          NA          NA          NA          NA -0.56166857  1.44237545
##  [83,]  0.13474062 -0.45103082 -1.28489979  0.94099456  0.62851215  0.46827241
##  [84,]  0.33925714          NA -0.39751583          NA -0.97608338          NA
##  [85,]  1.29536254 -1.23738476  1.30430583          NA          NA  1.14483807
##  [86,]  0.35578761          NA -0.19613124 -0.11192103 -0.03594423 -0.56571470
##  [87,]  0.72649785          NA  0.54246872  0.69731784  1.36119659 -0.23685409
##  [88,]          NA  0.43326308 -0.34570570 -0.07725011 -0.22143916 -1.41797511
##  [89,]          NA  1.51643520  0.03182146          NA  0.82194405  0.42814359
##  [90,]          NA  0.75173689  1.34980700 -0.16771619          NA -1.82706792
##  [91,]  1.59393647 -0.34548465          NA -0.74417473  0.77615951 -1.16364502
##  [92,] -0.22875025          NA          NA  0.27739851  0.69025657 -0.32523395
##  [93,]          NA  0.92873345  0.36402583  1.23277094 -0.88167456 -0.17027033
##  [94,]          NA          NA  0.83234941 -0.76268013          NA  0.69836515
##  [95,]  0.93669151 -0.19078806          NA  0.30142052 -1.14839974          NA
##  [96,] -1.65762272          NA          NA -1.22247986 -1.20686012  2.51390839
##  [97,]  1.01897830  0.76803259          NA  1.23275020  0.59113200          NA
##  [98,]  0.55384832          NA          NA  0.18373237          NA          NA
##  [99,]  0.76204383 -0.12521820 -1.22063637  0.47056201  0.28140761  0.30677606
## [100,]  2.89261554          NA          NA -1.53059901  1.34773014 -0.31610559
##              [,44]       [,45]       [,46]       [,47]       [,48]       [,49]
##   [1,] -0.98528405  0.82996570 -0.57773099  0.99783100  0.35461467  1.26067583
##   [2,] -0.85384421 -0.92459234 -0.52722044 -0.31463614 -0.34634402  1.77339457
##   [3,]  1.28710588  0.28280419  1.09648037  0.51744686 -0.02423242 -0.43088534
##   [4,] -0.84056542 -0.48587538          NA          NA  0.28764239          NA
##   [5,] -1.00659988  0.72892462  0.61248744  0.97924463 -1.35037678  0.43359416
##   [6,]          NA  0.87102948  0.54688516 -0.64135689          NA  0.57916455
##   [7,]          NA          NA  1.05559996          NA  0.16029557  0.42317251
##   [8,]          NA  0.67537190  0.79803136          NA  0.93008661 -0.81305409
##   [9,]  0.62609555          NA  0.99728912  0.43468361          NA -0.06423420
##  [10,]          NA -0.82517302 -0.54700651  0.57065897  0.06894617 -0.19395574
##  [11,]  0.52197680 -0.64313883  0.93427925 -0.33908817 -1.06543690  1.17256117
##  [12,]          NA          NA -1.31401608  1.43570048          NA  2.34272386
##  [13,] -1.06097082          NA  1.00570791          NA -0.02787787 -0.54800868
##  [14,] -1.51092355  1.37533831  1.19352407  0.14874768 -1.32282966  1.66131507
##  [15,] -0.20615705  2.46846344          NA  0.59641747 -1.07299875 -0.07533940
##  [16,] -0.99469729 -0.44344194 -1.12245303 -0.54554755 -1.00497193  0.17048945
##  [17,]          NA  0.79522843  0.05934620          NA -0.95332914  0.72234093
##  [18,]  0.18550509          NA          NA  0.07738344 -0.57891615  0.94437473
##  [19,]          NA          NA  2.35645257 -0.96521861          NA -0.96410667
##  [20,] -1.05220563  1.52477700 -0.68552853 -0.01579039  0.58186931 -1.05971964
##  [21,]          NA          NA  0.91411101  1.66069058 -0.46353951          NA
##  [22,]  1.70041935 -0.38582641 -1.25242389  1.96366449 -1.56696227 -0.67957610
##  [23,]          NA  1.72012517  1.65569657  0.87521693          NA          NA
##  [24,]  0.71600980          NA  1.82876652 -0.62634136 -0.54930188          NA
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##  [25,] -1.64427338 -1.37401394         NA         NA         NA         NA
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##  [27,]         NA         NA         NA         NA         NA  1.61848532
##  [28,]  0.24758884 -0.78694789  1.62068226 -0.70966849         NA  0.10654766
##  [29,] -1.18890493         NA  0.06892727  0.88353480  1.41260995 -0.22514563
##  [30,]         NA -0.10202754         NA -0.36156317  0.05375638         NA
##  [31,]         NA -0.47102718  1.20509155 -0.34477372         NA -0.33094521
##  [32,] -1.10550291  1.04726623 -0.60030756         NA -1.11325710  1.50604111
##  [33,]  1.78936269  0.39369620 -1.47417874  0.09021393         NA -0.78275039
##  [34,] -0.61457186  0.57065467         NA  1.17036888         NA  0.25161889
##  [35,] -2.06374100 -0.68029236  0.87356207         NA -0.48121045         NA
##  [36,]  0.42065145  0.04079406         NA -1.34456318 -1.31815106  0.65024812
##  [37,]         NA  1.72123635 -0.10476635 -0.61814207         NA -0.09102954
##  [38,] -1.49968313         NA  0.14113228 -0.67927782 -0.76709113  0.93373492
##  [39,]  1.56850840         NA  0.81034909         NA -1.62460248  2.34073874
##  [40,]         NA         NA  1.71846492         NA -0.77646815  0.70252316
##  [41,]  0.85230082         NA -0.60898059 -1.38386954 -1.77393195         NA
##  [42,] -0.20900832         NA  1.67933511  0.39720522 -0.37082486 -1.08098495
##  [43,]         NA -0.64912927  0.45676803         NA  2.33548363         NA
##  [44,] -0.40441779         NA         NA         NA         NA  0.75648723
##  [45,] -1.16022728  1.70274238 -1.10283022         NA         NA  0.23673957
##  [46,]  0.76079745         NA         NA  1.73211263 -0.63141901 -0.65708543
##  [47,] -1.48484561 -0.20314764         NA  0.72092267         NA -0.23672181
##  [48,] -1.14795508 -0.22302316  1.19045910 -1.28265425         NA         NA
##  [49,] -0.81592604  0.08652360  2.02167823         NA  0.01967418         NA
##  [50,] -0.54633577  0.64711018  1.10806165 -0.82221622  0.65989278 -0.56437811
##  [51,]         NA  2.18567475 -0.75629402 -0.71692096         NA  1.94673795
##  [52,]  0.01653421  0.96297605 -0.15436621  0.77787318 -0.42915097         NA
##  [53,]  1.11925695  0.41878190 -0.89414363 -0.13867343 -0.95691372  1.52282435
##  [54,] -1.50966577 -0.02116907 -0.54667678  1.39042525  0.55538073  1.42088772
##  [55,]         NA  0.54057671  1.36991200  0.12795306         NA -0.70628796
##  [56,]         NA -1.88084636 -0.39189095 -0.42058980 -0.96259259         NA
##  [57,]  1.03399211 -0.91298797         NA         NA  0.67788781  0.04187034
##  [58,]  0.90017330         NA         NA  0.93589274         NA -0.39613167
##  [59,]         NA -0.22811005 -0.09391128  0.56878231         NA -0.72141172
##  [60,] -1.10923096         NA         NA -0.06161523 -1.68936073  0.98243606
##  [61,]  1.45526361 -0.67840398         NA         NA  1.54061461         NA
##  [62,]  2.54560311 -0.62855160         NA  0.34061318 -1.67065048 -0.45683465
##  [63,]  0.04685684  0.01461123  0.19274672         NA -0.53802947         NA
##  [64,]  1.40272401         NA         NA -1.44982828 -0.97110399 -0.75938709
##  [65,] -0.58554603 -1.78532803 -0.90412031 -1.70568104  0.75790858         NA
##  [66,]         NA         NA -0.14837180         NA         NA  1.42639440
##  [67,] -1.05137398         NA -0.65666618  0.43686780 -0.34930737  1.51832427
##  [68,]         NA         NA         NA         NA         NA -0.80796250
##  [69,] -1.50100584  0.24431973 -0.15780445 -1.81178446 -0.95864703 -2.03553879
##  [70,]  0.82267023         NA         NA -0.25278207 -0.39564232         NA
##  [71,]         NA -1.05124453 -0.47442430  0.49703277 -0.04137573 -0.23059307
##  [72,] -2.33792731 -0.81801508         NA  0.51243997  0.44498125 -0.14654792
##  [73,] -0.10413559  1.14510043  0.61463379  0.04862963         NA  0.08930562
##  [74,] -2.42712925         NA         NA  0.84169175  0.64319560  1.28740740
##  [75,] -1.18063441  0.28737030  0.54989006  1.01858563 -1.07673774         NA
##  [76,] -0.43293372 -0.12534716 -0.53723467         NA  0.81292430  0.46462517
##  [77,] -0.89223156  0.85752104 -0.43139497 -0.35449251  0.80421391         NA
##  [78,]         NA         NA  3.00221043         NA -0.41223681  0.03535296
##  [79,]  1.67966708 -0.27262813 -0.76173598         NA         NA  1.44434996
##  [80,]  1.22694838 -0.30748074  0.51875168  0.35321828  0.93436264         NA
##  [81,]  0.24675127  0.15216269  0.80315397         NA  0.93251616 -0.03627220
##  [82,] -0.21360852         NA -1.12996849 -0.96655370  0.61208739         NA
##  [83,]  0.08738785  0.51849101 -0.07307303  0.91634299  0.46593426 -1.76646009
##  [84,] -0.84869651  1.15566406 -1.18810086         NA  1.32184174 -0.24290854
##  [85,]  0.91432268  0.46015512         NA -0.05981596 -1.44415762 -0.57331639
##  [86,]         NA -0.88782588  1.34574100         NA  0.25847042 -0.13059145
##  [87,]  0.41826015 -0.12777834 -2.04098710  0.26880349  0.99363296         NA
##  [88,]  0.22438605  1.04281125         NA -1.23687856         NA         NA
##  [89,]  1.18790543         NA  0.25844429         NA -0.28704682         NA
##  [90,]  0.38241723 -1.15976247  2.07806860 -1.86598753         NA -0.73382750
##  [91,]         NA -1.15446050 -1.72922507 -2.27566762         NA  1.05926352
##  [92,] -1.84519149 -0.05196357         NA         NA -1.44923430 -0.56589684
##  [93,] -0.34513007         NA         NA  1.29112295 -0.27115186 -1.31895750
##  [94,]  0.94790914  1.63299641  0.46801597  0.47852553  1.27402771  0.68653242
##  [95,]         NA  0.05509440         NA         NA -1.05628882 -0.14759103
##  [96,]         NA  0.47189300  0.20500978         NA         NA         NA
##  [97,]         NA -1.10580343  0.06587054  0.87569535         NA         NA
##  [98,]  0.13882211 -0.15172775  0.93721730  0.56104123 -0.45143606  0.20443265
##  [99,] -0.93138105         NA -2.12595037  0.18236407 -1.35630811 -0.09678629
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##             [,50]      [,51]      [,52]      [,53]       [,54]
##   [1,] -0.62113307  0.25190367 -0.76046513  1.35829615  0.120817523
##   [2,]         NA -1.18573473         NA -0.17973288 -1.382415945
##   [3,]  0.94160738 -1.30641973         NA -0.29358154          NA
##   [4,] -0.51634524         NA  0.40803473  0.89400462          NA
##   [5,] -0.21886279         NA         NA         NA  0.340455629
##   [6,]         NA -0.87193423 -1.18798474 -0.90382909  3.279453747
##   [7,] -0.26333447  0.83089746 -0.56531012 -0.69672655 -0.623361830
##   [8,] -0.53047857  0.21565912  0.65303364         NA  0.553911242
##   [9,]         NA         NA         NA -0.38101081 -0.445879834
##  [10,]         NA  1.19497859         NA  1.91373777  0.652227135
##  [11,]  0.39352525 -1.03546278  0.06542505         NA -2.206725280
##  [12,]  0.05033511  0.75945757  0.42093918  0.84758689  1.120946716
##  [13,]         NA         NA         NA  0.45238225 -1.002405759
##  [14,] -0.13308934 -1.91323186 -0.10382070         NA  0.219357466
##  [15,]  0.93665851 -0.09286136  0.55549620  2.16298953  2.583620868
##  [16,] -1.83867906  1.36936526         NA         NA -0.034151712
##  [17,]  0.89606763 -0.60423606 -0.29770969  1.10753990          NA
##  [18,] -1.35873021 -0.84271410  0.77763457         NA  0.364619463
##  [19,]         NA         NA         NA -0.62637864 -0.918837481
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##  [22,] -0.41420919 -1.25749325 -0.42604440         NA  0.952217287
##  [23,]  1.37848448 -0.35317928         NA  0.56661273 -1.371583700
##  [24,] -0.25519355  1.02254856         NA -0.76355632          NA
##  [25,]  0.04497566  0.56140093  1.30618771  0.13997481  0.433204572
##  [26,]  0.02881252  0.88139154         NA         NA -0.243617253
##  [27,]         NA         NA -0.55759594 -2.06057191          NA
##  [28,]  0.72781155 -0.27819244         NA         NA  1.130963319
##  [29,]         NA  0.40699996 -0.60209340 -2.77451564  1.520852741
##  [30,] -0.10799168  0.15892731 -1.38813885 -0.81255847 -0.922981104
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##  [32,]  0.46182224 -0.05263449         NA  0.44058035          NA
##  [33,] -0.39723471         NA         NA  1.81366500 -0.457707051
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##  [35,] -0.14735311 -0.17601230  0.16084998         NA          NA
##  [36,]         NA -0.58183304         NA -0.23646162 -1.213747029
##  [37,] -1.70752454 -0.43299019         NA         NA          NA
##  [38,] -1.03249582  0.62494809 -1.59981026  0.58143130  1.914454023
##  [39,] -0.68487997  2.00565334 -0.05719140         NA -1.301622634
##  [40,]  1.84271640  1.06228673 -1.85458272  0.80213149 -1.513206607
##  [41,]         NA         NA -0.20311271  0.60921349 -0.329269073
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##  [43,] -0.88758991 -0.83738582         NA  1.50244379 -2.134383693
##  [44,] -0.90997491         NA -0.04895847  0.34471718  0.970040428
##  [45,] -0.55670722  0.56166428  0.06299642         NA          NA
##  [46,]  0.99575917         NA         NA         NA  1.437957084
##  [47,]         NA  0.70958356 -1.49297460 -0.82645605          NA
##  [48,]         NA  0.44734115         NA         NA  0.522989461
##  [49,] -0.09759335 -1.37979612 -0.80499860         NA          NA
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##  [51,]  0.82663960  0.07188837         NA -0.41939150 -0.506029281
##  [52,]  1.25474818 -0.27522909  0.60866855 -0.32585894  0.486884599
##  [53,]  0.75258935         NA         NA  0.02215068 -0.974082836
##  [54,] -0.83712579 -0.20301646 -1.34339515  0.24623139 -1.953165993
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##  [59,]         NA -0.78915517 -0.37060514 -1.19383334  0.080284731
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##  [61,] -0.60117312  1.51119286         NA         NA -1.294429911
##  [62,]         NA         NA -0.34710111  0.77547144          NA
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##  [66,]         NA -1.09785983         NA -1.37291753  0.028706571
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##  [69,]  1.95094470  0.55311095         NA         NA          NA
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##  [71,]  0.59649002 -1.04516758  1.59572117         NA -0.491397050
##  [72,] -0.01284677  0.24640646  0.52298155  0.04972775 -0.794430986
##  [73,]         NA -0.74458251  0.20453569 -1.12956223  0.092133267
##  [74,]  0.05289424  0.82526464  0.30637909         NA          NA
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## [74,] -0.05289424 -0.82526404 -0.50057909          NA          NA
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## [81,] -0.92792576          NA -1.01116616 -1.62269653  0.752307509
## [82,]          NA -0.15377247  0.54350010  0.65493702 -0.416094878
## [83,]  0.12153539 -0.42366555 -0.56587176  1.38805194          NA
## [84,]  2.16876440 -1.96433132          NA -1.72466197 -2.054832218
## [85,]          NA  1.56289359  0.92193211  0.55169989 -0.762048891
## [86,] -0.17971800 -1.99196989  0.44222279          NA -1.115002673
## [87,]  1.85656150          NA          NA  0.77609469  0.576662412
## [88,]  0.52146568  0.13233434          NA          NA -0.140423762
## [89,]          NA -1.71978389          NA -0.20363447 -1.050378065
## [90,]  0.67358190          NA -0.49503589 -0.67439712          NA
## [91,]  0.02972058 -1.32004590 -0.09974214 -0.37061255  0.650416213
## [92,] -0.28198290          NA  0.96092388 -0.22431467          NA
## [93,] -0.93569852          NA  1.31623049          NA          NA
## [94,]  1.35515390  2.16870611 -0.04741877          NA          NA
## [95,]          NA  0.54427427 -0.44006571  1.27056037          NA
## [96,]  0.45365544          NA          NA -0.28038713  0.068277288
## [97,] -0.72622397 -0.49305367 -0.50203358 -0.81448567          NA
## [98,]  0.44433819          NA -0.43741667 -0.32157592 -0.732704619
## [99,]  0.30913633  0.36173270 -0.71047685          NA -0.412023555
## [100,] -1.27157428  1.44798008          NA -1.82809911 -0.067260207
##             [,55]       [,56]       [,57]       [,58]       [,59]
##   [1,] -1.689585742          NA  1.47341971 -0.70606493 -0.21958190
##   [2,]  0.213240557  0.98516339  0.54515340 -0.56043475  0.36409064
##   [3,] -2.723663023          NA          NA          NA  0.41131870
##   [4,]          NA  0.18196037 -0.17041365 -0.76280931  1.31763612
##   [5,] -0.562087617  0.31068988  1.19658172 -0.91853853 -2.51561924
##   [6,]  0.008351902  1.39630307          NA -0.33554010 -0.64197177
##   [7,]  0.936959726 -0.02507858  2.08206413          NA          NA
##   [8,]          NA          NA -1.12248630          NA          NA
##   [9,]  0.768478260 -1.34946468          NA  1.01028085 -0.21326541
##  [10,]  0.520664966 -1.42635983 -1.11698286  0.50849110  0.19605335
##  [11,] -0.230589031          NA          NA -0.27139235  0.84175506
##  [12,] -0.480484270          NA          NA -1.35432242 -0.99700180
##  [13,]          NA  0.47532109 -1.75333092          NA  0.92391848
##  [14,]  0.545115261 -0.36997073 -0.23917485 -0.47431185          NA
##  [15,]          NA  1.72715286  0.07138445          NA -0.17341281
##  [16,] -0.836483716  1.11514019 -0.57811470  0.06357804          NA
##  [17,] -0.100294658 -0.45856300  0.55315980          NA          NA
##  [18,] -0.410897196 -1.64031005  2.77423785          NA  0.11303501
##  [19,]          NA          NA  1.56911443 -0.49785707 -1.40213234
##  [20,] -0.307772866          NA  0.46585062  0.82620353          NA
##  [21,] -0.072048839  1.48251657 -2.06705329          NA          NA
##  [22,] -1.073450861          NA -0.49023697 -0.47840631          NA
##  [23,]          NA  0.74027790 -0.01590038          NA -1.09512522
##  [24,] -1.295999501 -0.57406114  0.66055612 -0.02467946  0.44605839
##  [25,]  0.660344483 -2.70639558  0.37995388 -0.44008839  0.66536830
##  [26,]          NA  0.56326515  1.07167198          NA  0.30764996
##  [27,] -0.076556526 -1.29206333  0.56543964          NA -0.18078755
##  [28,] -0.253094150 -1.37238844 -0.38631508 -1.89265362          NA
##  [29,] -0.036411689 -0.36108000          NA  0.43299897  0.52880918
##  [30,] -0.919267984  1.22305241  0.39407178 -0.60897166          NA
##  [31,]  0.512945997 -0.22578427  1.80782012 -1.72807153          NA
##  [32,]          NA          NA -0.62726389  0.14877344  1.77697957
##  [33,]  1.052171732 -2.91974154 -0.25865476 -1.29812236  1.23683517
##  [34,]          NA  1.47183718 -1.09917385 -0.72022302 -0.20943726
##  [35,] -0.233222810 -1.28657774          NA -0.21968019          NA
##  [36,]  2.098074368  0.41055827          NA          NA -0.07093143
##  [37,]          NA          NA          NA          NA          NA
##  [38,]          NA          NA  0.50558901          NA          NA
##  [39,] -0.498996836  1.12572784  0.62234221 -0.06401999          NA
##  [40,]  0.117084195          NA          NA  0.47039613          NA
##  [41,]          NA          NA          NA          NA -0.03191793
##  [42,]  0.280483873          NA -1.93489398 -1.35660473 -0.93386395
##  [43,]          NA -0.71245651          NA -0.98124992          NA
##  [44,] -0.633292933 -0.42697102 -2.02916073          NA  0.39717948
##  [45,]  0.667178279 -0.09049034  0.52523791          NA          NA
##  [46,] -0.025074721 -1.92298647  0.02067433          NA          NA
##  [47,]  1.014173138          NA          NA -0.86930661  0.56330302
##  [48,] -1.513088577  0.55786462          NA          NA          NA
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##  [49,] -1.466849182  0.65626106 -0.68348265 -0.79940175  0.95404874
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##  [51,] -1.918391766 -0.14643104  2.15711199  0.55903044          NA
##  [52,]  1.181274687  1.59085397 -0.56462955          NA  0.54104223
##  [53,]  0.101719851          NA -0.67498267          NA  0.65541740
##  [54,] -0.217684156  0.21311404  0.37803794          NA -0.67986461
##  [55,]          NA          NA -0.34387727          NA          NA
##  [56,]          NA -1.07649035  0.78284728  0.91136040  0.60145941
##  [57,]  1.062323989 -0.68651435 -0.15978296 -0.11210594          NA
##  [58,]  0.197507151 -1.54348642 -2.62987506 -0.83986511 -1.22520267
##  [59,]  2.172516450  0.41769298 -0.36950972  0.04202435  0.04719366
##  [60,]          NA -0.73987308 -0.74364155 -1.06816904 -0.69091274
##  [61,]  0.964137961          NA  0.85475222 -0.11281129 -0.72391821
##  [62,]  0.279042336          NA          NA  1.41893960          NA
##  [63,]          NA -1.62112134 -2.98546859          NA          NA
##  [64,] -2.739574968  0.11207934  0.65657426          NA  1.47310423
##  [65,] -2.221934994  0.23033640 -1.39456090          NA          NA
##  [66,]          NA  0.80896131          NA  0.92003924  0.26461309
##  [67,]          NA -1.17840335  0.67361632          NA -0.60553743
##  [68,]  0.318706209 -0.17758091 -1.31082396  0.65631885 -1.01502895
##  [69,] -0.258835363          NA  0.23113173 -0.80743435  0.69420378
##  [70,]          NA  0.92759507          NA -1.31067543  0.34998002
##  [71,]  0.553519926 -1.03519040 -1.02473943  0.27893124 -0.74926627
##  [72,] -1.371389414 -0.35963186          NA -0.97552320          NA
##  [73,]  2.635052336 -1.19380417          NA -2.39060229  1.77528290
##  [74,] -0.301035794  2.00471960 -0.99684047 -1.03822241 -0.71729976
##  [75,]  1.591435092 -0.17999509  0.87640193 -0.05368592 -0.65262640
##  [76,] -1.273612145          NA  0.05063369 -1.26319940          NA
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##  [78,]          NA -1.23138175  1.37177215 -0.20197484  0.07564565
##  [79,] -0.243213371  0.44897437 -0.11888667  0.76816748 -1.21340753
##  [80,]          NA -1.72053381 -0.81835988  1.88042796 -0.83412193
##  [81,]  1.145761269 -2.42306248  0.92802488          NA -0.06295356
##  [82,]          NA -0.58199483 -1.11251112  1.50311145  1.64551544
##  [83,]  0.241832334          NA -0.92977105 -0.66126848 -1.26602870
##  [84,] -1.482078564          NA          NA  0.21960564          NA
##  [85,]          NA -1.72233677  0.56014063  1.91984610  0.92193826
##  [86,]  2.203570183          NA          NA  0.45813746 -0.33404714
##  [87,]  0.885829788  0.97016059  2.05425431 -1.29108472  0.87653474
##  [88,]          NA          NA  0.90916633 -2.22947089  0.04951802
##  [89,] -0.472846033 -0.28774461 -1.33824263  0.48336244          NA
##  [90,]  0.340699850          NA  0.40010282          NA          NA
##  [91,] -2.694827128  0.68143256 -0.37055132          NA  0.98596379
##  [92,]  0.600546569  0.03354712 -1.28669270 -0.89028863  0.39765855
##  [93,]  2.050649386 -1.51779233  0.82866823 -0.83532622 -1.99768601
##  [94,]  0.109420019  0.77376030 -0.36936546 -1.04027555          NA
##  [95,] -1.081100418  0.19348842          NA -0.46155963  1.08233970
##  [96,] -1.833497743 -0.45127313  1.49778811 -1.17389265 -1.59945297
##  [97,]  0.070434837  1.58677405  2.00122462          NA -0.03599767
##  [98,]          NA -0.64830531 -0.46780951 -0.32371750 -0.15288082
##  [99,] -0.884900068 -0.50051192  1.57576927 -0.55887236          NA
## [100,]  0.508224660 -0.47778935 -0.17692154 -0.04872753 -1.37926660
##              [,60]       [,61]       [,62]       [,63]       [,64]
##   [1,]          NA -0.54595722          NA -0.709604247 -0.104279215
##   [2,]          NA -0.57702994 -1.65021606 -1.251861645 -0.532921560
##   [3,]  0.124343167  0.46625557 -1.57915629  0.883920282  0.786077289
##   [4,]  0.501910653  0.72574697  1.21427750  0.929353410          NA
##   [5,]  0.345224899 -0.58999677          NA  0.275265364  0.796695476
##   [6,] -1.445803345  0.18461677 -0.31284683  0.634910589 -0.160025696
##   [7,] -0.729895232 -1.06834183          NA  0.594412527          NA
##   [8,]          NA  2.51079980  2.37431734 -0.004282923  0.073092188
##   [9,] -0.133933307          NA  0.35805803          NA          NA
##  [10,] -1.484299198 -0.54490931 -0.76441684  0.990234379  0.443040424
##  [11,] -0.157783211          NA -1.11241221 -0.108203508  2.106174031
##  [12,]  0.812763715 -0.75165610  0.51182227          NA  1.210027106
##  [13,]  1.000035551  1.01386309 -2.34498060 -0.739021210 -1.228659847
##  [14,] -0.774475645 -0.96048405  0.47405680 -0.185749061 -1.067656954
##  [15,]          NA  0.26714346          NA  0.620997898 -0.905086376
##  [16,] -0.532159008  1.46107068 -0.03878008 -0.331237456  0.432794759
##  [17,]          NA -0.79022654          NA          NA          NA
##  [18,]  0.841939693  1.63272726          NA  0.334254326 -0.323863026
##  [19,]  1.082776787  0.82031932          NA  1.969542380 -0.943779089
##  [20,] -0.996853966  0.35198092  1.76734397  1.168504601 -0.531590998
##  [21,] -1.697027686          NA -0.74277448          NA          NA
##  [22,]          NA          NA  0.44634428          NA -1.849459582
##  [23,] -0.166982604 -0.36303644          NA -0.794579159          NA
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##  [23,] -0.166082604  0.36303644          NA -0.704579159          NA
##  [24,]  0.077663763          NA          NA          NA -0.264990113
##  [25,]          NA  1.23444192          NA          NA -1.720255321
##  [26,]          NA          NA  0.81447624  0.339400488          NA
##  [27,]  3.074019623  0.48819909          NA -0.077412168 -0.887129502
##  [28,]          NA          NA  1.95472314  0.542575632 -0.008804904
##  [29,]  0.871006001          NA  0.04873595          NA -0.094780165
##  [30,]  0.169793446 -0.50002910  1.04090609 -1.719961138  0.575748268
##  [31,]          NA -0.23069353          NA          NA -0.491319823
##  [32,] -0.518542540          NA  0.62629022 -1.927710975          NA
##  [33,]  1.846807558          NA  1.05231892  0.228639727          NA
##  [34,]          NA          NA -1.18438388          NA  0.849010553
##  [35,]  0.897124511  1.02305877  1.50417219 -1.532165619  0.769909798
##  [36,] -3.045521247 -0.09655870          NA          NA  0.756791796
##  [37,] -1.223243351          NA  0.84591554  0.557067251  0.450576294
##  [38,]          NA          NA  1.19097342 -0.768601807  0.710299923
##  [39,]          NA  0.17239041  0.05040015 -0.766383407 -1.258724253
##  [40,]          NA  1.62547081 -0.11143418          NA          NA
##  [41,]  1.633544150 -0.52624795  0.59421375  0.021907183  2.653427054
##  [42,] -0.249893289 -1.06913396  0.88696165  0.938757744 -1.392616126
##  [43,]          NA          NA  0.91164410 -1.419164167  2.017527274
##  [44,]  0.448696944 -1.70903863  0.41306947 -1.171683197 -0.753452341
##  [45,]  1.185500392 -0.24186278  1.59203463          NA -0.863978023
##  [46,]  0.683570037 -2.19502608  0.13685179          NA          NA
##  [47,]  1.182635603          NA  0.28948575 -0.477187319  0.610816866
##  [48,]          NA          NA          NA  0.459628620  0.943383448
##  [49,] -2.176337265          NA          NA          NA  1.899133322
##  [50,]          NA -1.05164165  1.44846407          NA          NA
##  [51,]  1.359436890  0.15364928  0.10256222  0.353991753 -0.611918611
##  [52,]          NA -0.09268908  0.07742274 -0.778296840  0.202121072
##  [53,] -0.897255982  1.22830620 -0.88047775 -0.528250265 -0.690277142
##  [54,]  1.064899075 -1.49448992 -0.43854640  1.203546980 -3.326177600
##  [55,]  0.203004017          NA          NA          NA          NA
##  [56,]  1.608888530          NA -0.31647690 -0.695814948 -0.680031969
##  [57,] -0.302069787 -0.94400176  1.56919680          NA          NA
##  [58,]          NA  0.46872944  1.81170602  1.313972573          NA
##  [59,]          NA  1.39670495          NA  0.690017783 -0.950577971
##  [60,]          NA          NA          NA          NA  0.020012315
##  [61,] -0.463099183  1.34893432  1.32845041  1.063674542 -0.655727876
##  [62,]  1.358754111  0.78201228  0.38695987  0.962953720 -2.314155940
##  [63,]  0.515614017 -0.20032598 -3.25426147 -0.791489909  0.510337960
##  [64,]          NA          NA -0.98882936  1.171712452 -0.799122252
##  [65,]  0.409570943  1.55404999  0.76272088          NA -0.607563632
##  [66,]  1.454114868 -1.66936475  0.98741094  0.148311239  0.893790336
##  [67,]  0.141151525 -0.53578503 -1.63640232          NA  0.325236636
##  [68,]          NA  0.61329974  0.63868232          NA  0.699452144
##  [69,]  0.414816613          NA  2.45113185          NA -1.399782394
##  [70,] -0.856908174  1.76583882          NA -0.148419502 -1.405597367
##  [71,]  0.255389247 -1.00085013 -0.72411808  0.802747287  0.291467298
##  [72,] -0.858100280 -0.67770316 -1.38509127 -0.876592282  0.351431324
##  [73,] -0.657449613 -0.19072241          NA  1.362300859          NA
##  [74,] -1.422601849          NA  0.39499352  0.034060321 -0.476214110
##  [75,]  0.558642739          NA          NA -2.099667721  1.635783504
##  [76,]  1.139070711  0.21449508 -0.52368020          NA -0.922843361
##  [77,]          NA -0.88520290          NA -0.556402916          NA
##  [78,] -0.175356079 -0.68579098 -0.41641395 -1.429350301          NA
##  [79,] -0.007185699 -1.08195683          NA -0.358907673          NA
##  [80,]  0.196134007          NA -1.24694297 -0.999375041 -1.347487676
##  [81,] -0.799732635  0.72325579  0.53622081  0.755646634          NA
##  [82,]          NA -0.20197656          NA  0.426309030  1.000620671
##  [83,]  2.053141680 -0.87937806          NA  0.330659040          NA
##  [84,]          NA -1.09684197 -0.62236386  1.005674945          NA
##  [85,] -1.797230230          NA -1.55334507 -0.513633366  0.274384762
##  [86,]  0.314237157 -0.60766539  0.60433177  0.837170390 -2.344857359
##  [87,] -1.488459566  0.14283049 -0.46760116  0.834916513  0.842623609
##  [88,]  1.070672409 -0.47537494 -0.70353108 -0.482111700          NA
##  [89,] -0.153855342 -0.29167560          NA  1.111877539  1.667292382
##  [90,] -1.579380591 -1.53600897 -0.27601908  0.507117383  0.199822609
##  [91,] -0.623868030 -2.56121903 -0.17469937          NA  0.753563372
##  [92,]  0.655704168  0.79717431          NA  0.752808519  0.244618257
##  [93,]          NA  2.39321510  1.36213316 -0.256325653          NA
##  [94,]  0.594136798          NA          NA -0.669852594  0.995175986
##  [95,]          NA          NA          NA          NA          NA
##  [96,]  1.309988695 -1.49114813 -0.09712588          NA          NA
##  [97,]  0.762212836          NA  0.25557013          NA -0.100430460
##  [98,]  0.035001652          NA  1.40447473 -0.139692015 -1.571875589
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##  [99,] -0.970863811  0.44328491  1.25988930          NA  0.258104156
## [100,]  1.232042153  0.13386016  0.88683368 -0.140374709          NA
##              [,65]       [,66]       [,67]       [,68]       [,69]
##   [1,]          NA          NA -0.912159908 -0.89572164 -1.64054083
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##   [3,]  0.332272206  0.67991158 -0.038195394 -0.16587944          NA
##   [4,]          NA -1.37345681  0.412224007 -0.30833794  1.00899742
##   [5,]  1.493361844  1.44809544 -1.073270090  1.71674635  1.29629366
##   [6,]  0.362437216          NA -0.078579454  1.15247277  0.93376334
##   [7,]          NA  0.01133985          NA -0.93923030  0.64117440
##   [8,]          NA  0.37878938  0.005130065  0.26986997          NA
##   [9,]  0.898052964          NA  0.431045944 -0.80355094  0.02064415
##  [10,] -0.207562614  1.34345636  0.847573671          NA -1.01378441
##  [11,]          NA          NA  1.429855588          NA          NA
##  [12,]          NA -1.99537225  0.670994267 -0.05434322  0.83234841
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##  [52,]          NA          NA  0.55243001  0.392503442          NA
##  [53,] -1.33257460          NA -0.54952355 -1.219527633 -0.11476254
##  [54,] -0.12395001  1.703170537 -1.21156113          NA          NA
##  [55,]          NA -1.213789523          NA -0.176194864          NA
##  [56,] -1.31693370 -0.361812988          NA          NA -0.87472848
##  [57,]          NA          NA          NA  0.254838702          NA
##  [58,]  1.55377267 -0.584278461 -0.14373590  2.052441847 -2.03470341
##  [59,]  0.16303046  0.520113867  1.02097045 -0.944058317          NA
##  [60,] -0.38000645  0.129769475 -0.33970984 -1.003380933 -1.79074379
##  [61,]          NA -1.335752876  1.06919902 -0.675272404  0.65390999
##  [62,] -1.71689215          NA -1.40090069  0.252432137 -0.01126250
##  [63,]          NA          NA  0.11478186 -1.160245029  0.41977106
##  [64,]          NA  0.569694045 -2.73335687 -0.235765905 -0.42379567
##  [65,]          NA -0.274719636  0.09242879          NA  0.39207889
##  [66,] -2.09746551 -0.101850757  0.34215931  1.409241500 -0.59984145
##  [67,] -1.54145821          NA -0.12350566 -0.105787470  0.58388528
##  [68,] -1.23367964  0.528614832 -1.33695190          NA  0.82882776
##  [69,] -0.18829740  0.775749949  0.46695636 -0.467009908          NA
##  [70,]  0.62432505          NA -0.70226371 -0.241971072          NA
##  [71,] -0.74665961 -2.734513418  0.02156550  0.603427123          NA
##  [72,]          NA  1.396439429  0.65863354  1.086988905 -0.04963818
##  [73,]  1.17352617  1.956517260  0.78123500  0.099360977  1.02168443
##  [74,]          NA          NA -0.82017507          NA          NA
##  [75,]          NA          NA -1.83877858 -0.088339075 -0.03633439
##  [76,] -0.42148783 -0.169539403  1.54661962  0.073053792          NA
##  [77,]  0.07857570  0.074823148  0.60542091 -0.316796308 -1.93132267
##  [78,] -0.94816545  0.175380198  0.16498717 -0.647164440  0.63180610
##  [79,]          NA -1.282206571          NA  0.258012009  0.71728135
##  [80,]  2.58483003          NA  1.25765286  0.132227022 -1.25906639
##  [81,]  0.57333323  0.124335856 -0.39207813          NA          NA
##  [82,] -1.12148327 -1.975659159          NA -0.857658748 -2.20162871
##  [83,] -0.95728386  0.329611705  1.82516838 -1.426280922 -1.72681516
##  [84,]  0.02277406          NA          NA  1.808234835          NA
##  [85,]  0.24562386 -1.347799343 -1.91625695  0.126243313  0.44861171
##  [86,] -0.26259229          NA  1.13319308          NA -1.25527245
##  [87,] -1.24246871 -0.196813616          NA  0.608640757          NA
##  [88,] -0.17431039          NA          NA          NA          NA
##  [89,]          NA -1.213433230 -0.89676499 -0.095606458  1.10482254
##  [90,] -1.89053006          NA  1.56195770 -2.769714131          NA
##  [91,]  0.26737411          NA  0.05099233          NA  0.04219603
##  [92,]  0.09241518  0.129226698          NA -0.058245629 -1.55178315
##  [93,] -0.33384876  3.006680990  0.58439485          NA  0.50602375
##  [94,]          NA -1.105004157  0.10803437          NA -1.26611157
##  [95,] -1.59703964  1.117158698  1.99640154 -0.946067936          NA
##  [96,]  0.20145222 -1.921283461  0.69715574 -0.224261407          NA
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##  [97,] -1.16258120  0.827572897  0.95323558  1.776021329  0.91072071
##  [98,]          NA           NA  1.19366802 -0.099777023          NA
##  [99,]  0.34121233           NA          NA -1.577286414 -0.29730857
## [100,] -2.08551289           NA          NA -0.197771073  0.23709822
##              [,81]       [,82]       [,83]       [,84]       [,85]
##   [1,] -1.92161652  0.41208765 -0.466800905  2.31800131  0.12037848
##   [2,]          NA -0.05416425 -0.286375682          NA -1.18470498
##   [3,]  0.35341580  2.09983936 -0.129872950          NA  0.86383995
##   [4,] -0.93933335          NA  0.087649879          NA          NA
##   [5,] -1.55172309  0.39112421  1.208572992  0.40045731          NA
##   [6,]  0.90884914 -1.07258629 -1.481349373          NA -0.06894376
##   [7,] -0.04911029          NA -1.384972414 -1.22342832          NA
##   [8,] -0.77329135  0.14422621 -0.623084039 -0.49777101  1.78095078
##   [9,]  0.86516161  0.78883318 -0.544328881  0.67106137 -0.55780122
##  [10,] -0.85241810 -0.28584946 -1.860995931          NA -1.46772492
##  [11,]          NA -1.47908939  0.027105933 -0.85771150          NA
##  [12,] -1.16079558  0.26586978          NA -0.62525072 -0.44495927
##  [13,]          NA -1.86749835  0.025421462          NA -1.01456059
##  [14,]          NA  0.76522342  1.036858584          NA  0.24729880
##  [15,]          NA  0.86393052 -1.976518250          NA          NA
##  [16,]          NA          NA -0.224203581          NA          NA
##  [17,] -0.34469778  0.10723038 -0.003698836          NA          NA
##  [18,] -0.76305364  0.52869892          NA -1.42938040  0.02493639
##  [19,]  1.94535544 -1.02866410  0.453945466          NA  0.60701032
##  [20,]          NA  1.06752683          NA  0.52617039  1.31006954
##  [21,]          NA -1.16792556 -0.347092758          NA -0.86244877
##  [22,]  1.47355716 -0.52819303  1.211442046 -0.93745863 -0.38870094
##  [23,] -0.15213360  0.06014623  0.675538166  1.45260810 -1.07197020
##  [24,]          NA -0.01327611 -0.910508802 -1.04319237  1.76458199
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##  [26,]  0.29047254 -0.01305486 -1.065796369  0.63806497  0.33867772
##  [27,] -1.28416051 -1.68166408 -0.693469513  1.00592471 -1.07906603
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##  [29,]          NA  0.47659984  0.396237377          NA -0.76591453
##  [30,] -0.23186139 -1.09107687 -0.531482686          NA  0.09620382
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##  [43,]  0.19517000  0.38285093  1.264633789 -1.76693977 -0.40395528
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##  [46,]          NA -0.54068587 -2.137299032  0.59309024 -0.85320884
##  [47,] -0.31851116  1.06669549          NA  1.75009803          NA
##  [48,] -0.47991054          NA  1.214838588  1.75754224  0.46751707
##  [49,]  2.43397669  1.39421057  0.078403960 -0.15229736          NA
##  [50,] -0.14079512 -0.91574570  0.042083878  0.01509517          NA
##  [51,]  0.01547822          NA -0.554507285  0.91487154 -0.20467897
##  [52,] -0.44235847          NA  0.910223599 -0.15307834          NA
##  [53,]  0.58179387 -0.13019395          NA          NA -0.06360909
##  [54,]          NA  0.20397970  1.170611126  0.95204312 -0.59102089
##  [55,] -0.15600463  0.93384673 -2.508096028 -0.74173273          NA
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##  [57,]          NA          NA  1.921038626 -2.12566455          NA
##  [58,]  1.06328617  1.18769417  1.591609642          NA  0.45705528
##  [59,]  1.35332179  1.47820584          NA -0.54705237          NA
##  [60,]  0.91032292          NA          NA -0.19217127  0.65319564
##  [61,] -0.14820871  0.09833606 -1.347309622          NA -0.14499887
##  [62,]          NA -0.63967236 -1.027852683 -0.80062441  0.38157070
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##  [64,] -1.02010418 -0.72368871          NA          NA -0.29126663
##  [65,]          NA -0.52158691 -0.210882757 -0.41811311          NA
##  [66,] -0.15158985 -0.34864601  0.469549938          NA  0.58697902
##  [67,]          NA  1.40244717 -1.478863882  1.77470011          NA
##  [68,]  0.72850768  0.10259064  1.079534738          NA          NA
##  [69,]          NA -2.36482445 -0.501539719 -0.38085393  0.47468048
##  [70,]          NA          NA          NA -0.60622332  0.78358356
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## [74,]  1.64033053 -0.60127877 -0.915890643 -1.12200479  2.03239264
## [75,] -1.07081890 -1.25512853           NA          NA  1.40153503
## [76,]  0.22505394          NA -1.341862281          NA          NA
## [77,]  0.95464059  0.35007645 -0.507994184 -0.93444746          NA
## [78,]  1.68982203  0.87776201           NA          NA  0.14487028
## [79,]  0.54652244          NA  0.508491306  0.09437150  1.40898018
## [80,] -1.37565427  0.19315751           NA          NA          NA
## [81,]  0.51484081 -0.50707183  1.196530970  1.54297460  0.22036424
## [82,]  0.40747967  0.12853377  0.094512298 -0.56250734  1.07773839
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## [85,]          NA          NA -0.726211434  1.30959092 -1.19866423
## [86,] -2.06254385  0.06874370           NA          NA -0.15442988
## [87,] -0.83618764  0.18800810 -0.073701970          NA -3.75020651
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## [89,]          NA          NA           NA          NA -1.29931091
## [90,]          NA  1.23211557 -0.112733532          NA          NA
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## [92,]          NA -0.16583623           NA -1.28474233  0.70445878
## [93,]          NA  2.38622519           NA  1.78871713  0.18916849
## [94,] -1.94018136  0.19972195  0.420227327  0.45615470  1.75801361
## [95,] -0.08172226 -1.17500471           NA          NA -0.07637668
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## [97,]  0.21188205 -0.78276037           NA  0.20869906  0.93724946
## [98,]          NA -0.11689131           NA  0.37199396 -0.90437987
## [99,]          NA -0.20795102           NA -0.06228851          NA
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##              [,86]        [,87]       [,88]       [,89]        [,90]
##   [1,]          NA  0.004561827          NA  0.68908657           NA
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##   [3,]          NA           NA  0.10353836  0.41887681 -2.451161719
##   [4,]  0.335572322           NA  0.32924998  1.89828759 -1.130331693
##   [5,]  1.251518297  0.839955261          NA          NA           NA
##   [6,]  0.073684210  2.536312405  0.16494578  0.70007120           NA
##   [7,]          NA           NA  0.21749358          NA -0.004785856
##   [8,] -0.905217257  0.057546835          NA  0.08605181  1.298420900
##   [9,]  1.545557974 -0.452989509          NA  1.29006903 -0.518701257
##  [10,]  0.866434590           NA  1.40544269          NA           NA
##  [11,]  0.948737185  1.001377424  1.39924239 -0.17726283 -1.013597757
##  [12,]          NA           NA          NA  1.97795823 -0.693449158
##  [13,]  0.077210926           NA -0.38001817  2.06606013  0.142760449
##  [14,]  1.546994660  0.828049677          NA          NA           NA
##  [15,]  0.153589743  3.146638225 -1.12192842  1.43523368 -1.446135886
##  [16,]  1.714175030 -0.302343271 -0.63132958 -1.90521223  0.862502175
##  [17,]  0.036942366  1.001500514 -1.39621074  1.64171055           NA
##  [18,]  0.072869899 -1.612135755          NA          NA -0.232589356
##  [19,]          NA  0.989135337 -2.29623925  1.38054287           NA
##  [20,]  0.356312301           NA  0.28791456 -1.55737673 -1.480784130
##  [21,]  2.314157093  1.070989742          NA -0.78475434  0.172445147
##  [22,]  1.414415723           NA -0.10663504          NA  0.239076784
##  [23,]          NA           NA          NA  1.64801287 -0.748737592
##  [24,] -0.051614574           NA          NA -1.16627295  0.471540422
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##  [28,] -0.019480658 -1.226535756  0.44100543 -1.45471386  0.676673475
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##  [31,]          NA -0.060994912  2.00270082 -0.25211832 -1.048950470
##  [32,]          NA  0.576610237 -1.57107166          NA  2.276392596
##  [33,]          NA -1.159613658          NA  1.35323127 -0.275444853
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##  [50,]  0.492439935          NA          NA  1.75566220 -0.232091802
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##  [56,]  0.019812935  0.603730440  0.81302460          NA          NA
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##  [59,]  0.982434050  1.507071993  0.16657176  2.99507652 -2.049411934
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##  [66,]  0.240126121 -0.208441923          NA  0.80321688  1.328383312
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##  [75,]  1.223679338 -0.187158775  1.30801634          NA -0.701906456
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##  [82,]  1.233550231 -0.329011554 -2.33495238  0.42687097          NA
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##  [89,] -0.417058779  1.095278443  1.34628361  1.03273061          NA
##  [90,]          NA -1.917553931 -1.69114459  0.71509933          NA
##  [91,] -0.188741723  0.463555926 -0.54045747  3.03271369          NA
##  [92,] -2.725349107 -1.586210661 -0.38528178  0.10752842  0.886751257
##  [93,]  1.181857330 -0.284694510  0.36890575 -0.57410491  0.663454466
##  [94,]          NA -0.930031093          NA -0.25430151          NA
##  [95,]  0.427833343  0.004904926          NA -1.23756059          NA
##  [96,] -0.487742330          NA          NA -2.46901761 -0.180805480
##  [97,]  0.717899940 -0.189638526 -1.38048232 -1.01413979 -1.650942046
##  [98,] -0.546167205 -0.075688411  0.01765478          NA  2.542482904
##  [99,]  0.747922413 -0.563610112          NA -0.88632545          NA
## [100,]          NA -0.784325305          NA          NA          NA
##             [,91]      [,92]      [,93]      [,94]      [,95]
##   [1,]          NA  0.87137248 -0.15166866          NA -0.108246735
##   [2,]  0.08107262  0.64322006 -0.23409997 -0.339114574          NA
##   [3,] -0.77217680 -1.34442583          NA  0.291303698  0.610843119
##   [4,]  0.35651091          NA -0.69504781 -0.134973109          NA
##   [5,]          NA  1.58275905 -1.86250185  0.704783823          NA
##   [6,] -1.44767129  0.09977199  0.58636589 -0.003156527  0.692952416
##   [7,] -0.14033514          NA  1.24849332  0.102223269 -1.527514254
##   [8,]          NA -1.41737614 -2.43382874 -0.814702265 -0.057989735
##   [9,]  1.79730193  0.40708146          NA -0.118234052 -1.837566210
##  [10,] -1.10527186          NA  2.84729419 -0.473250570  1.061539696
##  [11,]  0.54004083 -1.02866209  0.88138684  0.220720206 -0.223488878
##  [12,] -0.20667897 -0.90467343 -0.55392990  0.360125527 -0.264382857
##  [13,] -2.13211816 -2.09378828  0.52432756 -0.544350785  0.213615710
##  [14,] -0.20022814          NA -0.31257713 -0.858252844  0.346231789
##  [15,]          NA -0.33612151          NA          NA -0.078766113
##  [16,]  0.64571147          NA          NA  0.165411845 -0.726022618
##  [17,]  0.12290778  0.08508027          NA -1.097234067  3.590085856
##  [18,] -0.40548145 -0.10322441  1.26661339 -0.273278449  0.339159304
##  [19,] -0.76570345          NA          NA -1.799808761 -1.557201290
##  [20,] -0.80561244 -0.09509884 -1.39476610 -0.998341528 -2.660323402
```

```
## [20,] 0.80561244 0.09590884 -1.39476610 -0.998341528 -2.660323402
## [21,] 0.78160691 NA -0.60014384 -1.227584687 -0.475656512
## [22,] -0.62767785 0.05318618 NA 0.270169865 0.740032131
## [23,] NA 0.79842951 0.91582625 -0.202349342 NA
## [24,] 0.61668440 0.84025756 -0.10672167 NA 0.730028385
## [25,] -0.61502562 0.18392456 -0.42614981 -0.113719882 -0.606995122
## [26,] -0.73490909 1.49729252 NA -0.179698197 2.183371868
## [27,] -0.29338694 -0.46595037 0.47966004 0.774353855 -1.434663598
## [28,] -2.18188257 1.87134136 0.98997891 -0.162876648 1.167805018
## [29,] -1.52951593 -0.50490188 0.38949467 NA -1.250053324
## [30,] 0.22473476 NA -0.40267054 0.970971925 0.003426563
## [31,] 1.25067188 NA 0.80478002 1.490941698 1.621167671
## [32,] 0.16238781 0.75704150 1.20681451 0.098304171 0.018812996
## [33,] 2.10711860 1.15995205 0.38366113 -1.097343091 NA
## [34,] 0.91645137 NA NA 0.911052018 0.874892196
## [35,] 1.36439241 NA -0.45985603 NA 0.173351592
## [36,] -0.02080196 0.86081339 -0.35064089 0.074745216 -0.229253267
## [37,] NA NA 2.86965302 0.565720995 NA
## [38,] -2.08023712 -1.12447192 NA 1.097004512 NA
## [39,] 0.36162830 -0.05207468 NA -0.247369761 NA
## [40,] NA NA -0.92395960 -1.921169411 -0.701355112
## [41,] 0.61617326 1.70622881 NA 0.172586529 NA
## [42,] 0.13592195 -1.70321374 NA -0.253652645 NA
## [43,] 1.30305845 1.13512920 NA -0.579576815 0.559798220
## [44,] NA -0.09029064 NA NA 0.131539879
## [45,] 1.34126559 -0.10582902 2.12830281 NA 0.988435872
## [46,] 0.28661139 0.20816767 NA 0.320625520 0.162177407
## [47,] -1.64364907 NA 2.48639510 NA 0.161358069
## [48,] -0.89808063 2.04006214 1.82669151 -0.636825875 -0.562541253
## [49,] 0.06939858 0.08066516 NA 0.327628170 1.059500847
## [50,] -1.77088656 NA 0.60889112 0.286953826 0.070298304
## [51,] NA -1.46844796 0.32261094 1.058639165 -0.472467516
## [52,] 0.75257185 -0.02729113 NA 0.454982028 NA
## [53,] 0.28762333 0.13659456 -0.36702651 0.533707134 0.659881220
## [54,] 0.40900986 NA 0.49488306 NA 0.117421065
## [55,] 0.16861329 NA 1.56392708 -1.972303053 0.446206409
## [56,] NA -0.41246576 0.71223066 NA 0.224160660
## [57,] -1.28039552 -0.97290417 -0.35221338 1.155821670 -0.144926260
## [58,] 0.26526980 0.01151339 NA NA 0.067700833
## [59,] 0.36543956 0.65644022 0.40639243 -0.433753750 NA
## [60,] 0.88836754 0.42473519 0.87253527 NA -0.271373158
## [61,] -0.21236070 0.68989689 -1.74594111 1.982601730 -0.903631219
## [62,] 0.14875735 NA -0.69995754 1.078218976 0.548175995
## [63,] 0.35018109 -0.93786156 -1.28306641 0.096716922 -0.602413556
## [64,] 1.29323866 NA 1.56062348 -2.010236886 NA
## [65,] -1.11696317 NA 0.41576801 0.197874169 NA
## [66,] -0.62064306 0.59411804 NA 0.938505681 -1.772167003
## [67,] -1.31223151 NA NA 0.134193104 NA
## [68,] 1.16020291 -0.91481073 0.53265825 -0.367611880 NA
## [69,] -1.59096759 0.70903164 0.69962599 -0.356980809 0.967073131
## [70,] 0.02097215 0.32774385 0.30966220 -0.573115073 NA
## [71,] NA -1.65925687 NA -0.777370453 NA
## [72,] -1.08638818 0.42579162 -0.25303729 -0.984701946 -0.419482948
## [73,] NA 1.62516533 NA -0.740528298 NA
## [74,] NA -1.36916470 -0.54320817 0.688199394 0.578864292
## [75,] -0.17600761 NA NA NA NA
## [76,] NA 0.56106194 0.11602193 0.075830640 NA
## [77,] NA -0.52687429 -0.99223189 -0.760910360 -0.800616868
## [78,] NA -0.63899302 -0.10422457 0.729379195 0.517334878
## [79,] -0.70270510 -0.53712279 NA NA 0.259530925
## [80,] NA -1.23878753 -2.17902219 -0.333930533 -1.982638823
## [81,] -0.49003107 -0.43075627 1.28660301 -1.191896158 NA
## [82,] -0.60558279 -2.08447711 -0.74470807 -0.269119298 NA
## [83,] 1.08029658 -1.52538110 -1.55393288 0.281494067 -0.300477938
## [84,] -0.95400802 NA NA NA NA
## [85,] -0.47559352 -0.12315766 2.38006739 0.223056648 0.101737791
## [86,] -0.07860523 NA 0.31655067 -2.337306950 0.913102528
## [87,] NA -0.38255991 1.50676706 1.315045722 1.172707870
## [88,] 0.49090704 2.77363621 -0.25467883 -0.179501095 0.553816105
## [89,] NA NA -2.12931194 0.687500323 -0.611066063
## [90,] NA NA 0.05283758 -0.524457304 -0.222041353
## [91,] 2.07143205 0.50026911 0.98594428 NA 0.652667812
## [92,] -0.98976188 -0.40491090 NA -0.138198387 NA
## [93,] -0.44808041 -1.29666764 NA NA -0.497335564
## [94,] 1.48818777 -1.11572739 1.21936795 0.290827591 -1.320466996
## [95,] NA -0.18301995 NA 1.464997113 0.159466362
```

```
##  [96,]  1.72221886  1.05960147          NA  1.068116579 -1.277051289
##  [97,]  0.50197897          NA -0.55627807          NA -1.481508382
##  [98,] -0.28111673          NA          NA -0.264886494          NA
##  [99,] -3.19781193          NA  0.18973860 -0.847580223          NA
## [100,]          NA -0.84992163          NA          NA  1.949868095
##              [,96]       [,97]       [,98]       [,99]       [,100]
##   [1,] -0.139065911 -1.24069709  1.19767407 -0.44568065  1.793291582
##   [2,] -0.017282682 -0.49087499 -1.23282950 -0.47311291          NA
##   [3,] -0.319724242  0.86596075 -0.02830377  2.42986203 -1.187342576
##   [4,]  1.009397658          NA          NA -0.95400426 -0.881328888
##   [5,]          NA  1.11457873  0.04884708          NA  0.785885641
##   [6,]          NA -1.85047130 -1.14528584          NA -0.150597645
##   [7,]  0.762322250 -0.64985949  0.26604847  0.42703986  0.785484745
##   [8,]  0.208537483          NA -0.75539722 -0.34358144          NA
##   [9,]          NA -0.50058154  2.95249470 -0.23785490          NA
##  [10,]          NA -0.14892226  0.45924547 -1.01535463 -0.351060385
##  [11,]  0.082142968 -0.54725247  1.44421701  0.01406091          NA
##  [12,] -1.971548293 -1.43308999          NA  0.41875433  0.433847078
##  [13,]          NA          NA  1.29903355 -1.03458364          NA
##  [14,]  0.628190898 -0.34755490  0.56838139          NA          NA
##  [15,]          NA          NA -0.53733062          NA -0.290343325
##  [16,]  0.132118148  0.96558644 -1.32313020          NA  1.137436217
##  [17,] -0.731886628  0.06316633  1.44809954 -0.26744508          NA
##  [18,]  0.117742736  0.94363308 -2.47608011 -0.14638798  0.090207985
##  [19,]  0.759897509 -0.72093735 -0.64179283          NA -1.121968490
##  [20,]  0.276282451 -0.78756506 -0.69730176  0.22706491          NA
##  [21,]  1.789911242          NA  0.08625518 -0.15288212 -0.106510619
##  [22,]          NA -0.21962010  0.95402004  0.81995287 -0.983825112
##  [23,]  0.978780102 -0.20826652  1.04143882          NA -0.725402491
##  [24,]  1.316662697 -0.86528440          NA  0.30434893          NA
##  [25,]  0.623658416  1.27660600  0.64075836          NA -0.968626286
##  [26,]  0.399733182  1.03556766          NA  1.84689746  1.867425524
##  [27,]  0.789690317 -1.54583695 -0.34547916 -1.61467400  1.065989847
##  [28,] -0.680532819          NA          NA  0.74076938  0.291400138
##  [29,] -0.245083568  0.32937625 -0.09638573          NA          NA
##  [30,]  2.266311769          NA  1.17667491 -0.29639660 -2.810677525
##  [31,]  0.698974759          NA  1.25543023          NA -0.974022597
##  [32,]          NA          NA -0.21670435 -0.16838348 -0.136914116
##  [33,]          NA -0.24939184          NA          NA  0.283799607
##  [34,]          NA  1.70229872  1.94051396 -0.26616364  0.298010673
##  [35,]  0.450885227          NA -0.48487819  1.23773224          NA
##  [36,] -1.435655341 -0.73106743          NA          NA  0.240647634
##  [37,] -0.232105025          NA  1.33478496          NA -0.316033958
##  [38,]          NA -1.22362683 -0.61889538  0.46597888 -0.149228156
##  [39,] -1.391764225  2.03524235 -0.00599911  0.58421508  0.869777968
##  [40,] -0.147792597          NA          NA  0.45334587          NA
##  [41,]  1.267181556  1.16953866  1.05773845 -0.05264762 -1.254913102
##  [42,]  0.820967855  0.20872362 -0.25695164  0.72830516  0.046076343
##  [43,]  1.166016621  0.19177240          NA -0.30605076  0.774373717
##  [44,] -0.736208435          NA          NA -1.53741401  0.057881121
##  [45,]          NA          NA  1.37734025          NA -0.722816319
##  [46,]  1.080495259  0.85644701          NA  0.67352619 -1.542528131
##  [47,] -0.362355041          NA -0.39739964 -0.07181523  1.199579659
##  [48,] -0.270450284  0.90319506 -0.14507417  0.33606956          NA
##  [49,]  2.274507019  0.07734432  0.17680420 -0.28346914 -0.346005120
##  [50,]  0.021639364  1.06240493 -0.51281540  0.54235111 -0.464622441
##  [51,]  0.050306171          NA -0.53394945          NA -0.652534624
##  [52,] -0.306195693          NA  1.34608394  0.16846921 -0.717608068
##  [53,]  0.009471815          NA  0.85626823 -0.22564858  0.882136508
##  [54,] -1.745113398 -0.51779480 -0.44177400 -1.56665602  0.828515214
##  [55,]          NA  1.94342498          NA -0.50360189          NA
##  [56,]  0.034621739 -2.05309004  0.96051386 -0.17458151          NA
##  [57,]          NA  1.93066822 -0.54035488 -0.40406875          NA
##  [58,] -1.063565234 -1.50754643  0.28965112          NA  1.751996515
##  [59,] -0.788719576  0.96356706 -1.69522747          NA          NA
##  [60,] -1.185771240 -0.70987980  0.34716191          NA -0.043860533
##  [61,] -0.648709489  0.33391237          NA  0.47180122 -1.408526133
##  [62,]          NA  0.80787061          NA          NA -0.870327618
##  [63,]  1.764346097          NA  0.93438712  0.51883414  0.136146307
##  [64,] -0.400590252          NA          NA -0.04043199  0.326890339
##  [65,]  0.263304815 -0.22177674  0.18937391          NA -0.005401313
##  [66,]  1.194562966          NA -1.41865613 -1.10958803  1.379140852
##  [67,] -0.473357549  0.14627223          NA -1.03054168 -1.027611510
##  [68,]  0.930713185  1.21311609          NA  1.00934026          NA
##  [69,] -0.761204544          NA          NA  0.30155203  1.370750994
```

```
##  [70,]          NA -0.37946453          NA -0.71218879  0.147329532
##  [71,]  0.624477787  0.12365145 -0.73222865  0.43221022  0.925629286
##  [72,]  0.435681118  0.62011157 -0.16019340 -0.15842282 -0.913834907
##  [73,]  0.207481734  1.46406501 -0.29810985 -0.28921952 -0.854011143
##  [74,]          NA          NA          NA -0.95211495 -1.237732790
##  [75,]  1.079232931  0.88147450          NA          NA -0.826554629
##  [76,]          NA  1.72444906 -0.43559183          NA -0.478549925
##  [77,]          NA          NA -0.50908472  1.28405212 -0.758119264
##  [78,]  0.018985120 -0.40073463          NA -0.44936679 -1.419766165
##  [79,]          NA -0.51670023          NA  1.68922028          NA
##  [80,]          NA          NA          NA -0.05475293 -1.759521064
##  [81,]          NA  1.34638724  0.30528355 -2.01710727          NA
##  [82,] -0.191934067          NA  0.30541257  0.67684735  1.039262673
##  [83,]  1.015795612          NA  0.68621050  1.05729134  1.600442154
##  [84,] -0.767898373 -0.64450188  0.42234274          NA -0.433943091
##  [85,]  1.411610960          NA          NA -0.25213597 -0.282141068
##  [86,]          NA  0.63660174 -0.59212004  0.30991419 -0.772303323
##  [87,]          NA -0.98038401          NA  1.55101152 -1.140367057
##  [88,] -0.732235983 -0.44006280          NA  0.89711170  0.272827867
##  [89,] -0.943345553 -1.66778663          NA -0.77952618 -1.182799131
##  [90,] -0.377034717  0.05149009 -2.43370248  0.70404841  0.409704233
##  [91,]          NA  1.20172887          NA  0.78855890  2.347280084
##  [92,]          NA  0.50701877  1.39980221 -0.83429534  0.409377221
##  [93,] -0.021889816 -1.36637529  0.97360763          NA  0.640000649
##  [94,]  0.473515244 -1.75852081          NA  2.00881410          NA
##  [95,]          NA          NA -0.70108588 -0.28900438  1.039183322
##  [96,]  1.112142797          NA -1.11447607          NA          NA
##  [97,] -1.442814061  0.01452711 -1.15853342 -0.39369137  1.470251910
##  [98,]          NA -0.32408373          NA -1.48316771          NA
##  [99,] -0.612987319          NA -2.06337638          NA  1.070828192
## [100,]  0.945940577          NA          NA          NA  0.330506967
```

Sort the rows in matrix R by the largest row sum to lowest. Be careful about the NA's!

```
rowSums(R,na.rm=TRUE)
##  [1]  50   0  25   0 100   0  50   0  50  25  25  50  25   0   0  50  75  75  50
## [20]  25   0  50   0  25  75  25  50  50  50   0   0 100  75  50  25  25  50  75
## [39]   0   0  75  25   0  50  75  50 100   0  75  25
sorted_R=R[order(rowSums(R,na.rm=TRUE),decreasing=TRUE), ]
sorted_R
##       [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
##  [1,]    2    2    2    2    2    2    2    2    2    2    2    2    2
##  [2,]    2    2    2    2    2    2    2    2    2    2    2    2    2
##  [3,]    2    2    2    2    2    2    2    2    2    2    2    2    2
##  [4,]    1    2    1    2    1    2    1    2    1    2    1    2    1
##  [5,]    1    2    1    2    1    2    1    2    1    2    1    2    1
##  [6,]    2    1    2    1    2    1    2    1    2    1    2    1    2
##  [7,]    2    1    2    1    2    1    2    1    2    1    2    1    2
##  [8,]    1    2    1    2    1    2    1    2    1    2    1    2    1
##  [9,]    2    1    2    1    2    1    2    1    2    1    2    1    2
## [10,]    1    2    1    2    1    2    1    2    1    2    1    2    1
## [11,]    1    2    1    2    1    2    1    2    1    2    1    2    1
## [12,]    2    0    2    0    2    0    2    0    2    0    2    0    2
## [13,]    1    1    1    1    1    1    1    1    1    1    1    1    1
## [14,]    2    0    2    0    2    0    2    0    2    0    2    0    2
## [15,]    0    2    0    2    0    2    0    2    0    2    0    2    0
## [16,]    0    2    0    2    0    2    0    2    0    2    0    2    0
## [17,]    0    2    0    2    0    2    0    2    0    2    0    2    0
## [18,]    2    0    2    0    2    0    2    0    2    0    2    0    2
## [19,]    2    0    2    0    2    0    2    0    2    0    2    0    2
## [20,]    2    0    2    0    2    0    2    0    2    0    2    0    2
## [21,]    2    0    2    0    2    0    2    0    2    0    2    0    2
## [22,]    2    0    2    0    2    0    2    0    2    0    2    0    2
## [23,]    0    2    0    2    0    2    0    2    0    2    0    2    0
## [24,]    1    1    1    1    1    1    1    1    1    1    1    1    1
## [25,]    1    1    1    1    1    1    1    1    1    1    1    1    1
## [26,]    0    1    0    1    0    1    0    1    0    1    0    1    0
## [27,]    1    0    1    0    1    0    1    0    1    0    1    0    1
## [28,]    0    1    0    1    0    1    0    1    0    1    0    1    0
## [29,]    0    1    0    1    0    1    0    1    0    1    0    1    0
## [30,]    1    0    1    0    1    0    1    0    1    0    1    0    1
## [31,]    0    1    0    1    0    1    0    1    0    1    0    1    0
## [32,]    0    1    0    1    0    1    0    1    0    1    0    1    0
## [33,]    1    0    1    0    1    0    1    0    1    0    1    0    1
## [34,]    0    1    0    1    0    1    0    1    0    1    0    1    0
## [35,]    0    1    0    1    0    1    0    1    0    1    0    1    0
## [36,]    0    1    0    1    0    1    0    1    0    1    0    1    0
```

```
##  [37,]   0   0   0   0   0   0   0   0   0   0   0   0   0
##  [38,]   0   0   0   0   0   0   0   0   0   0   0   0   0
##  [39,]   0   0   0   0   0   0   0   0   0   0   0   0   0
##  [40,]   0   0   0   0   0   0   0   0   0   0   0   0   0
##  [41,]   0   0   0   0   0   0   0   0   0   0   0   0   0
##  [42,]   0   0   0   0   0   0   0   0   0   0   0   0   0
##  [43,]   0   0   0   0   0   0   0   0   0   0   0   0   0
##  [44,]   0   0   0   0   0   0   0   0   0   0   0   0   0
##  [45,]   0   0   0   0   0   0   0   0   0   0   0   0   0
##  [46,]   0   0   0   0   0   0   0   0   0   0   0   0   0
##  [47,]   0   0   0   0   0   0   0   0   0   0   0   0   0
##  [48,]   0   0   0   0   0   0   0   0   0   0   0   0   0
##  [49,]   0   0   0   0   0   0   0   0   0   0   0   0   0
##  [50,]   0   0   0   0   0   0   0   0   0   0   0   0   0
##       [,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24] [,25]
##  [1,]    2    2    2    2    2    2    2    2    2    2    2    2
##  [2,]    2    2    2    2    2    2    2    2    2    2    2    2
##  [3,]    2    2    2    2    2    2    2    2    2    2    2    2
##  [4,]    2    1    2    1    2    1    2    1    2    1    2    1
##  [5,]    2    1    2    1    2    1    2    1    2    1    2    1
##  [6,]    1    2    1    2    1    2    1    2    1    2    1    2
##  [7,]    1    2    1    2    1    2    1    2    1    2    1    2
##  [8,]    2    1    2    1    2    1    2    1    2    1    2    1
##  [9,]    1    2    1    2    1    2    1    2    1    2    1    2
##  [10,]    2    1    2    1    2    1    2    1    2    1    2    1
##  [11,]    2    1    2    1    2    1    2    1    2    1    2    1
##  [12,]    0    2    0    2    0    2    0    2    0    2    0    2
##  [13,]    1    1    1    1    1    1    1    1    1    1    1    1
##  [14,]    0    2    0    2    0    2    0    2    0    2    0    2
##  [15,]    2    0    2    0    2    0    2    0    2    0    2    0
##  [16,]    2    0    2    0    2    0    2    0    2    0    2    0
##  [17,]    2    0    2    0    2    0    2    0    2    0    2    0
##  [18,]    0    2    0    2    0    2    0    2    0    2    0    2
##  [19,]    0    2    0    2    0    2    0    2    0    2    0    2
##  [20,]    0    2    0    2    0    2    0    2    0    2    0    2
##  [21,]    0    2    0    2    0    2    0    2    0    2    0    2
##  [22,]    0    2    0    2    0    2    0    2    0    2    0    2
##  [23,]    2    0    2    0    2    0    2    0    2    0    2    0
##  [24,]    1    1    1    1    1    1    1    1    1    1    1    1
##  [25,]    1    1    1    1    1    1    1    1    1    1    1    1
##  [26,]    1    0    1    0    1    0    1    0    1    0    1    0
##  [27,]    0    1    0    1    0    1    0    1    0    1    0    1
##  [28,]    1    0    1    0    1    0    1    0    1    0    1    0
##  [29,]    1    0    1    0    1    0    1    0    1    0    1    0
##  [30,]    0    1    0    1    0    1    0    1    0    1    0    1
##  [31,]    1    0    1    0    1    0    1    0    1    0    1    0
##  [32,]    1    0    1    0    1    0    1    0    1    0    1    0
##  [33,]    0    1    0    1    0    1    0    1    0    1    0    1
##  [34,]    1    0    1    0    1    0    1    0    1    0    1    0
##  [35,]    1    0    1    0    1    0    1    0    1    0    1    0
##  [36,]    1    0    1    0    1    0    1    0    1    0    1    0
##  [37,]    0    0    0    0    0    0    0    0    0    0    0    0
##  [38,]    0    0    0    0    0    0    0    0    0    0    0    0
##  [39,]    0    0    0    0    0    0    0    0    0    0    0    0
##  [40,]    0    0    0    0    0    0    0    0    0    0    0    0
##  [41,]    0    0    0    0    0    0    0    0    0    0    0    0
##  [42,]    0    0    0    0    0    0    0    0    0    0    0    0
##  [43,]    0    0    0    0    0    0    0    0    0    0    0    0
##  [44,]    0    0    0    0    0    0    0    0    0    0    0    0
##  [45,]    0    0    0    0    0    0    0    0    0    0    0    0
##  [46,]    0    0    0    0    0    0    0    0    0    0    0    0
##  [47,]    0    0    0    0    0    0    0    0    0    0    0    0
##  [48,]    0    0    0    0    0    0    0    0    0    0    0    0
##  [49,]    0    0    0    0    0    0    0    0    0    0    0    0
##  [50,]    0    0    0    0    0    0    0    0    0    0    0    0
##       [,26] [,27] [,28] [,29] [,30] [,31] [,32] [,33] [,34] [,35] [,36] [,37]
##  [1,]    2    2    2    2    2    2    2    2    2    2    2    2
##  [2,]    2    2    2    2    2    2    2    2    2    2    2    2
##  [3,]    2    2    2    2    2    2    2    2    2    2    2    2
##  [4,]    2    1    2    1    2    1    2    1    2    1    2    1
##  [5,]    2    1    2    1    2    1    2    1    2    1    2    1
##  [6,]    1    2    1    2    1    2    1    2    1    2    1    2
##  [7,]    1    2    1    2    1    2    1    2    1    2    1    2
##  [8,]    2    1    2    1    2    1    2    1    2    1    2    1
##  [9,]    1    2    1    2    1    2    1    2    1    2    1    2
##  [10,]    2    1    2    1    2    1    2    1    2    1    2    1
```

```
##  [10,]  2  1  2  1  2  1  2  1  2  1  2  1
##  [11,]  2  1  2  1  2  1  2  1  2  1  2  1
##  [12,]  0  2  0  2  0  2  0  2  0  2  0  2
##  [13,]  1  1  1  1  1  1  1  1  1  1  1  1
##  [14,]  0  2  0  2  0  2  0  2  0  2  0  2
##  [15,]  2  0  2  0  2  0  2  0  2  0  2  0
##  [16,]  2  0  2  0  2  0  2  0  2  0  2  0
##  [17,]  2  0  2  0  2  0  2  0  2  0  2  0
##  [18,]  0  2  0  2  0  2  0  2  0  2  0  2
##  [19,]  0  2  0  2  0  2  0  2  0  2  0  2
##  [20,]  0  2  0  2  0  2  0  2  0  2  0  2
##  [21,]  0  2  0  2  0  2  0  2  0  2  0  2
##  [22,]  0  2  0  2  0  2  0  2  0  2  0  2
##  [23,]  2  0  2  0  2  0  2  0  2  0  2  0
##  [24,]  1  1  1  1  1  1  1  1  1  1  1  1
##  [25,]  1  1  1  1  1  1  1  1  1  1  1  1
##  [26,]  1  0  1  0  1  0  1  0  1  0  1  0
##  [27,]  0  1  0  1  0  1  0  1  0  1  0  1
##  [28,]  1  0  1  0  1  0  1  0  1  0  1  0
##  [29,]  1  0  1  0  1  0  1  0  1  0  1  0
##  [30,]  0  1  0  1  0  1  0  1  0  1  0  1
##  [31,]  1  0  1  0  1  0  1  0  1  0  1  0
##  [32,]  1  0  1  0  1  0  1  0  1  0  1  0
##  [33,]  0  1  0  1  0  1  0  1  0  1  0  1
##  [34,]  1  0  1  0  1  0  1  0  1  0  1  0
##  [35,]  1  0  1  0  1  0  1  0  1  0  1  0
##  [36,]  1  0  1  0  1  0  1  0  1  0  1  0
##  [37,]  0  0  0  0  0  0  0  0  0  0  0  0
##  [38,]  0  0  0  0  0  0  0  0  0  0  0  0
##  [39,]  0  0  0  0  0  0  0  0  0  0  0  0
##  [40,]  0  0  0  0  0  0  0  0  0  0  0  0
##  [41,]  0  0  0  0  0  0  0  0  0  0  0  0
##  [42,]  0  0  0  0  0  0  0  0  0  0  0  0
##  [43,]  0  0  0  0  0  0  0  0  0  0  0  0
##  [44,]  0  0  0  0  0  0  0  0  0  0  0  0
##  [45,]  0  0  0  0  0  0  0  0  0  0  0  0
##  [46,]  0  0  0  0  0  0  0  0  0  0  0  0
##  [47,]  0  0  0  0  0  0  0  0  0  0  0  0
##  [48,]  0  0  0  0  0  0  0  0  0  0  0  0
##  [49,]  0  0  0  0  0  0  0  0  0  0  0  0
##  [50,]  0  0  0  0  0  0  0  0  0  0  0  0
##       [,38] [,39] [,40] [,41] [,42] [,43] [,44] [,45] [,46] [,47] [,48] [,49]
##  [1,]  2  2  2  2  2  2  2  2  2  2  2  2
##  [2,]  2  2  2  2  2  2  2  2  2  2  2  2
##  [3,]  2  2  2  2  2  2  2  2  2  2  2  2
##  [4,]  2  1  2  1  2  1  2  1  2  1  2  1
##  [5,]  2  1  2  1  2  1  2  1  2  1  2  1
##  [6,]  1  2  1  2  1  2  1  2  1  2  1  2
##  [7,]  1  2  1  2  1  2  1  2  1  2  1  2
##  [8,]  2  1  2  1  2  1  2  1  2  1  2  1
##  [9,]  1  2  1  2  1  2  1  2  1  2  1  2
##  [10,]  2  1  2  1  2  1  2  1  2  1  2  1
##  [11,]  2  1  2  1  2  1  2  1  2  1  2  1
##  [12,]  0  2  0  2  0  2  0  2  0  2  0  2
##  [13,]  1  1  1  1  1  1  1  1  1  1  1  1
##  [14,]  0  2  0  2  0  2  0  2  0  2  0  2
##  [15,]  2  0  2  0  2  0  2  0  2  0  2  0
##  [16,]  2  0  2  0  2  0  2  0  2  0  2  0
##  [17,]  2  0  2  0  2  0  2  0  2  0  2  0
##  [18,]  0  2  0  2  0  2  0  2  0  2  0  2
##  [19,]  0  2  0  2  0  2  0  2  0  2  0  2
##  [20,]  0  2  0  2  0  2  0  2  0  2  0  2
##  [21,]  0  2  0  2  0  2  0  2  0  2  0  2
##  [22,]  0  2  0  2  0  2  0  2  0  2  0  2
##  [23,]  2  0  2  0  2  0  2  0  2  0  2  0
##  [24,]  1  1  1  1  1  1  1  1  1  1  1  1
##  [25,]  1  1  1  1  1  1  1  1  1  1  1  1
##  [26,]  1  0  1  0  1  0  1  0  1  0  1  0
##  [27,]  0  1  0  1  0  1  0  1  0  1  0  1
##  [28,]  1  0  1  0  1  0  1  0  1  0  1  0
##  [29,]  1  0  1  0  1  0  1  0  1  0  1  0
##  [30,]  0  1  0  1  0  1  0  1  0  1  0  1
##  [31,]  1  0  1  0  1  0  1  0  1  0  1  0
##  [32,]  1  0  1  0  1  0  1  0  1  0  1  0
##  [33,]  0  1  0  1  0  1  0  1  0  1  0  1
##  [34,]  1  0  1  0  1  0  1  0  1  0  1  0
```

```
## [35,]    1    0    1    0    1    0    1    0    1    0    1    0
## [36,]    1    0    1    0    1    0    1    0    1    0    1    0
## [37,]    0    0    0    0    0    0    0    0    0    0    0    0
## [38,]    0    0    0    0    0    0    0    0    0    0    0    0
## [39,]    0    0    0    0    0    0    0    0    0    0    0    0
## [40,]    0    0    0    0    0    0    0    0    0    0    0    0
## [41,]    0    0    0    0    0    0    0    0    0    0    0    0
## [42,]    0    0    0    0    0    0    0    0    0    0    0    0
## [43,]    0    0    0    0    0    0    0    0    0    0    0    0
## [44,]    0    0    0    0    0    0    0    0    0    0    0    0
## [45,]    0    0    0    0    0    0    0    0    0    0    0    0
## [46,]    0    0    0    0    0    0    0    0    0    0    0    0
## [47,]    0    0    0    0    0    0    0    0    0    0    0    0
## [48,]    0    0    0    0    0    0    0    0    0    0    0    0
## [49,]    0    0    0    0    0    0    0    0    0    0    0    0
## [50,]    0    0    0    0    0    0    0    0    0    0    0    0
##       [,50]
##  [1,]     2
##  [2,]     2
##  [3,]     2
##  [4,]     2
##  [5,]     2
##  [6,]     1
##  [7,]     1
##  [8,]     2
##  [9,]     1
## [10,]     2
## [11,]     2
## [12,]     0
## [13,]     1
## [14,]     0
## [15,]     2
## [16,]     2
## [17,]     2
## [18,]     0
## [19,]     0
## [20,]     0
## [21,]     0
## [22,]     0
## [23,]     2
## [24,]     1
## [25,]     1
## [26,]     1
## [27,]     0
## [28,]     1
## [29,]     1
## [30,]     0
## [31,]     1
## [32,]     1
## [33,]     0
## [34,]     1
## [35,]     1
## [36,]     1
## [37,]     0
## [38,]     0
## [39,]     0
## [40,]     0
## [41,]     0
## [42,]     0
## [43,]     0
## [44,]     0
## [45,]     0
## [46,]     0
## [47,]     0
## [48,]     0
## [49,]     0
## [50,]     0
```

We will now learn the apply function. This is a handy function that saves writing for loops which should be eschewed in R. Use the apply function to compute a vector whose entries are the standard deviation of each row. Use the apply function to compute a vector whose entries are the standard deviation of each column. Be careful about the NA's! This should be one line.

```
sd_row=apply(sorted_R,1,sd,na.rm=TRUE)
sd_row
##  [1] 0.0000000 0.0000000 0.0000000 0.5050763 0.5050763 0.5050763 0.5050763
```

```
##  [8] 0.5050763 0.5050763 0.5050763 0.5050763 1.0101525 0.0000000 1.0101525
## [15] 1.0101525 1.0101525 1.0101525 1.0101525 1.0101525 1.0101525 1.0101525
## [22] 1.0101525 1.0101525 0.0000000 0.0000000 0.5050763 0.5050763 0.5050763
## [29] 0.5050763 0.5050763 0.5050763 0.5050763 0.5050763 0.5050763 0.5050763
## [36] 0.5050763 0.0000000 0.0000000 0.0000000 0.0000000 0.0000000 0.0000000
## [43] 0.0000000 0.0000000 0.0000000 0.0000000 0.0000000 0.0000000 0.0000000
## [50] 0.0000000
```

```
sd_col=apply(sorted_R,2,sd,na.rm=TRUE)
sd_col
```

```
##  [1] 0.8526070 0.8221425 0.8526070 0.8221425 0.8526070 0.8221425 0.8526070
##  [8] 0.8221425 0.8526070 0.8221425 0.8526070 0.8221425 0.8526070 0.8221425
## [15] 0.8526070 0.8221425 0.8526070 0.8221425 0.8526070 0.8221425 0.8526070
## [22] 0.8221425 0.8526070 0.8221425 0.8526070 0.8221425 0.8526070 0.8221425
## [29] 0.8526070 0.8221425 0.8526070 0.8221425 0.8526070 0.8221425 0.8526070
## [36] 0.8221425 0.8526070 0.8221425 0.8526070 0.8221425 0.8526070 0.8221425
## [43] 0.8526070 0.8221425 0.8526070 0.8221425 0.8526070 0.8221425 0.8526070
## [50] 0.8221425
```

Use the apply function to compute a vector whose entries are the count of entries that are 1 or 2 in each column. This should be one line.

```
apply(sorted_R!=0,2,sum,na.rm=TRUE)
```

```
##  [1] 24 26 24 26 24 26 24 26 24 26 24 26 24 26 24 26 24 26 24 26 24 26 24 26
## [26] 26 24 26 24 26 24 26 24 26 24 26 24 26 24 26 24 26 24 26 24 26 24 26 24
```

Use the split function to create a list whose keys are the column number and values are the vector of the columns. Look at the last example in the documentation ?split.

```
?split
split(sorted_R,col(sorted_R))
```

```
## $`1`
##  [1] 2 2 2 1 1 2 2 1 2 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`2`
##  [1] 2 2 2 2 2 2 1 1 2 1 2 2 0 1 0 2 2 2 0 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`3`
##  [1] 2 2 2 1 1 2 2 1 2 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`4`
##  [1] 2 2 2 2 2 2 1 1 2 1 2 2 0 1 0 2 2 2 0 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`5`
##  [1] 2 2 2 1 1 2 2 1 2 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`6`
##  [1] 2 2 2 2 2 2 1 1 2 1 2 2 0 1 0 2 2 2 0 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`7`
##  [1] 2 2 2 1 1 2 2 1 2 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`8`
##  [1] 2 2 2 2 2 2 1 1 2 1 2 2 0 1 0 2 2 2 0 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`9`
##  [1] 2 2 2 1 1 2 2 1 2 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`10`
##  [1] 2 2 2 2 2 2 1 1 2 1 2 2 0 1 0 2 2 2 0 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`11`
##  [1] 2 2 2 1 1 2 2 1 2 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`12`
##  [1] 2 2 2 2 2 2 1 1 2 1 2 2 0 1 0 2 2 2 0 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`13`
```

```
## [1] 2 2 2 1 1 2 2 1 2 1 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`14`
## [1] 2 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 2 0 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`15`
## [1] 2 2 2 2 1 1 2 2 1 2 1 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`16`
## [1] 2 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 2 0 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`17`
## [1] 2 2 2 2 1 1 2 2 1 2 1 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`18`
## [1] 2 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 2 0 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`19`
## [1] 2 2 2 2 1 1 2 2 1 2 1 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`20`
## [1] 2 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 2 0 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`21`
## [1] 2 2 2 2 1 1 2 2 1 2 1 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`22`
## [1] 2 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 2 0 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`23`
## [1] 2 2 2 2 1 1 2 2 1 2 1 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`24`
## [1] 2 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 2 0 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`25`
## [1] 2 2 2 2 1 1 2 2 1 2 1 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`26`
## [1] 2 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 2 0 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`27`
## [1] 2 2 2 2 1 1 2 2 1 2 1 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`28`
## [1] 2 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 2 0 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`29`
## [1] 2 2 2 2 1 1 2 2 1 2 1 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`30`
## [1] 2 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 2 0 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`31`
## [1] 2 2 2 2 1 1 2 2 1 2 1 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
```

```
## $`32`
##  [1] 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`33`
##  [1] 2 2 2 2 1 1 2 2 1 2 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`34`
##  [1] 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`35`
##  [1] 2 2 2 2 1 1 2 2 1 2 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`36`
##  [1] 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`37`
##  [1] 2 2 2 2 1 1 2 2 1 2 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`38`
##  [1] 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`39`
##  [1] 2 2 2 2 1 1 2 2 1 2 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`40`
##  [1] 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`41`
##  [1] 2 2 2 2 1 1 2 2 1 2 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`42`
##  [1] 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`43`
##  [1] 2 2 2 2 1 1 2 2 1 2 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`44`
##  [1] 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`45`
##  [1] 2 2 2 2 1 1 2 2 1 2 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`46`
##  [1] 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`47`
##  [1] 2 2 2 2 1 1 2 2 1 2 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`48`
##  [1] 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`49`
##  [1] 2 2 2 2 1 1 2 2 1 2 1 1 2 1 2 0 0 0 2 2 2 2 2 0 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
##
## $`50`
##  [1] 2 2 2 2 2 1 1 2 1 2 2 2 0 1 0 2 2 2 0 0 0 0 2 1 1 1 0 1 1 0 1 1 0 1 1 1 0 0
## [39] 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

In one statement, use the lapply function to create a list whose keys are the column number and values are themselves a list with keys: “min” whose value is the minimum of the column, “max” whose value is the maximum of the column, “pct_missing” is the proportion of missingness in the column and “first_NA” whose value is the row number of the first time the NA appears.

```
lapply(split(sorted_R, col(sorted_R)), function(x){as.list(c(min=min(x,na.rm=TRUE),
max=max(x,na.rm=TRUE),pct_missing=mean(is.na(x)),first_NA=which.min(is.na(x))))})
## $`1`
## $`1`$min
## [1] 0
##
## $`1`$max
## [1] 2
##
## $`1`$pct_missing
## [1] 0
##
## $`1`$first_NA
## [1] 1
##
##
## $`2`
## $`2`$min
## [1] 0
##
## $`2`$max
## [1] 2
##
## $`2`$pct_missing
## [1] 0
##
## $`2`$first_NA
## [1] 1
##
##
## $`3`
## $`3`$min
## [1] 0
##
## $`3`$max
## [1] 2
##
## $`3`$pct_missing
## [1] 0
##
## $`3`$first_NA
## [1] 1
##
##
## $`4`
## $`4`$min
## [1] 0
##
## $`4`$max
## [1] 2
##
## $`4`$pct_missing
## [1] 0
##
## $`4`$first_NA
## [1] 1
##
##
## $`5`
## $`5`$min
## [1] 0
##
## $`5`$max
## [1] 2
##
## $`5`$pct_missing
## [1] 0
##
## $`5`$first_NA
## [1] 1
##
```

```
##
##
## $`6`
## $`6`$min
## [1] 0
##
## $`6`$max
## [1] 2
##
## $`6`$pct_missing
## [1] 0
##
## $`6`$first_NA
## [1] 1
##
##
## $`7`
## $`7`$min
## [1] 0
##
## $`7`$max
## [1] 2
##
## $`7`$pct_missing
## [1] 0
##
## $`7`$first_NA
## [1] 1
##
##
## $`8`
## $`8`$min
## [1] 0
##
## $`8`$max
## [1] 2
##
## $`8`$pct_missing
## [1] 0
##
## $`8`$first_NA
## [1] 1
##
##
## $`9`
## $`9`$min
## [1] 0
##
## $`9`$max
## [1] 2
##
## $`9`$pct_missing
## [1] 0
##
## $`9`$first_NA
## [1] 1
##
##
## $`10`
## $`10`$min
## [1] 0
##
## $`10`$max
## [1] 2
##
## $`10`$pct_missing
## [1] 0
##
## $`10`$first_NA
## [1] 1
##
##
## $`11`
## $`11`$min
## [1] 0
##
```

```
##
## $`11`$max
## [1] 2
##
## $`11`$pct_missing
## [1] 0
##
## $`11`$first_NA
## [1] 1
##
##
## $`12`
## $`12`$min
## [1] 0
##
## $`12`$max
## [1] 2
##
## $`12`$pct_missing
## [1] 0
##
## $`12`$first_NA
## [1] 1
##
##
## $`13`
## $`13`$min
## [1] 0
##
## $`13`$max
## [1] 2
##
## $`13`$pct_missing
## [1] 0
##
## $`13`$first_NA
## [1] 1
##
##
## $`14`
## $`14`$min
## [1] 0
##
## $`14`$max
## [1] 2
##
## $`14`$pct_missing
## [1] 0
##
## $`14`$first_NA
## [1] 1
##
##
## $`15`
## $`15`$min
## [1] 0
##
## $`15`$max
## [1] 2
##
## $`15`$pct_missing
## [1] 0
##
## $`15`$first_NA
## [1] 1
##
##
## $`16`
## $`16`$min
## [1] 0
##
## $`16`$max
## [1] 2
##
## $`16`$pct_missing
## [1] 0
```

```
##
## $`16`$first_NA
## [1] 1
##
##
## $`17`
## $`17`$min
## [1] 0
##
## $`17`$max
## [1] 2
##
## $`17`$pct_missing
## [1] 0
##
## $`17`$first_NA
## [1] 1
##
##
## $`18`
## $`18`$min
## [1] 0
##
## $`18`$max
## [1] 2
##
## $`18`$pct_missing
## [1] 0
##
## $`18`$first_NA
## [1] 1
##
##
## $`19`
## $`19`$min
## [1] 0
##
## $`19`$max
## [1] 2
##
## $`19`$pct_missing
## [1] 0
##
## $`19`$first_NA
## [1] 1
##
##
## $`20`
## $`20`$min
## [1] 0
##
## $`20`$max
## [1] 2
##
## $`20`$pct_missing
## [1] 0
##
## $`20`$first_NA
## [1] 1
##
##
## $`21`
## $`21`$min
## [1] 0
##
## $`21`$max
## [1] 2
##
## $`21`$pct_missing
## [1] 0
##
## $`21`$first_NA
## [1] 1
##
##
## $`22`
```

```
## $`22`
## $`22`$min
## [1] 0
##
## $`22`$max
## [1] 2
##
## $`22`$pct_missing
## [1] 0
##
## $`22`$first_NA
## [1] 1
##
##
## $`23`
## $`23`$min
## [1] 0
##
## $`23`$max
## [1] 2
##
## $`23`$pct_missing
## [1] 0
##
## $`23`$first_NA
## [1] 1
##
##
## $`24`
## $`24`$min
## [1] 0
##
## $`24`$max
## [1] 2
##
## $`24`$pct_missing
## [1] 0
##
## $`24`$first_NA
## [1] 1
##
##
## $`25`
## $`25`$min
## [1] 0
##
## $`25`$max
## [1] 2
##
## $`25`$pct_missing
## [1] 0
##
## $`25`$first_NA
## [1] 1
##
##
## $`26`
## $`26`$min
## [1] 0
##
## $`26`$max
## [1] 2
##
## $`26`$pct_missing
## [1] 0
##
## $`26`$first_NA
## [1] 1
##
##
## $`27`
## $`27`$min
## [1] 0
##
## $`27`$max
## [1] 2
```

```
##
## $`27`$pct_missing
## [1] 0
##
## $`27`$first_NA
## [1] 1
##
##
## $`28`
## $`28`$min
## [1] 0
##
## $`28`$max
## [1] 2
##
## $`28`$pct_missing
## [1] 0
##
## $`28`$first_NA
## [1] 1
##
##
## $`29`
## $`29`$min
## [1] 0
##
## $`29`$max
## [1] 2
##
## $`29`$pct_missing
## [1] 0
##
## $`29`$first_NA
## [1] 1
##
##
## $`30`
## $`30`$min
## [1] 0
##
## $`30`$max
## [1] 2
##
## $`30`$pct_missing
## [1] 0
##
## $`30`$first_NA
## [1] 1
##
##
## $`31`
## $`31`$min
## [1] 0
##
## $`31`$max
## [1] 2
##
## $`31`$pct_missing
## [1] 0
##
## $`31`$first_NA
## [1] 1
##
##
## $`32`
## $`32`$min
## [1] 0
##
## $`32`$max
## [1] 2
##
## $`32`$pct_missing
## [1] 0
##
## $`32`$first_NA
```

```
## [1] 1
##
##
## $`33`
## $`33`$min
## [1] 0
##
## $`33`$max
## [1] 2
##
## $`33`$pct_missing
## [1] 0
##
## $`33`$first_NA
## [1] 1
##
##
## $`34`
## $`34`$min
## [1] 0
##
## $`34`$max
## [1] 2
##
## $`34`$pct_missing
## [1] 0
##
## $`34`$first_NA
## [1] 1
##
##
## $`35`
## $`35`$min
## [1] 0
##
## $`35`$max
## [1] 2
##
## $`35`$pct_missing
## [1] 0
##
## $`35`$first_NA
## [1] 1
##
##
## $`36`
## $`36`$min
## [1] 0
##
## $`36`$max
## [1] 2
##
## $`36`$pct_missing
## [1] 0
##
## $`36`$first_NA
## [1] 1
##
##
## $`37`
## $`37`$min
## [1] 0
##
## $`37`$max
## [1] 2
##
## $`37`$pct_missing
## [1] 0
##
## $`37`$first_NA
## [1] 1
##
##
## $`38`
## $`38`$min
## [1] 0
```

[1] 0
##
$`38`$max
[1] 2
##
$`38`$pct_missing
[1] 0
##
$`38`$first_NA
[1] 1
##
##
$`39`
$`39`$min
[1] 0
##
$`39`$max
[1] 2
##
$`39`$pct_missing
[1] 0
##
$`39`$first_NA
[1] 1
##
##
$`40`
$`40`$min
[1] 0
##
$`40`$max
[1] 2
##
$`40`$pct_missing
[1] 0
##
$`40`$first_NA
[1] 1
##
##
$`41`
$`41`$min
[1] 0
##
$`41`$max
[1] 2
##
$`41`$pct_missing
[1] 0
##
$`41`$first_NA
[1] 1
##
##
$`42`
$`42`$min
[1] 0
##
$`42`$max
[1] 2
##
$`42`$pct_missing
[1] 0
##
$`42`$first_NA
[1] 1
##
##
$`43`
$`43`$min
[1] 0
##
$`43`$max
[1] 2
##
$`43`$pct_missing

```
## [1] 0
##
## $`43`$first_NA
## [1] 1
##
##
## $`44`
## $`44`$min
## [1] 0
##
## $`44`$max
## [1] 2
##
## $`44`$pct_missing
## [1] 0
##
## $`44`$first_NA
## [1] 1
##
##
## $`45`
## $`45`$min
## [1] 0
##
## $`45`$max
## [1] 2
##
## $`45`$pct_missing
## [1] 0
##
## $`45`$first_NA
## [1] 1
##
##
## $`46`
## $`46`$min
## [1] 0
##
## $`46`$max
## [1] 2
##
## $`46`$pct_missing
## [1] 0
##
## $`46`$first_NA
## [1] 1
##
##
## $`47`
## $`47`$min
## [1] 0
##
## $`47`$max
## [1] 2
##
## $`47`$pct_missing
## [1] 0
##
## $`47`$first_NA
## [1] 1
##
##
## $`48`
## $`48`$min
## [1] 0
##
## $`48`$max
## [1] 2
##
## $`48`$pct_missing
## [1] 0
##
## $`48`$first_NA
## [1] 1
##
##
```

```
##
## $`49`
## $`49`$min
## [1] 0
##
## $`49`$max
## [1] 2
##
## $`49`$pct_missing
## [1] 0
##
## $`49`$first_NA
## [1] 1
##
##
## $`50`
## $`50`$min
## [1] 0
##
## $`50`$max
## [1] 2
##
## $`50`$pct_missing
## [1] 0
##
## $`50`$first_NA
## [1] 1
```

Set a seed and then create a vector v consisting of a sample of 1,000 iid normal realizations with mean -10 and variance 100.

```
set.seed(1984)
v=rnorm(1000, mean=-10, sd=10)
v
##    [1]  -5.90796784 -13.23024971  -3.64147673 -28.46128784  -0.46352635
##    [6]   1.88489843  -4.57545551 -18.32725430 -15.26207884   4.15982758
##   [11]  -7.17988996  -7.12066284  -1.62951750   0.23934459  -9.82254904
##   [16]   7.23994016  -8.79258195 -27.75560489  -8.73854471 -27.13757881
##   [21]   2.41956568  -5.70259385 -16.48615930  -0.96606019 -10.13218140
##   [26]  -7.52482282  -9.08281850  -1.77715352 -15.86308605   0.07988490
##   [31] -21.07586889 -24.70424177  -3.94162654  -0.43701072  -7.02334037
##   [36] -18.54028356  15.04353748 -12.88511063 -13.41417168  -7.56694485
##   [41]  -9.50523660  -1.99013348 -11.09611755 -23.39192163   2.41340869
##   [46]   1.84416366 -14.56775098   1.48872047 -16.66521389   1.08656689
##   [51]   2.43355160 -16.30020808 -19.74257623 -21.76807275 -13.80277843
##   [56] -25.65803802 -16.48259559 -18.24168801 -16.89461998 -10.16576089
##   [61] -17.37300246  -3.46447371   6.65904980 -13.32130524   6.16506062
##   [66] -12.82746714 -15.40028467 -16.29519683  -8.85849164  -1.00430266
##   [71] -15.08369396 -20.74937012  -7.00179388 -15.52191948 -14.21296895
##   [76] -12.69807216  -5.04967073 -13.88592872 -17.64967661 -14.86203728
##   [81]  -8.04904575  -4.38263148 -14.56730956 -24.49376020  -8.41093720
##   [86]   1.71336122 -14.72072134 -18.83119186  12.24101296 -11.08844767
##   [91] -10.78065157 -15.83103259 -28.40645476   1.69540893   2.43515038
##   [96]  -2.63156436 -14.35880553 -17.59250501   4.04956928 -23.17218827
##  [101]  -7.87975159 -21.31939960  -5.25317706 -17.27047414  13.22781948
##  [106] -16.29279321 -21.82156521 -10.10859263 -15.44585934 -11.22080964
##  [111] -22.57970905  -4.19276975 -13.52031882  -6.11333569 -11.55713325
##  [116] -18.80099088 -25.30408345 -13.58927991   2.42929973   0.57073465
##  [121] -11.00049652 -23.38935517  -0.48338583 -18.24414603 -10.16406861
##  [126]  -0.44021534  -1.61541765 -16.58219635 -12.94288594 -12.28528314
##  [131] -17.39451940 -21.28567863 -10.14397576  -0.39313871  -8.95982592
##  [136]   9.28707337 -11.98098839 -27.66102728 -19.09346586  -1.12303867
##  [141]  -3.11264626 -26.67399926 -19.34430661  -8.77722940 -15.05144004
##  [146]  -4.42385963 -11.56402408  -5.16329148 -36.41863170   6.85477578
##  [151] -15.99006877  -0.91057455  -1.68802071  -1.47607730 -20.90654924
##  [156] -14.19169196 -16.89634055  -1.40167623  -7.20149938 -19.25904354
##  [161] -10.99779541 -10.71377302  -7.46468607 -12.21280151 -12.38804312
##  [166] -13.06427416 -12.87457517 -31.10591651 -14.20382679  -9.53999153
##  [171] -10.89471545 -10.82098039  -7.30462951 -35.76929480   0.75211293
##  [176]   3.72694365 -21.88117885   9.18897513 -16.65739767 -10.81351611
##  [181]  -8.10399905 -20.80099492  -4.21087448  -2.11773304 -18.90904372
##  [186]  -8.61583847 -21.92324436 -10.93629266  -4.60301947  -3.17276193
##  [191] -11.73213868 -17.49039478 -23.73247528   1.42637568   1.00809851
##  [196]  -7.06468788   4.74895318 -13.01935586  -1.28515042  -1.96328993
##  [201] -12.48152800  -8.65648187 -16.87042913 -16.92750812 -12.84899063
##  [206]  -7.19542584 -17.44978431 -21.39920811 -21.10078306 -19.49908421
##  [211]  -8.04296419 -11.29632427  10.46349346 -22.94785942 -19.31614010
##  [216]  -1.22649723 -10.59618157 -20.73379422  -8.69924325 -12.07157858
```

```
##  [216]  -1.22649725 -10.30618157 -20.73379422  -8.69924525 -12.07137858
##  [221] -10.03284038 -18.55206062 -16.26972893 -20.40927635   0.30344890
##  [226] -14.28165384  17.32346574 -20.92144729  -3.51540727 -20.40951257
##  [231] -15.28029317 -12.72012782 -15.82784591 -18.26447143  -0.65780525
##  [236] -18.66217004  -8.79850964 -36.11748883 -21.47660868 -16.46981928
##  [241] -14.17594750   4.35594345  -1.41602980 -11.07537004  -2.66579093
##  [246]  -0.53594856 -17.88166228   7.82024894 -22.43681537 -24.25868855
##  [251]  16.13054036 -14.13675088  -2.71542050   0.49622642  -0.80834006
##  [256] -16.31575616 -12.67337121  -9.93785528 -14.27372950  -5.07328203
##  [261] -11.52271305   0.87644507 -10.51995528  -6.73117639 -10.76945156
##  [266]  -4.63756169   0.02861170  -2.69481266 -15.73965675 -20.50676249
##  [271]  -7.35133214 -36.45230069 -13.83730267 -27.94726862   0.10882241
##  [276]  -5.73963347  -3.87161777   1.88599836 -16.52228204 -21.77516014
##  [281]  -0.06003723 -18.91274829   2.76591754 -20.98130737 -16.68045474
##  [286] -13.27365003 -23.39393449 -25.79350365  -0.19075338  -5.15493127
##  [291] -19.46035381 -11.78502414 -20.97999683 -20.83898988  -3.16501442
##  [296] -14.83916789 -11.31772950  -5.33211638 -12.18824377 -13.96768806
##  [301]  -9.29550952 -15.05228917  -9.36078653  -4.19267874  -8.34864847
##  [306] -31.30177070 -29.32990262   5.54488034  -9.87153989  -3.90564096
##  [311]  -7.28717888 -21.99536259  -0.08047085 -16.66684048  -4.66956920
##  [316]   0.37091117 -10.65325837   4.67129310 -12.35362914  13.55378820
##  [321]   3.80608340 -13.58588945   3.22219906   2.50845126 -19.95098424
##  [326] -21.37820958 -13.85068320  -3.63133287 -17.03565059 -18.23061683
##  [331]  -7.53315064 -11.82358911 -13.24355960 -11.32046463 -14.14312911
##  [336] -10.19547423  -6.51134034  -8.91276038  -0.41465003 -10.50116216
##  [341] -23.65223483  -5.95965343 -17.35237525 -24.11151655  -2.42469842
##  [346]   1.97570831 -21.36234439 -25.51650675 -11.37754863 -15.39035463
##  [351] -31.13701579  -1.16093820 -19.37798571 -18.28792399 -13.70555689
##  [356] -11.37560109   4.87565939   2.86499775 -32.01285881  -2.63844004
##  [361]  -8.47800024  -5.40578571 -16.89252079  -6.93603627  -7.44724159
##  [366]  -9.72193304 -11.88586566 -16.53706810 -17.62713473  -3.06265873
##  [371]  -6.00221712 -12.02350731 -12.32754380   6.11962631  -4.98311496
##  [376] -14.39900766  -4.01328836  -1.88317027 -15.10267955 -11.05027217
##  [381] -14.36324315  -4.46421404  -2.62915654  14.50231926 -31.32187133
##  [386]  -3.53959317 -20.89441783  -9.45016599  -1.22588589  -7.41584609
##  [391]  -1.64970047   4.35022740  -5.01063208 -23.80047694  -6.81754271
##  [396] -31.50223977 -11.04717561  -6.62269588  11.23762934 -18.70375896
##  [401]  -2.20545478 -21.32199656 -25.85569124  -7.92166674  -9.14381103
##  [406]  -8.21837265  -8.58412634  14.68131192 -14.99347091   6.61683820
##  [411] -27.34348202 -21.68289520 -10.56558501  -5.68546355  -2.77054151
##  [416]  -8.35023835 -11.82657665 -18.72297310  -7.93347122 -14.92723510
##  [421] -18.27057860  -5.21596152 -15.57161673 -15.59681197  -6.19422162
##  [426] -10.07023860   2.31538274  -8.06781086 -14.26707526  -6.52652715
##  [431] -11.04758065  -3.13736811 -18.24575089 -30.55205704 -23.81418353
##  [436]  -8.58275801   4.35645905  -4.44646574   5.81994675  -6.12924584
##  [441]   5.40710656 -10.66088694 -17.11477258  -4.02109198 -13.86959524
##  [446]  -4.83024226  -7.89533249 -10.87213830 -10.02675060  -3.99463374
##  [451]  -7.69660654 -15.44042603  -3.07933256   6.25910819 -19.11426458
##  [456]   3.62753723  -7.12787937   3.52407484 -12.54098569   4.20820588
##  [461] -28.78181597 -12.67154101  -5.33286557 -17.23003140 -24.68062273
##  [466] -14.57842751   8.71836688 -10.15302501 -29.96489073 -19.23542562
##  [471] -11.82882447 -15.47479304  -9.15871745 -29.20840150 -21.95245530
##  [476] -13.82600745 -17.01978525 -10.12924511   1.73386380 -14.61798552
##  [481]   0.23536703   6.45025394 -13.01446182   1.44821719  -3.19283241
##  [486] -13.13423065 -15.59779771 -12.82908138  -6.26612290 -11.87559989
##  [491] -14.23294271  -1.29296976 -24.29434230  -7.07623632 -10.35818076
##  [496]   0.13995552 -14.37924024   0.32206534   5.71130839  12.25692029
##  [501] -14.55550096 -19.49364819 -11.71975372  -2.16289190   3.97637125
##  [506] -26.57943934 -15.33171928 -11.99072237 -10.94941490  -9.72528011
##  [511] -18.46202271 -14.46806514 -11.92035663 -21.08437481   1.06080652
##  [516]  -5.47935864 -12.35327331 -22.33895435 -25.11959196 -34.62423179
##  [521]  -6.56989183   2.05038916  -6.80007208  -5.29309420   4.38373612
##  [526] -11.27063572 -10.54539285 -17.47349313   1.01559590 -14.09169795
##  [531] -16.76075428  -6.73490422 -15.49030935 -17.22881328  -0.07988122
##  [536]  -8.92305015 -13.09137538 -14.19989956 -36.24955833 -10.39577463
##  [541] -13.47010261 -24.29142158 -17.09440427  -8.26323975  11.23406804
##  [546]   2.61013341 -19.04652166   1.83249893 -10.92106939   0.03445530
##  [551]  -1.39806845  -1.81330637 -24.22109523 -17.64486905  -4.64420712
##  [556] -10.03473835   7.08603867  -4.08139481  -6.51979661 -18.08233921
##  [561] -14.54515656  -6.07063978 -34.98349940  -8.77697978  -7.96545755
##  [566] -32.36126456 -15.15027101 -19.14816510  -5.77902111  -5.93196333
##  [571]  -6.36519539   8.27337832  -4.54662586 -14.81636836 -25.90574102
##  [576] -22.96547830  18.07519211  -5.92088376 -15.89470415 -11.20016433
##  [581]  -1.40593918 -13.69779839 -13.11912603 -11.37951645 -37.07445156
##  [586] -15.49690764 -19.61837015 -16.79291144  -4.86646185 -24.85394100
##  [591] -29.72513504  -7.65441673 -16.29593224  20.15146921 -13.32268504
```

```
##  [596]   6.94074201 -25.66373379  -6.75775503 -18.51681236 -23.62318562
##  [601]  -6.38334492  -7.39028592 -16.28580343 -28.08896233 -10.49542165
##  [606]  -5.50248821 -15.03328274  -8.91027806   0.51200339 -16.81829255
##  [611]  -3.69183687 -12.03064437 -18.41846329  -3.80105282  13.08955814
##  [616]  -4.66825513 -18.84427399  -6.47048865  -8.46794499  -3.66495156
##  [621] -18.22054776   0.35765032 -26.43404445  10.40780985 -10.78890010
##  [626] -23.03331344 -15.03301775  -2.88081635 -15.17114603 -12.28249484
##  [631] -28.80800994 -12.39599975  -9.22424616 -20.91744249 -24.84798766
##  [636] -23.30990930 -20.63605358   1.01672529 -11.29470431 -12.29722911
##  [641]  -1.52203100 -27.63516192  -9.51894554 -12.93445928   0.50559476
##  [646] -12.19371104  -8.28014562 -21.80800472 -24.60546909 -20.90980507
##  [651] -20.13809260   3.24680404 -14.43800051   1.21730039 -30.66447312
##  [656]   1.35587921 -28.66492745 -22.50002074 -20.36182882 -10.09565048
##  [661] -12.98851406  -0.35370324  -8.07040358   3.25149257 -19.53437440
##  [666]   7.01493771 -11.52407347 -24.79944776  -8.52739144 -26.79181452
##  [671] -13.30357072  -7.05914020 -11.81135383 -10.95204001  10.27030906
##  [676]  -3.28389546  -6.67089577  -8.27172688  -1.62501381  -3.08381403
##  [681]  -7.68930259  -7.66754882  -6.93916537  -5.64669728 -22.26459615
##  [686] -18.43544808 -18.64865077 -20.24119212 -21.02731757  -2.73650018
##  [691] -12.85001451 -24.07770450 -23.60065581  -1.37868168   1.92536019
##  [696]   6.03719786 -12.13174480 -20.63227591  -9.32079359 -13.21197250
##  [701]  -1.38183410 -23.30619376 -10.03734520 -23.85222453 -12.81079757
##  [706]  -7.70455116 -17.64398954  -7.91231279  10.13071193  -5.18247689
##  [711]   3.99021595   1.25735898  -7.74475720  -7.45338607  -6.91288626
##  [716]  -1.74785991 -15.38703208 -18.85648516 -14.28420565 -17.63052715
##  [721]  -5.97315646 -19.29309617 -21.56166832 -16.46984046  -2.64531023
##  [726] -11.63018107 -13.26977303 -22.06678682 -23.53571825 -22.92183187
##  [731] -22.46073145  -9.19409758 -24.96178873  -9.16062424   8.76753303
##  [736] -15.28912503 -17.83335365 -10.18903616 -23.01131094 -13.74259543
##  [741] -14.59677487 -12.49891991 -11.79564215 -21.97166825 -10.75529700
##  [746] -22.69293157 -24.49190066   1.35860222 -11.88616926  -9.84067520
##  [751] -13.00249076  10.19681731 -16.77016302  10.52059618 -32.88893436
##  [756]  -3.83607145  -2.82559492   5.22215270 -30.47640119 -17.76165021
##  [761]   1.16328730 -13.24560235  -6.81676746  -4.05337452 -20.84163069
##  [766]  -8.45407440 -22.59280025 -17.86812936  -4.87051228 -11.64671641
##  [771]  -1.88201389  -5.21604045 -24.72469265  -8.08134730   0.07514260
##  [776]  -2.59577457  -3.95652255   2.83600451 -15.42798744 -16.72809614
##  [781] -16.23570622 -13.40099656 -17.02719722  -5.62630708 -21.27999288
##  [786]   6.17545280  -2.03463740  -0.98757032 -30.72100071   2.41186950
##  [791]  -3.25531754 -12.73589610 -13.57479378 -20.13623952 -16.11541102
##  [796]   2.38324220  -8.66826401 -19.83562764 -31.04214150 -23.37324823
##  [801] -18.67417633 -11.81884808 -12.13847015   0.96596102  -6.10353376
##  [806] -21.38293960 -17.10542577 -17.86537038 -11.21442129  -5.48697957
##  [811]  -2.89012774 -27.68352812 -20.30021542 -17.68217492 -23.60374546
##  [816]  -3.11899903   6.99207231  -9.22013634 -12.66286116   4.50417005
##  [821]  -6.59106098  -6.76657626 -23.24691136   1.19531367 -13.26723662
##  [826]   3.80516748   1.86682045 -17.14676175 -14.71664308 -20.58768651
##  [831]  -5.86262740  -3.35764608 -13.25333704 -10.65724512 -17.43085182
##  [836] -18.85781579  -1.57041491 -22.98382133  -1.82895184  -7.40927459
##  [841] -22.24325148  -8.38500674 -18.54697277 -13.64068350 -12.20859452
##  [846] -13.78668140 -14.79743382  -3.69271357  -5.75770085  -7.62421766
##  [851] -17.86684023 -32.33876114  -1.69997146   4.27409367 -12.94301915
##  [856]  -5.34600493   0.57647374 -11.92658752  -8.02002095  -3.80494040
##  [861]   7.41847413  -6.88196269   1.46257429 -26.37714172  -9.43903955
##  [866] -31.43228611   9.29619226  -7.27812911 -17.10884005  -4.17368884
##  [871]  16.83224497 -14.17075488 -13.07686341 -14.47154042 -16.39790428
##  [876]  -0.59455870   0.65511154  -4.12411808 -23.99380308 -11.93490224
##  [881] -24.04370461   4.92923284  -4.97420145  -4.39681856   2.58379548
##  [886]  -5.85480980  -8.51599749  -0.63261366  -1.81024658  -0.84001636
##  [891] -21.54249246   1.40658948 -15.06248022  -5.28812563   4.51847178
##  [896]  -1.62786668   7.82468599  -3.37961152   4.32832156  -6.99172434
##  [901]  15.60452146 -15.99836242   6.75924016 -11.09106534 -14.50338224
##  [906]  -8.06259530  -4.68096129 -19.64812931  -5.13394175 -27.27108493
##  [911]  -8.18951737 -13.78332553   0.77583501 -24.92423672   4.82342782
##  [916]  -8.27791014 -18.43230841 -15.49605453 -10.49292267 -26.66152929
##  [921]  -6.37182398 -11.55102669   0.16651281  -1.47837308 -19.19511558
##  [926]  -2.50849062 -21.26695437  -7.32677172 -15.54673214 -13.25355770
##  [931]  -9.01948766  -2.26133044  -0.25666777  -1.81094299 -18.22971992
##  [936]  15.06720519 -14.13784142   4.91604350  -8.53609046 -20.55774219
##  [941] -12.61634725 -21.26357735 -26.56100057 -16.43481110 -12.11693716
##  [946] -17.70834987  -9.52955348  -3.51924227  -2.78598315  -9.65222671
##  [951]   4.25603237 -10.07903774 -20.88109039  -9.52082751  -2.90911404
##  [956]  -3.54507540  -8.11249688 -25.06507120 -11.22763942  -3.08404193
##  [961]  -4.08965113 -21.80223102 -26.61990729  -4.54131822   6.94675338
##  [966] -12.10780157 -11.51359045 -28.36763380  -5.81983524 -22.12000624
```

```
##  [971]  -8.06473934  -6.85364696 -30.53635485  -4.74109391  -4.13838082
##  [976] -27.54572110  12.58180353   0.40865440 -11.17960355 -19.76128331
##  [981]  -4.45971842   8.33255115  -8.56050963  -0.97233743   5.60966433
##  [986]  -2.75244443  -4.04696330 -31.10977731 -23.12006291 -24.35134193
##  [991]  -1.76530250  -0.21731224  -4.57790908   3.48983708  -7.86194083
##  [996] -11.65473570 -32.30720632 -10.89101263  -8.75802514 -20.95217621
```

Repeat this exercise by resetting the seed to ensure you obtain the same results.

```
set.seed(1984)
rnorm(1000, mean=-10, sd=10)
```

```
##    [1]  -5.90796784 -13.23024971  -3.64147673 -28.46128784  -0.46352635
##    [6]   1.88489843  -4.57545551 -18.32725430 -15.26207884   4.15982758
##   [11]  -7.17988996  -7.12066284  -1.62951750   0.23934459  -9.82254904
##   [16]   7.23994016  -8.79258195 -27.75560489  -8.73854471 -27.13757881
##   [21]   2.41956568  -5.70259385 -16.48615930  -0.96606019 -10.13218140
##   [26]  -7.52482282  -9.08281850  -1.77715352 -15.86308605   0.07988490
##   [31] -21.07586889 -24.70424177  -3.94162654  -0.43701072  -7.02334037
##   [36] -18.54028356  15.04353748 -12.88511063 -13.41417168  -7.56694485
##   [41]  -9.50523660  -1.99013348 -11.09611755 -23.39192163   2.41340869
##   [46]   1.84416366 -14.56775098   1.48872047 -16.66521389   1.08656689
##   [51]   2.43355160 -16.30020808 -19.74257623 -21.76807275 -13.80277843
##   [56] -25.65803802 -16.48259559 -18.24168801 -16.89461998 -10.16576089
##   [61] -17.37300246  -3.46447371   6.65904980 -13.32130524   6.16506062
##   [66] -12.82746714 -15.40028467 -16.29519683  -8.85849164  -1.00430266
##   [71] -15.08369396 -20.74937012  -7.00179388 -15.52191948 -14.21296895
##   [76] -12.69807216  -5.04967073 -13.88592872 -17.64967661 -14.86203728
##   [81]  -8.04904575  -4.38263148 -14.56730956 -24.49376020  -8.41093720
##   [86]   1.71336122 -14.72072134 -18.83119186  12.24101296 -11.08844767
##   [91] -10.78065157 -15.83103259 -28.40645476   1.69540893   2.43515038
##   [96]  -2.63156436 -14.35880553 -17.59250501   4.04956928 -23.17218827
##  [101]  -7.87975159 -21.31939960  -5.25317706 -17.27047414  13.22781948
##  [106] -16.29279321 -21.82156521 -10.10859263 -15.44585934 -11.22080964
##  [111] -22.57970905  -4.19276975 -13.52031882  -6.11333569 -11.55713325
##  [116] -18.80099088 -25.30408345 -13.58927991   2.42929973   0.57073465
##  [121] -11.00049652 -23.38935517  -0.48338583 -18.24414603 -10.16406861
##  [126]  -0.44021534  -1.61541765 -16.58219635 -12.94288594 -12.28528314
##  [131] -17.39451940 -21.28567863 -10.14397576  -0.39313871  -8.95982592
##  [136]   9.28707337 -11.98098839 -27.66102728 -19.09346586  -1.12303867
##  [141]  -3.11264626 -26.67399926 -19.34430661  -8.77722940 -15.05144004
##  [146]  -4.42385963 -11.56402408  -5.16329148 -36.41863170   6.85477578
##  [151] -15.99006877  -0.91057455  -1.68802071  -1.47607730 -20.90654924
##  [156] -14.19169196 -16.89634055  -1.40167623  -7.20149938 -19.25904354
##  [161] -10.99779541 -10.71377302  -7.46468607 -12.21280151 -12.38804312
##  [166] -13.06427416 -12.87457517 -31.10591651 -14.20382679  -9.53999153
##  [171] -10.89471545 -10.82098039  -7.30462951 -35.76929480   0.75211293
##  [176]   3.72694365 -21.88117885   9.18897513 -16.65739767 -10.81351611
##  [181]  -8.10399905 -20.80099492  -4.21087448  -2.11773304 -18.90904372
##  [186]  -8.61583847 -21.92324436 -10.93629266  -4.60301947  -3.17276193
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##  [201] -12.48152800  -8.65648187 -16.87042913 -16.92750812 -12.84899063
##  [206]  -7.19542584 -17.44978431 -21.39920811 -21.10078306 -19.49908421
##  [211]  -8.04296419 -11.29632427  10.46349346 -22.94785942 -19.31614010
##  [216]  -1.22649723 -10.50618157 -20.73379422  -8.69924325 -12.07157858
##  [221] -10.03284038 -18.55206062 -16.26972893 -20.40927635   0.30344890
##  [226] -14.28165384  17.32346574 -20.92144729  -3.51540727 -20.40951257
##  [231] -15.28029317 -12.72012782 -15.82784591 -18.26447143  -0.65780525
##  [236] -18.66217004  -8.79850964 -36.11748883 -21.47660868 -16.46981928
##  [241] -14.17594750   4.35594345  -1.41602980 -11.07537004  -2.66579093
##  [246]  -0.53594856 -17.88166228   7.82024894 -22.43681537 -24.25868855
##  [251]  16.13054036 -14.13675088  -2.71542050   0.49622642  -0.80834006
##  [256] -16.31575616 -12.67337121  -9.93785528 -14.27372950  -5.07328203
##  [261] -11.52271305   0.87644507 -10.51995528  -6.73117639 -10.76945156
##  [266]  -4.63756169   0.02861170  -2.69481266 -15.73965675 -20.50676249
##  [271]  -7.35133214 -36.45230069 -13.83730267 -27.94726862   0.10882241
##  [276]  -5.73963347  -3.87161777   1.88599836 -16.52228204 -21.77516014
##  [281]  -0.06003723 -18.91274829   2.76591754 -20.98130737 -16.68045474
##  [286] -13.27365003 -23.39393449 -25.79350365  -0.19075338  -5.15493127
##  [291] -19.46035381 -11.78502414 -20.97999683 -20.83898988  -3.16501442
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##  [301]  -9.29550952 -15.05228917  -9.36078653  -4.19267874  -8.34864847
##  [306] -31.30177070 -29.32990262   5.54488034  -9.87153989  -3.90564096
##  [311]  -7.28717888 -21.99536259  -0.08047085 -16.66684048  -4.66956920
##  [316]   0.37091117 -10.65325837   4.67129310 -12.35362914  13.55378820
##  [321]   3.80608340 -13.58588945   3.22219906   2.50845126 -19.95098424
##  [326] -21.37820958 -13.85068320  -3.63133287 -17.03565059 -18.23061683
```

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## [331]  -7.53315064 -11.82358911 -13.24355960 -11.32046463 -14.14312911
## [336] -10.19547423  -6.51134034  -8.91276038  -0.41465003 -10.50116216
## [341] -23.65223483  -5.95965343 -17.35237525 -24.11151655  -2.42469842
## [346]   1.97570831 -21.36234439 -25.51650675 -11.37754863 -15.39035463
## [351] -31.13701579  -1.16093820 -19.37798571 -18.28792399 -13.70555689
## [356] -11.37560109   4.87565939   2.86499775 -32.01285881  -2.63844004
## [361]  -8.47800024  -5.40578571 -16.89252079  -6.93603627  -7.44724159
## [366]  -9.72193304 -11.88586566 -16.53706810 -17.62713473  -3.06265873
## [371]  -6.00221712 -12.02350731 -12.32754380   6.11962631  -4.98311496
## [376] -14.39900766  -4.01328836  -1.88317027 -15.10267955 -11.05027217
## [381] -14.36324315  -4.46421404  -2.62915654  14.50231926 -31.32187133
## [386]  -3.53959317 -20.89441783  -9.45016599  -1.22588589  -7.41584609
## [391]  -1.64970047   4.35022740  -5.01063208 -23.80047694  -6.81754271
## [396] -31.50223977 -11.04717561  -6.62269588  11.23762934 -18.70375896
## [401]  -2.20545478 -21.32199656 -25.85569124  -7.92166674  -9.14381103
## [406]  -8.21837265  -8.58412634  14.68131192 -14.99347091   6.61683820
## [411] -27.34348202 -21.68289520 -10.56558501  -5.68546355  -2.77054151
## [416]  -8.35023835 -11.82657665 -18.72297310  -7.93347122 -14.92723510
## [421] -18.27057860  -5.21596152 -15.57161673 -15.59681197  -6.19422162
## [426] -10.07023860   2.31538274  -8.06781086 -14.26707526  -6.52652715
## [431] -11.04758065  -3.13736811 -18.24575089 -30.55205704 -23.81418353
## [436]  -8.58275801   4.35645905  -4.44646574   5.81994675  -6.12924584
## [441]   5.40710656 -10.66088694 -17.11477258  -4.02109198 -13.86959524
## [446]  -4.83024226  -7.89533249 -10.87213830 -10.02675060  -3.99463374
## [451]  -7.69660654 -15.44042603  -3.07933256   6.25910819 -19.11426458
## [456]   3.62753723  -7.12787937   3.52407484 -12.54098569   4.20820588
## [461] -28.78181597 -12.67154101  -5.33286557 -17.23003140 -24.68062273
## [466] -14.57842751   8.71836688 -10.15302501 -29.96489073 -19.23542562
## [471] -11.82882447 -15.47479304  -9.15871745 -29.20840150 -21.95245530
## [476] -13.82600745 -17.01978525 -10.12924511   1.73386380 -14.61798552
## [481]   0.23536703   6.45025394 -13.01446182   1.44821719  -3.19283241
## [486] -13.13423065 -15.59779771 -12.82908138  -6.26612290 -11.87559989
## [491] -14.23294271  -1.29296976 -24.29434230  -7.07623632 -10.35818076
## [496]   0.13995552 -14.37924024   0.32206534   5.71130839  12.25692029
## [501] -14.55550096 -19.49364819 -11.71975372  -2.16289190   3.97637125
## [506] -26.57943934 -15.33171928 -11.99072237 -10.94941490  -9.72528011
## [511] -18.46202271 -14.46806514 -11.92035663 -21.08437481   1.06080652
## [516]  -5.47935864 -12.35327331 -22.33895435 -25.11959196 -34.62423179
## [521]  -6.56989183   2.05038916  -6.80007208  -5.29309420   4.38373612
## [526] -11.27063572 -10.54539285 -17.47349313   1.01559590 -14.09169795
## [531] -16.76075428  -6.73490422 -15.49030935 -17.22881328  -0.07988122
## [536]  -8.92305015 -13.09137538 -14.19989956 -36.24955833 -10.39577463
## [541] -13.47010261 -24.29142158 -17.09440427  -8.26323975  11.23406804
## [546]   2.61013341 -19.04652166   1.83249893 -10.92106939   0.03445530
## [551]  -1.39806845  -1.81330637 -24.22109523 -17.64486905  -4.64420712
## [556] -10.03473835   7.08603867  -4.08139481  -6.51979661 -18.08233921
## [561] -14.54515656  -6.07063978 -34.98349940  -8.77697978  -7.96545755
## [566] -32.36126456 -15.15027101 -19.14816510  -5.77902111  -5.93196333
## [571]  -6.36519539   8.27337832  -4.54662586 -14.81636836 -25.90574102
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## [581]  -1.40593918 -13.69779839 -13.11912603 -11.37951645 -37.07445156
## [586] -15.49690764 -19.61837015 -16.79291144  -4.86646185 -24.85394100
## [591] -29.72513504  -7.65441673 -16.29593224  20.15146921 -13.32268504
## [596]   6.94074201 -25.66373379  -6.75775503 -18.51681236 -23.62318562
## [601]  -6.38334492  -7.39028592 -16.28580343 -28.08896233 -10.49542165
## [606]  -5.50248821 -15.03328274  -8.91027806   0.51200339 -16.81829255
## [611]  -3.69183687 -12.03064437 -18.41846329  -3.80105282  13.08955814
## [616]  -4.66825513 -18.84427399  -6.47048865  -8.46794499  -3.66495156
## [621] -18.22054776   0.35765032 -26.43404445  10.40780985 -10.78890010
## [626] -23.03331344 -15.03301775  -2.88081635 -15.17114603 -12.28249484
## [631] -28.80800994 -12.39599975  -9.22424616 -20.91744249 -24.84798766
## [636] -23.30990930 -20.63605358   1.01672529 -11.29470431 -12.29722911
## [641]  -1.52203100 -27.63516192  -9.51894554 -12.93445928   0.50559476
## [646] -12.19371104  -8.28014562 -21.80800472 -24.60546909 -20.90980507
## [651] -20.13809260   3.24680404 -14.43800051   1.21730039 -30.66447312
## [656]   1.35587921 -28.66492745 -22.50002074 -20.36182882 -10.09565048
## [661] -12.98851406  -0.35370324  -8.07040358   3.25149257 -19.53437440
## [666]   7.01493771 -11.52407347 -24.79944776  -8.52739144 -26.79181452
## [671] -13.30357072  -7.05914020 -11.81135383 -10.95204001  10.27030906
## [676]  -3.28389546  -6.67089577  -8.27172688  -1.62501381  -3.08381403
## [681]  -7.68930259  -7.66754882  -6.93916537  -5.64669728 -22.26459615
## [686] -18.43544808 -18.64865077 -20.24119212 -21.02731757  -2.73650018
## [691] -12.85001451 -24.07770450 -23.60065581  -1.37868168   1.92536019
## [696]   6.03719786 -12.13174480 -20.63227591  -9.32079359 -13.21197250
## [701]  -1.38183410 -23.30619376 -10.03734520 -23.85222453 -12.81079757
## [706]  -7.70455116 -17.64398954  -7.91231279  10.13071193  -5.18247689
```

```
##  [711]   3.99021595   1.25735898  -7.74475720  -7.45338607  -6.91288626
##  [716]  -1.74785991 -15.38703208 -18.85648516 -14.28420565 -17.63052715
##  [721]  -5.97315646 -19.29309617 -21.56166832 -16.46984046  -2.64531023
##  [726] -11.63018107 -13.26977303 -22.06678682 -23.53571825 -22.92183187
##  [731] -22.46073145  -9.19409758 -24.96178873  -9.16062424   8.76753303
##  [736] -15.28912503 -17.83335365 -10.18903616 -23.01131094 -13.74259543
##  [741] -14.59677487 -12.49891991 -11.79564215 -21.97166825 -10.75529700
##  [746] -22.69293157 -24.49190066   1.35860222 -11.88616926  -9.84067520
##  [751] -13.00249076  10.19681731 -16.77016302  10.52059618 -32.88893436
##  [756]  -3.83607145  -2.82559492   5.22215270 -30.47640119 -17.76165021
##  [761]   1.16328730 -13.24560235  -6.81676746  -4.05337452 -20.84163069
##  [766]  -8.45407440 -22.59280025 -17.86812936  -4.87051228 -11.64671641
##  [771]  -1.88201389  -5.21604045 -24.72469265  -8.08134730   0.07514260
##  [776]  -2.59577457  -3.95652255   2.83600451 -15.42798744 -16.72809614
##  [781] -16.23570622 -13.40099656 -17.02719722  -5.62630708 -21.27999288
##  [786]   6.17545280  -2.03463740  -0.98757032 -30.72100071   2.41186950
##  [791]  -3.25531754 -12.73589610 -13.57479378 -20.13623952 -16.11541102
##  [796]   2.38324220  -8.66826401 -19.83562764 -31.04214150 -23.37324823
##  [801] -18.67417633 -11.81884808 -12.13847015   0.96596102  -6.10353376
##  [806] -21.38293960 -17.10542577 -17.86537038 -11.21442129  -5.48697957
##  [811]  -2.89012774 -27.68352812 -20.30021542 -17.68217492 -23.60374546
##  [816]  -3.11899903   6.99207231  -9.22013634 -12.66286116   4.50417005
##  [821]  -6.59106098  -6.76657626 -23.24691136   1.19531367 -13.26723662
##  [826]   3.80516748   1.86682045 -17.14676175 -14.71664308 -20.58768651
##  [831]  -5.86262740  -3.35764608 -13.25333704 -10.65724512 -17.43085182
##  [836] -18.85781579  -1.57041491 -22.98382133  -1.82895184  -7.40927459
##  [841] -22.24325148  -8.38500674 -18.54697277 -13.64068350 -12.20859452
##  [846] -13.78668140 -14.79743382  -3.69271357  -5.75770085  -7.62421766
##  [851] -17.86684023 -32.33876114  -1.69997146   4.27409367 -12.94301915
##  [856]  -5.34600493   0.57647374 -11.92658752  -8.02002095  -3.80494040
##  [861]   7.41847413  -6.88196269   1.46257429 -26.37714172  -9.43903955
##  [866] -31.43228611   9.29619226  -7.27812911 -17.10884005  -4.17368884
##  [871]  16.83224497 -14.17075488 -13.07686341 -14.47154042 -16.39790428
##  [876]  -0.59455870   0.65511154  -4.12411808 -23.99380308 -11.93490224
##  [881] -24.04370461   4.92923284  -4.97420145  -4.39681856   2.58379548
##  [886]  -5.85480980  -8.51599749  -0.63261366  -1.81024658  -0.84001636
##  [891] -21.54249246   1.40658948 -15.06248022  -5.28812563   4.51847178
##  [896]  -1.62786668   7.82468599  -3.37961152   4.32832156  -6.99172434
##  [901]  15.60452146 -15.99836242   6.75924016 -11.09106534 -14.50338224
##  [906]  -8.06259530  -4.68096129 -19.64812931  -5.13394175 -27.27108493
##  [911]  -8.18951737 -13.78332553   0.77583501 -24.92423672   4.82342782
##  [916]  -8.27791014 -18.43230841 -15.49605453 -10.49292267 -26.66152929
##  [921]  -6.37182398 -11.55102669   0.16651281  -1.47837308 -19.19511558
##  [926]  -2.50849062 -21.26695437  -7.32677172 -15.54673214 -13.25355770
##  [931]  -9.01948766  -2.26133044  -0.25666777  -1.81094299 -18.22971992
##  [936]  15.06720519 -14.13784142   4.91604350  -8.53609046 -20.55774219
##  [941] -12.61634725 -21.26357735 -26.56100057 -16.43481110 -12.11693716
##  [946] -17.70834987  -9.52955348  -3.51924227  -2.78598315  -9.65222671
##  [951]   4.25603237 -10.07903774 -20.88109039  -9.52082751  -2.90911404
##  [956]  -3.54507540  -8.11249688 -25.06507120 -11.22763942  -3.08404193
##  [961]  -4.08965113 -21.80223102 -26.61990729  -4.54131822   6.94675338
##  [966] -12.10780157 -11.51359045 -28.36763380  -5.81983524 -22.12000624
##  [971]  -8.06473934  -6.85364696 -30.53635485  -4.74109391  -4.13838082
##  [976] -27.54572110  12.58180353   0.40865440 -11.17960355 -19.76128331
##  [981]  -4.45971842   8.33255115  -8.56050963  -0.97233743   5.60966433
##  [986]  -2.75244443  -4.04696330 -31.10977731 -23.12006291 -24.35134193
##  [991]  -1.76530250  -0.21731224  -4.57790908   3.48983708  -7.86194083
##  [996] -11.65473570 -32.30720632 -10.89101263  -8.75802514 -20.95217621
```

Find the average of v and the standard error of v.

```
mean(v)
## [1] -10.40334
standard_error = sd(v) / sqrt (1000)
standard_error
## [1] 0.31315
```

Find the 5%ile of v and use the qnorm function to compute what it theoretically should be. Is the estimate about what is expected by theory?

```
quantile(v,prob=0.05)
##       5%
## -26.58146
qnorm(.05,mean=-10,sd=10)
## [1] -26.44854
# Yes, the estimate is close to what is expected by theory.
```

What is the percentile of v that corresponds to the value 0? What should it be theoretically? Is the estimate about what is expected by theory?

```
inverse_quantile=ecdf(v)
inverse_quantile(0)
## [1] 0.85
quantile(v,prob=.85)
##         85%
## -0.04673989
# The percentile of v that corresponds to the value 0 is 85 and it should be that theoretically as well, so they are very similar.
```