

Lab 07

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#Rcpp

We will get some experience with speeding up R code using C++ via the Rcpp package.

First, clear the workspace and load the Rcpp package.

```
pacman :: p_load(Rcpp)
```

Create a variable `n` to be 10 and a variable `Nvec` to be 100 initially. Create a random vector via `rnorm Nvec` times and load it into a `Nvec x n` dimensional matrix.

```
n = 10
Nvec = 100
X = matrix(data=rnorm(Nvec*n), nrow=Nvec)
head(X)
```

```
##           [,1]      [,2]      [,3]      [,4]      [,5]      [,6]
## [1,]  1.9613626 -1.00022642  0.17358147 -1.225329826 -0.119059686  0.1911415
## [2,] -1.2014117  0.55046557 -1.30159274 -1.117349803 -1.540150406 -0.6120255
## [3,]  0.3606739 -0.32876420  0.86805169 -0.184299505 -0.627025182 -0.9704654
## [4,] -1.3322894 -0.95477198 -0.05481644  0.004423433  1.678429012  0.4305421
## [5,] -1.0953987 -0.00955414 -1.74701801 -0.454215285  1.334037661  0.0427112
## [6,]  0.6266948 -0.66106716 -0.31354808  1.194480652 -0.008887205 -0.1896121
##           [,7]      [,8]      [,9]      [,10]
## [1,]  0.58438791  0.3820558  0.20312416 -2.86864634
## [2,] -0.53734400  0.1965327  0.01699266  0.92201065
## [3,] -1.25302604 -0.3096396 -1.08133486 -1.25784915
## [4,]  0.52563671 -0.9442695 -0.98348383 -0.00381894
## [5,]  0.08249117 -0.1629095  0.63494039  2.38670096
## [6,] -0.29893010 -0.6450580  0.46028231 -0.97975289
```

Write a function `all_angles` that measures the angle between each of the pairs of vectors. You should measure the vector on a scale of 0 to 180 degrees with negative angles coerced to be positive.

```
angle = function(u,v){
  acos(sum(u*v)/sqrt(sum(u^2)*sum(v^2))) *(180/pi)
}
all_angles = function(X){
  A = matrix(NA, nrow=nrow(X), ncol=nrow(X))
  for(i in 1:(nrow(X)-1)){
    for(j in (i+1):nrow(X)){
      A[i,j] = angle(X[i,],X[j,])
    }
  }
  A
}
```

```
}
all_angles(X)
```

##		[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]
##	[1,]	NA	113.5936	67.76059	100.74627	129.76343	68.97517	73.89792	74.11845
##	[2,]	NA	NA	94.08441	105.50761	66.31817	117.95894	88.98072	117.61489
##	[3,]	NA	NA	NA	97.75807	134.72489	73.97497	85.74918	86.92631
##	[4,]	NA	NA	NA	NA	69.89119	92.79142	101.51382	75.51731
##	[5,]	NA	NA	NA	NA	NA	112.02531	100.30570	85.51378
##	[6,]	NA	NA	NA	NA	NA	NA	42.55337	68.57425
##	[7,]	NA	NA	NA	NA	NA	NA	NA	78.82892
##	[8,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[9,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[10,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[11,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[12,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[13,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[14,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[15,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[16,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[17,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[18,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[19,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[20,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[21,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[22,]	NA	NA	NA	NA	NA	NA	NA	NA
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##	[24,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[25,]	NA	NA	NA	NA	NA	NA	NA	NA
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##	[27,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[28,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[29,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[30,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[31,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[32,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[33,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[34,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[35,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[36,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[37,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[38,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[39,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[40,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[41,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[42,]	NA	NA	NA	NA	NA	NA	NA	NA
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##	[44,]	NA	NA	NA	NA	NA	NA	NA	NA
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##	[47,]	NA	NA	NA	NA	NA	NA	NA	NA
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##	[68,]	NA	NA	NA	NA	NA	NA	NA	NA
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##	[76,]	NA	NA	NA	NA	NA	NA	NA	NA
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##	[81,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[84,]	NA	NA	NA	NA	NA	NA	NA	NA
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##	[89,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA	NA
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##	[97,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA	NA
##		[,9]	[,10]	[,11]	[,12]	[,13]	[,14]	[,15]	
##	[1,]	67.70004	67.20172	105.27831	57.97640	84.29694	87.66388	67.81588	
##	[2,]	98.01436	142.68772	79.13102	83.15495	94.37954	86.91218	88.36663	
##	[3,]	81.65677	92.39978	64.63802	79.29516	97.46846	69.81839	56.21255	

##	[4,]	96.46634	52.44792	76.36525	108.94261	89.32406	120.36632	112.42233
##	[5,]	89.68551	105.75903	104.51559	120.15995	87.68251	108.29151	120.72435
##	[6,]	89.77470	78.63009	118.03849	98.66885	79.16414	108.16267	55.41914
##	[7,]	103.26963	93.90416	118.21512	80.65325	94.57351	97.99593	70.15756
##	[8,]	76.76573	70.26019	124.69612	120.92194	82.32315	90.24182	80.57205
##	[9,]	NA	99.55652	103.71724	97.52796	99.79872	78.74420	77.67848
##	[10,]	NA	NA	87.58805	84.25653	83.05306	106.90844	105.65651
##	[11,]	NA	NA	NA	74.85914	112.32540	75.74094	102.97249
##	[12,]	NA	NA	NA	NA	97.94360	76.43763	96.28383
##	[13,]	NA	NA	NA	NA	NA	126.59239	68.77606
##	[14,]	NA	NA	NA	NA	NA	NA	96.29545
##	[15,]	NA	NA	NA	NA	NA	NA	NA
##	[16,]	NA	NA	NA	NA	NA	NA	NA
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##	[60,]	NA	NA	NA	NA	NA	NA	NA
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##	[71,]	NA	NA	NA	NA	NA	NA	NA
##	[72,]	NA	NA	NA	NA	NA	NA	NA
##	[73,]	NA	NA	NA	NA	NA	NA	NA
##	[74,]	NA	NA	NA	NA	NA	NA	NA
##	[75,]	NA	NA	NA	NA	NA	NA	NA
##	[76,]	NA	NA	NA	NA	NA	NA	NA
##	[77,]	NA	NA	NA	NA	NA	NA	NA
##	[78,]	NA	NA	NA	NA	NA	NA	NA
##	[79,]	NA	NA	NA	NA	NA	NA	NA
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##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
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##	[86,]	NA	NA	NA	NA	NA	NA	NA
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##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
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##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,16]	[,17]	[,18]	[,19]	[,20]	[,21]	[,22]
##	[1,]	100.39325	95.95955	86.93167	92.23020	71.58400	112.87983	82.69240
##	[2,]	89.22895	70.56425	98.80037	71.08432	76.21994	103.08460	91.38770
##	[3,]	56.30093	98.27073	84.31423	75.39793	86.28564	88.93988	130.07458
##	[4,]	111.83200	84.51077	79.39582	92.95934	118.15334	74.58521	76.08685
##	[5,]	111.89633	95.56829	111.63490	77.38544	102.19326	90.06025	57.87276
##	[6,]	77.74826	99.71337	73.63987	124.87926	63.82769	100.74180	99.63021
##	[7,]	85.71012	84.14674	61.62010	122.05522	40.06349	103.17599	80.01537
##	[8,]	90.80773	123.36677	94.87205	82.94483	94.61783	75.47775	65.88725
##	[9,]	98.49077	128.88641	118.41889	74.34170	85.05352	111.59637	84.84956
##	[10,]	107.35106	85.82476	70.51798	105.10434	111.46725	76.06518	77.20487

##	[11,]	72.12936	73.31711	74.11503	75.38786	114.86746	77.37199	123.96842
##	[12,]	102.89270	60.87569	79.13015	93.95282	67.27732	104.20946	87.39601
##	[13,]	108.99559	70.82520	117.80639	96.64975	93.60609	90.49723	90.92745
##	[14,]	65.89933	108.53150	90.42405	69.68246	83.32375	69.71934	95.43478
##	[15,]	70.35097	91.93833	89.85873	100.29888	67.00296	104.63178	120.57881
##	[16,]	NA	113.26802	74.93080	77.26004	99.99777	88.76682	136.15416
##	[17,]	NA	NA	73.79056	115.60011	75.83687	80.42905	91.29543
##	[18,]	NA	NA	NA	121.47109	81.05896	84.29118	97.14163
##	[19,]	NA	NA	NA	NA	119.86529	95.38654	90.85068
##	[20,]	NA	NA	NA	NA	NA	101.68491	79.43286
##	[21,]	NA	NA	NA	NA	NA	NA	87.24218
##	[22,]	NA	NA	NA	NA	NA	NA	NA
##	[23,]	NA	NA	NA	NA	NA	NA	NA
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##	[25,]	NA	NA	NA	NA	NA	NA	NA
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##	[62,]	NA	NA	NA	NA	NA	NA	NA
##	[63,]	NA	NA	NA	NA	NA	NA	NA
##	[64,]	NA	NA	NA	NA	NA	NA	NA

##	[65,]	NA	NA	NA	NA	NA	NA	NA
##	[66,]	NA	NA	NA	NA	NA	NA	NA
##	[67,]	NA	NA	NA	NA	NA	NA	NA
##	[68,]	NA	NA	NA	NA	NA	NA	NA
##	[69,]	NA	NA	NA	NA	NA	NA	NA
##	[70,]	NA	NA	NA	NA	NA	NA	NA
##	[71,]	NA	NA	NA	NA	NA	NA	NA
##	[72,]	NA	NA	NA	NA	NA	NA	NA
##	[73,]	NA	NA	NA	NA	NA	NA	NA
##	[74,]	NA	NA	NA	NA	NA	NA	NA
##	[75,]	NA	NA	NA	NA	NA	NA	NA
##	[76,]	NA	NA	NA	NA	NA	NA	NA
##	[77,]	NA	NA	NA	NA	NA	NA	NA
##	[78,]	NA	NA	NA	NA	NA	NA	NA
##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
##	[84,]	NA	NA	NA	NA	NA	NA	NA
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,23]	[,24]	[,25]	[,26]	[,27]	[,28]	[,29]
##	[1,]	90.92211	74.86248	77.08995	110.51129	88.70763	96.04256	91.65710
##	[2,]	82.41427	58.13859	101.47537	95.55796	81.38337	122.68186	96.88578
##	[3,]	86.27941	97.35712	31.36369	73.59705	76.67188	81.95884	92.68730
##	[4,]	124.31618	100.41413	74.24616	77.94378	101.28027	64.59987	56.51318
##	[5,]	97.14978	76.50387	121.93545	96.67957	119.88820	108.27034	73.22570
##	[6,]	63.20542	86.46929	61.35969	64.96233	81.39282	95.31052	89.62376
##	[7,]	57.21604	66.68924	79.17079	65.13357	81.60704	122.68344	75.90117
##	[8,]	74.37333	87.68599	82.38822	93.79468	115.51835	99.01148	73.23604
##	[9,]	85.05275	70.01103	95.26463	113.30442	110.13600	105.69359	98.64367
##	[10,]	119.72962	115.33360	77.82889	88.18247	94.86553	51.67805	69.12392
##	[11,]	118.30327	112.53967	66.96468	70.73869	75.39684	58.60282	86.52626
##	[12,]	108.83992	86.67942	91.09924	101.11837	74.63535	91.18292	85.57741
##	[13,]	96.91763	93.84244	87.21352	120.10806	72.96179	75.72228	114.61198
##	[14,]	77.11410	103.62679	95.31376	87.45303	96.69814	98.03376	87.05832
##	[15,]	53.51611	70.57490	60.87934	92.02453	58.24680	99.68379	127.43383
##	[16,]	61.89560	101.26186	65.15203	53.69636	88.42307	89.77511	102.78417
##	[17,]	106.46889	92.61431	89.56941	94.70045	43.39399	75.06315	95.71075

##	[18,]	77.20846	89.26471	75.89586	49.58975	69.71278	85.04680	78.27946
##	[19,]	105.32799	86.47592	89.37242	106.62348	124.35340	98.85106	83.56421
##	[20,]	59.72925	62.73766	92.45147	88.71374	69.06748	126.45397	91.11651
##	[21,]	94.89464	134.24753	85.34317	80.94760	80.26060	61.23787	77.29925
##	[22,]	97.94532	73.31600	126.08379	112.52072	118.80256	113.34543	57.85438
##	[23,]	NA	66.90656	94.15915	77.78243	78.49728	124.43118	112.83504
##	[24,]	NA	NA	101.83022	103.79100	92.87529	144.39375	96.60575
##	[25,]	NA	NA	NA	60.56920	75.16293	71.43868	82.43392
##	[26,]	NA	NA	NA	NA	88.28506	85.44597	68.04533
##	[27,]	NA	NA	NA	NA	NA	73.20232	123.71197
##	[28,]	NA	NA	NA	NA	NA	NA	95.55151
##	[29,]	NA	NA	NA	NA	NA	NA	NA
##	[30,]	NA	NA	NA	NA	NA	NA	NA
##	[31,]	NA	NA	NA	NA	NA	NA	NA
##	[32,]	NA	NA	NA	NA	NA	NA	NA
##	[33,]	NA	NA	NA	NA	NA	NA	NA
##	[34,]	NA	NA	NA	NA	NA	NA	NA
##	[35,]	NA	NA	NA	NA	NA	NA	NA
##	[36,]	NA	NA	NA	NA	NA	NA	NA
##	[37,]	NA	NA	NA	NA	NA	NA	NA
##	[38,]	NA	NA	NA	NA	NA	NA	NA
##	[39,]	NA	NA	NA	NA	NA	NA	NA
##	[40,]	NA	NA	NA	NA	NA	NA	NA
##	[41,]	NA	NA	NA	NA	NA	NA	NA
##	[42,]	NA	NA	NA	NA	NA	NA	NA
##	[43,]	NA	NA	NA	NA	NA	NA	NA
##	[44,]	NA	NA	NA	NA	NA	NA	NA
##	[45,]	NA	NA	NA	NA	NA	NA	NA
##	[46,]	NA	NA	NA	NA	NA	NA	NA
##	[47,]	NA	NA	NA	NA	NA	NA	NA
##	[48,]	NA	NA	NA	NA	NA	NA	NA
##	[49,]	NA	NA	NA	NA	NA	NA	NA
##	[50,]	NA	NA	NA	NA	NA	NA	NA
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##	[53,]	NA	NA	NA	NA	NA	NA	NA
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##	[57,]	NA	NA	NA	NA	NA	NA	NA
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##	[62,]	NA	NA	NA	NA	NA	NA	NA
##	[63,]	NA	NA	NA	NA	NA	NA	NA
##	[64,]	NA	NA	NA	NA	NA	NA	NA
##	[65,]	NA	NA	NA	NA	NA	NA	NA
##	[66,]	NA	NA	NA	NA	NA	NA	NA
##	[67,]	NA	NA	NA	NA	NA	NA	NA
##	[68,]	NA	NA	NA	NA	NA	NA	NA
##	[69,]	NA	NA	NA	NA	NA	NA	NA
##	[70,]	NA	NA	NA	NA	NA	NA	NA
##	[71,]	NA	NA	NA	NA	NA	NA	NA

##	[72,]	NA	NA	NA	NA	NA	NA	NA
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##	[74,]	NA	NA	NA	NA	NA	NA	NA
##	[75,]	NA	NA	NA	NA	NA	NA	NA
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##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
##	[84,]	NA	NA	NA	NA	NA	NA	NA
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,30]	[,31]	[,32]	[,33]	[,34]	[,35]	[,36]
##	[1,]	111.16273	99.14328	79.37478	68.26727	102.11795	82.00595	64.10220
##	[2,]	68.61530	105.62524	80.29445	88.36627	85.12115	80.11495	113.39966
##	[3,]	99.15895	127.88756	102.51557	97.45943	120.43207	86.12672	69.51949
##	[4,]	109.93611	94.69418	113.52361	112.40604	101.37223	117.61396	96.11234
##	[5,]	66.64586	73.88157	86.51755	107.31129	83.20918	96.24468	112.91552
##	[6,]	106.52735	63.42675	67.19317	119.73560	72.31486	44.61569	66.63492
##	[7,]	104.20135	65.34315	51.55876	99.71989	64.88261	25.03361	68.40224
##	[8,]	82.10532	87.10335	91.87684	109.73825	109.95249	84.44829	59.36656
##	[9,]	61.19580	93.48005	105.13085	90.35388	98.02494	99.70950	103.20733
##	[10,]	131.71529	87.15468	100.17636	83.38663	100.89511	111.67155	68.75226
##	[11,]	100.80469	123.81250	118.93815	79.12009	106.24215	122.84480	99.68764
##	[12,]	123.15123	105.80556	79.22571	40.70061	93.52767	88.26090	84.94334
##	[13,]	105.43839	93.34462	83.17174	109.81322	95.48304	86.73996	94.33562
##	[14,]	70.09828	109.51645	106.52891	60.21940	108.91981	97.11029	80.42925
##	[15,]	82.55181	97.67568	83.60698	112.63550	84.43487	60.97964	84.98921
##	[16,]	72.54593	90.71033	81.65506	99.11570	91.87186	75.08707	62.75035
##	[17,]	124.17061	102.29463	91.97386	80.37029	77.88556	90.58650	111.64224
##	[18,]	108.16093	77.07016	82.95856	82.16650	64.73589	76.68924	74.18110
##	[19,]	68.13830	123.44151	95.73348	81.64581	136.61468	113.57732	78.14713
##	[20,]	93.96113	80.19720	71.47269	86.55368	66.64863	43.27285	96.18953
##	[21,]	95.59690	107.01747	129.41398	95.51501	108.84854	111.01659	92.46591
##	[22,]	91.54159	76.78000	81.84160	76.27551	90.43854	90.95242	89.56857
##	[23,]	56.20955	68.05716	70.94772	102.59913	61.70603	45.89748	81.47543
##	[24,]	68.75572	82.51391	63.56113	90.08178	70.89381	64.33760	96.71238

##	[25,]	114.12637	115.68031	100.27922	117.78047	112.69027	83.88014	70.62947
##	[26,]	98.19270	74.41442	83.82073	111.36024	75.87630	70.01649	74.31884
##	[27,]	105.27882	101.72811	100.65021	91.56127	70.86015	81.83133	110.39360
##	[28,]	118.83346	103.06215	123.35905	92.12699	103.68289	128.87521	94.24987
##	[29,]	111.06273	91.03801	90.18839	90.35728	108.48400	92.46164	72.44524
##	[30,]	NA	83.28148	94.85860	96.88516	81.68119	90.01251	105.03922
##	[31,]	NA	NA	56.21309	97.80288	38.05477	61.70947	87.13060
##	[32,]	NA	NA	NA	85.81616	66.21088	42.06912	62.04873
##	[33,]	NA	NA	NA	NA	92.71677	105.24793	83.47968
##	[34,]	NA	NA	NA	NA	NA	61.47668	108.56577
##	[35,]	NA	NA	NA	NA	NA	NA	72.14675
##	[36,]	NA	NA	NA	NA	NA	NA	NA
##	[37,]	NA	NA	NA	NA	NA	NA	NA
##	[38,]	NA	NA	NA	NA	NA	NA	NA
##	[39,]	NA	NA	NA	NA	NA	NA	NA
##	[40,]	NA	NA	NA	NA	NA	NA	NA
##	[41,]	NA	NA	NA	NA	NA	NA	NA
##	[42,]	NA	NA	NA	NA	NA	NA	NA
##	[43,]	NA	NA	NA	NA	NA	NA	NA
##	[44,]	NA	NA	NA	NA	NA	NA	NA
##	[45,]	NA	NA	NA	NA	NA	NA	NA
##	[46,]	NA	NA	NA	NA	NA	NA	NA
##	[47,]	NA	NA	NA	NA	NA	NA	NA
##	[48,]	NA	NA	NA	NA	NA	NA	NA
##	[49,]	NA	NA	NA	NA	NA	NA	NA
##	[50,]	NA	NA	NA	NA	NA	NA	NA
##	[51,]	NA	NA	NA	NA	NA	NA	NA
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##	[53,]	NA	NA	NA	NA	NA	NA	NA
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##	[55,]	NA	NA	NA	NA	NA	NA	NA
##	[56,]	NA	NA	NA	NA	NA	NA	NA
##	[57,]	NA	NA	NA	NA	NA	NA	NA
##	[58,]	NA	NA	NA	NA	NA	NA	NA
##	[59,]	NA	NA	NA	NA	NA	NA	NA
##	[60,]	NA	NA	NA	NA	NA	NA	NA
##	[61,]	NA	NA	NA	NA	NA	NA	NA
##	[62,]	NA	NA	NA	NA	NA	NA	NA
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##	[64,]	NA	NA	NA	NA	NA	NA	NA
##	[65,]	NA	NA	NA	NA	NA	NA	NA
##	[66,]	NA	NA	NA	NA	NA	NA	NA
##	[67,]	NA	NA	NA	NA	NA	NA	NA
##	[68,]	NA	NA	NA	NA	NA	NA	NA
##	[69,]	NA	NA	NA	NA	NA	NA	NA
##	[70,]	NA	NA	NA	NA	NA	NA	NA
##	[71,]	NA	NA	NA	NA	NA	NA	NA
##	[72,]	NA	NA	NA	NA	NA	NA	NA
##	[73,]	NA	NA	NA	NA	NA	NA	NA
##	[74,]	NA	NA	NA	NA	NA	NA	NA
##	[75,]	NA	NA	NA	NA	NA	NA	NA
##	[76,]	NA	NA	NA	NA	NA	NA	NA
##	[77,]	NA	NA	NA	NA	NA	NA	NA
##	[78,]	NA	NA	NA	NA	NA	NA	NA

##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
##	[84,]	NA	NA	NA	NA	NA	NA	NA
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,37]	[,38]	[,39]	[,40]	[,41]	[,42]	[,43]
##	[1,]	91.65247	134.62337	104.76881	80.96209	79.45156	97.28758	88.79468
##	[2,]	117.90463	75.61640	90.02326	120.10013	97.11391	103.07748	81.88137
##	[3,]	116.01531	99.01242	87.20907	119.09060	69.50747	103.63180	97.18852
##	[4,]	67.36505	80.78485	107.88129	81.34266	59.94205	108.34973	127.74236
##	[5,]	66.79073	70.48778	93.60744	74.14468	110.34183	80.27178	77.77930
##	[6,]	104.16279	137.41479	110.76018	73.11794	69.90815	92.42747	93.46544
##	[7,]	120.79170	136.28269	128.38898	82.71923	70.09800	101.92914	85.59177
##	[8,]	64.63140	104.72854	96.68063	67.64912	102.22601	63.03992	67.43583
##	[9,]	64.79153	112.82173	84.53375	94.01925	100.82559	62.79440	64.53545
##	[10,]	67.35387	95.54726	101.84184	63.06581	67.85608	102.50591	121.54929
##	[11,]	107.23779	56.50284	75.45436	128.66658	65.86013	118.91045	123.80127
##	[12,]	110.25339	102.75114	108.76919	95.78211	73.20269	119.59654	102.64473
##	[13,]	79.90038	90.24171	90.26577	64.10167	100.18676	89.74486	99.26286
##	[14,]	91.70748	77.63196	75.98283	113.32968	107.67555	64.74549	56.58633
##	[15,]	115.50672	119.79842	85.31490	108.74619	83.13863	86.11630	86.20116
##	[16,]	123.45374	79.89643	55.29723	112.35564	97.70198	88.24736	79.24250
##	[17,]	108.91669	82.26815	111.70747	100.51970	62.53805	121.96525	128.83822
##	[18,]	120.79778	101.36509	101.08194	107.82030	52.08749	113.91803	116.20973
##	[19,]	83.47514	63.02944	64.21215	96.92752	119.97563	87.62283	68.76915
##	[20,]	111.41183	133.93461	128.90334	96.67489	76.19426	88.26127	76.29253
##	[21,]	70.44745	57.75274	91.76538	94.43700	89.24005	69.53726	92.93492
##	[22,]	58.19699	100.21369	120.75776	58.75652	101.10148	78.27592	72.87834
##	[23,]	111.75221	111.89129	81.63743	103.92526	103.88522	62.44590	56.03739
##	[24,]	107.65190	122.52246	101.80573	101.41339	90.18620	96.94202	75.67458
##	[25,]	113.25114	99.96944	98.90491	106.35178	52.40201	116.57432	117.88025
##	[26,]	118.67174	90.69840	96.68848	101.89958	61.33654	107.99837	106.06495
##	[27,]	117.37509	93.79622	93.86268	119.67519	63.48371	101.82258	117.54379
##	[28,]	74.04314	63.50858	76.13603	86.47707	73.96935	98.10305	130.25957
##	[29,]	79.77805	91.43376	127.42625	73.68698	71.85403	105.86544	95.78573
##	[30,]	83.09291	79.83236	56.93543	109.12964	128.21414	48.96692	45.29677
##	[31,]	86.70007	109.65853	91.89932	59.53216	97.99114	79.20817	80.78216

##	[32,]	118.55821	113.96456	95.41586	65.53983	101.52448	106.75863	77.87839
##	[33,]	91.17195	85.72866	83.93519	93.59403	100.00397	93.36710	82.65005
##	[34,]	106.02265	109.32771	93.00907	90.63708	82.43960	89.43085	93.97354
##	[35,]	125.46879	128.69393	110.32236	83.29797	86.92728	94.03457	74.06507
##	[36,]	103.41000	101.37646	87.10714	70.65991	96.06952	97.99117	80.30364
##	[37,]	NA	79.92245	89.44672	59.90974	109.52745	54.71261	78.44135
##	[38,]	NA	NA	57.86314	99.53042	110.21111	86.04460	94.53470
##	[39,]	NA	NA	NA	102.00261	125.83926	71.59073	76.53331
##	[40,]	NA	NA	NA	NA	107.63862	83.27998	83.05862
##	[41,]	NA	NA	NA	NA	NA	130.53277	142.02353
##	[42,]	NA	NA	NA	NA	NA	NA	41.68464
##	[43,]	NA	NA	NA	NA	NA	NA	NA
##	[44,]	NA	NA	NA	NA	NA	NA	NA
##	[45,]	NA	NA	NA	NA	NA	NA	NA
##	[46,]	NA	NA	NA	NA	NA	NA	NA
##	[47,]	NA	NA	NA	NA	NA	NA	NA
##	[48,]	NA	NA	NA	NA	NA	NA	NA
##	[49,]	NA	NA	NA	NA	NA	NA	NA
##	[50,]	NA	NA	NA	NA	NA	NA	NA
##	[51,]	NA	NA	NA	NA	NA	NA	NA
##	[52,]	NA	NA	NA	NA	NA	NA	NA
##	[53,]	NA	NA	NA	NA	NA	NA	NA
##	[54,]	NA	NA	NA	NA	NA	NA	NA
##	[55,]	NA	NA	NA	NA	NA	NA	NA
##	[56,]	NA	NA	NA	NA	NA	NA	NA
##	[57,]	NA	NA	NA	NA	NA	NA	NA
##	[58,]	NA	NA	NA	NA	NA	NA	NA
##	[59,]	NA	NA	NA	NA	NA	NA	NA
##	[60,]	NA	NA	NA	NA	NA	NA	NA
##	[61,]	NA	NA	NA	NA	NA	NA	NA
##	[62,]	NA	NA	NA	NA	NA	NA	NA
##	[63,]	NA	NA	NA	NA	NA	NA	NA
##	[64,]	NA	NA	NA	NA	NA	NA	NA
##	[65,]	NA	NA	NA	NA	NA	NA	NA
##	[66,]	NA	NA	NA	NA	NA	NA	NA
##	[67,]	NA	NA	NA	NA	NA	NA	NA
##	[68,]	NA	NA	NA	NA	NA	NA	NA
##	[69,]	NA	NA	NA	NA	NA	NA	NA
##	[70,]	NA	NA	NA	NA	NA	NA	NA
##	[71,]	NA	NA	NA	NA	NA	NA	NA
##	[72,]	NA	NA	NA	NA	NA	NA	NA
##	[73,]	NA	NA	NA	NA	NA	NA	NA
##	[74,]	NA	NA	NA	NA	NA	NA	NA
##	[75,]	NA	NA	NA	NA	NA	NA	NA
##	[76,]	NA	NA	NA	NA	NA	NA	NA
##	[77,]	NA	NA	NA	NA	NA	NA	NA
##	[78,]	NA	NA	NA	NA	NA	NA	NA
##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
##	[84,]	NA	NA	NA	NA	NA	NA	NA
##	[85,]	NA	NA	NA	NA	NA	NA	NA

##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##	[,44]	[,45]	[,46]	[,47]	[,48]	[,49]	[,50]	
##	[1,]	46.50984	97.95977	86.47776	122.36084	94.31444	77.57246	74.89131
##	[2,]	112.33079	88.31920	94.84612	91.70274	74.01611	65.21796	109.02846
##	[3,]	49.38212	82.54073	100.93734	84.82047	110.74702	95.28530	36.35780
##	[4,]	101.20070	101.53129	82.11221	95.88808	79.90794	80.27798	97.07231
##	[5,]	144.23672	95.91704	87.68675	95.05152	87.20850	72.37711	120.04128
##	[6,]	46.18325	74.72589	89.42135	75.07200	120.64669	127.94794	74.51002
##	[7,]	57.93983	74.29403	82.03565	91.94490	103.13978	107.74675	99.52637
##	[8,]	86.77200	76.10671	70.36429	113.00362	113.56269	91.64646	69.70293
##	[9,]	79.36389	81.93122	74.13178	115.98693	98.59040	63.33390	71.97816
##	[10,]	77.60012	106.75635	86.95752	99.89825	84.67681	96.47156	89.11100
##	[11,]	88.72360	95.00878	104.11903	77.24758	71.35386	82.25303	81.90910
##	[12,]	69.57005	117.34476	100.43847	103.77023	75.06338	76.10112	98.83469
##	[13,]	101.79932	116.92196	102.49289	71.52427	98.80294	106.51585	82.54744
##	[14,]	85.76469	76.33495	80.25968	100.32943	96.16146	84.60852	68.64414
##	[15,]	54.69768	66.47527	83.83891	79.75192	100.54362	105.34324	61.86398
##	[16,]	70.38047	53.62888	110.01320	67.98260	111.56586	114.38497	63.11067
##	[17,]	96.38172	114.05874	87.75831	74.85621	56.16321	94.11437	114.11172
##	[18,]	61.30789	62.02719	75.15444	90.86547	65.91078	101.73094	108.63593
##	[19,]	110.03115	98.49841	113.19187	110.70587	102.88488	56.00343	70.59015
##	[20,]	65.47079	83.26378	68.70595	94.52130	92.17545	95.06650	97.10620
##	[21,]	109.51029	91.64404	68.74808	75.10508	88.96334	109.60524	75.20736
##	[22,]	112.96681	105.23544	67.37604	130.30889	82.12691	64.41776	119.90772
##	[23,]	73.43454	35.62615	68.42604	86.19129	97.39678	108.53197	87.42832
##	[24,]	82.35708	72.22408	76.70080	123.12876	75.19223	55.53076	113.30466
##	[25,]	53.21503	87.17783	103.00608	74.42542	111.34901	105.85871	48.25393
##	[26,]	69.70248	64.58474	97.36767	65.33271	103.46289	118.79706	86.95860
##	[27,]	73.45553	84.75107	76.22602	63.39492	64.14313	110.50640	89.94820
##	[28,]	91.51401	109.29041	99.67535	62.39574	83.87773	111.92313	74.17384
##	[29,]	93.90681	104.97227	89.93568	109.88612	102.16003	77.85386	96.07448
##	[30,]	108.90529	51.76117	74.04838	98.18533	88.93138	75.60480	89.80477
##	[31,]	88.20066	72.63766	88.46751	80.17099	95.42953	113.44521	121.09688
##	[32,]	79.22024	87.27117	117.00427	92.10385	104.56408	98.23714	111.81775
##	[33,]	88.30045	102.25704	89.77322	117.64941	64.39571	66.77401	107.13286
##	[34,]	83.13079	64.86376	76.29556	75.57476	69.27601	107.03435	131.21900
##	[35,]	64.83359	70.76016	93.09204	80.73620	112.06411	113.70512	94.87770
##	[36,]	65.43495	83.30387	110.43006	102.00967	118.81566	102.12065	71.90655
##	[37,]	118.31889	108.43563	72.52036	103.63003	93.46179	80.22713	86.73679
##	[38,]	136.83447	100.21581	104.48865	71.97417	80.33012	89.33526	90.18431

##	[39,]	101.83596	70.38488	106.58020	78.05484	87.68111	93.84143	78.67395
##	[40,]	101.06324	118.14387	106.73094	90.89244	116.26727	104.31659	97.52697
##	[41,]	57.52799	92.26864	80.19023	85.21663	75.25215	93.22208	92.29633
##	[42,]	105.90910	70.28551	61.06134	92.78432	101.16586	97.57676	76.54038
##	[43,]	100.69507	72.11228	81.13183	107.06289	112.45118	83.55923	81.24454
##	[44,]	NA	72.69825	88.83875	92.94639	100.10745	102.71838	69.24320
##	[45,]	NA	NA	64.64035	92.04920	83.86682	97.74859	89.50503
##	[46,]	NA	NA	NA	111.40265	62.56475	79.79287	99.29605
##	[47,]	NA	NA	NA	NA	105.89562	144.39616	78.49652
##	[48,]	NA	NA	NA	NA	NA	64.45862	129.52538
##	[49,]	NA	NA	NA	NA	NA	NA	105.12561
##	[50,]	NA	NA	NA	NA	NA	NA	NA
##	[51,]	NA	NA	NA	NA	NA	NA	NA
##	[52,]	NA	NA	NA	NA	NA	NA	NA
##	[53,]	NA	NA	NA	NA	NA	NA	NA
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##	[55,]	NA	NA	NA	NA	NA	NA	NA
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##	[58,]	NA	NA	NA	NA	NA	NA	NA
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##	[64,]	NA	NA	NA	NA	NA	NA	NA
##	[65,]	NA	NA	NA	NA	NA	NA	NA
##	[66,]	NA	NA	NA	NA	NA	NA	NA
##	[67,]	NA	NA	NA	NA	NA	NA	NA
##	[68,]	NA	NA	NA	NA	NA	NA	NA
##	[69,]	NA	NA	NA	NA	NA	NA	NA
##	[70,]	NA	NA	NA	NA	NA	NA	NA
##	[71,]	NA	NA	NA	NA	NA	NA	NA
##	[72,]	NA	NA	NA	NA	NA	NA	NA
##	[73,]	NA	NA	NA	NA	NA	NA	NA
##	[74,]	NA	NA	NA	NA	NA	NA	NA
##	[75,]	NA	NA	NA	NA	NA	NA	NA
##	[76,]	NA	NA	NA	NA	NA	NA	NA
##	[77,]	NA	NA	NA	NA	NA	NA	NA
##	[78,]	NA	NA	NA	NA	NA	NA	NA
##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
##	[84,]	NA	NA	NA	NA	NA	NA	NA
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA

##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,51]	[,52]	[,53]	[,54]	[,55]	[,56]	[,57]
##	[1,]	89.80825	109.47102	96.11567	100.12246	120.62419	56.24617	84.20291
##	[2,]	78.53077	94.39642	85.62340	77.43181	82.32021	94.56539	90.75806
##	[3,]	113.59639	120.89887	101.94155	95.15703	112.72432	99.85350	89.16086
##	[4,]	65.49991	48.04231	73.38152	94.89157	82.66162	103.68989	83.30584
##	[5,]	50.02410	58.14227	63.32001	73.80367	56.80373	89.64213	101.89982
##	[6,]	108.88758	96.53916	87.24655	86.71147	79.46643	99.41204	89.32756
##	[7,]	88.64820	103.62299	68.18403	87.20787	80.20641	95.45545	90.18244
##	[8,]	72.76441	82.57327	45.96410	68.68132	96.54777	79.93174	92.38880
##	[9,]	74.16281	95.49155	96.91779	74.03022	100.36349	71.78747	107.47091
##	[10,]	87.10789	71.22877	87.36961	111.54285	101.30454	82.06784	78.12430
##	[11,]	103.22357	90.85386	114.25350	106.13719	98.07925	109.29973	90.81170
##	[12,]	90.99752	122.28924	108.77834	130.26828	115.53734	73.30401	78.23875
##	[13,]	106.75749	84.07901	99.19873	97.84664	95.98136	86.52993	52.19215
##	[14,]	91.93696	132.16910	85.05441	93.39667	114.90025	90.73490	102.68910
##	[15,]	123.86978	104.13457	103.01461	69.01954	103.76135	97.00353	76.30535
##	[16,]	125.45364	102.12495	99.22354	68.63586	75.36651	98.62311	119.04985
##	[17,]	100.01990	91.02937	101.37296	119.42209	105.55165	110.36530	42.64347
##	[18,]	100.03538	79.70899	84.63413	86.26426	87.23225	105.48940	92.72418
##	[19,]	72.52154	94.21676	83.13974	79.29331	91.17907	62.90261	113.52527
##	[20,]	87.75748	123.50022	81.75444	96.48459	102.20061	99.26932	75.76903
##	[21,]	94.37525	96.77629	69.69342	104.62795	112.95555	126.88749	62.60490
##	[22,]	33.39962	80.00513	47.05328	93.20279	92.21299	68.80094	87.09613
##	[23,]	106.61855	100.05203	77.52605	48.91125	83.79167	97.64551	99.90893
##	[24,]	66.89347	80.51211	78.27452	56.52062	82.03336	68.01249	101.93628
##	[25,]	111.19496	99.70468	96.11222	97.52585	98.24372	111.39905	82.77257
##	[26,]	102.13077	86.91939	83.56143	87.04580	61.98404	122.49533	110.65966
##	[27,]	130.38020	100.50123	115.64225	99.57954	114.71435	122.15204	45.73558
##	[28,]	117.25349	79.71122	117.39307	117.77171	102.61233	108.31851	68.21284
##	[29,]	45.79064	87.90655	50.09600	108.55344	81.79789	91.47507	101.57496
##	[30,]	83.69989	83.45267	82.35145	38.51960	78.34249	86.05260	117.41308
##	[31,]	90.36712	69.56039	87.77258	75.70310	47.19141	84.80077	112.42612
##	[32,]	90.74955	90.55422	85.74520	81.01854	56.66761	60.76359	111.32683
##	[33,]	83.80436	108.62949	101.00043	109.06638	113.33574	58.84370	93.58447
##	[34,]	101.39233	72.83565	101.48053	74.14085	63.12075	99.79558	95.95201
##	[35,]	99.30480	106.84590	78.09088	78.36804	71.01410	92.76072	96.33187
##	[36,]	95.19622	100.06545	72.34729	87.59828	86.48058	64.80847	109.12806
##	[37,]	64.73177	75.65801	78.42278	96.19146	99.14051	81.88313	84.10177
##	[38,]	94.43228	79.62947	93.04098	94.20227	86.46905	102.11181	88.41229
##	[39,]	118.33688	79.72665	115.44205	63.38785	81.36784	77.54009	111.82770
##	[40,]	76.78487	80.80501	78.28022	105.34472	71.90923	65.74133	92.14716
##	[41,]	92.57742	85.48802	96.24621	109.43517	98.01728	118.01817	73.01472
##	[42,]	89.14275	98.14210	77.31951	69.69242	99.93505	91.44881	92.52193
##	[43,]	77.47712	111.81627	68.62546	65.97770	89.17371	70.09416	112.42418
##	[44,]	112.45134	109.93411	105.37842	92.83391	101.69125	88.57737	94.83729
##	[45,]	102.37545	80.21023	80.56075	36.27369	79.07709	100.93963	113.95902

##	[46,]	74.59615	85.19600	66.62405	74.17991	116.93854	108.01014	71.19785
##	[47,]	135.52116	94.42328	116.66076	102.47719	72.39705	129.72733	77.75757
##	[48,]	84.41660	66.60736	98.49511	84.60699	104.93641	92.10282	73.79251
##	[49,]	44.97220	80.41115	79.63206	80.27169	101.89642	60.49684	100.80736
##	[50,]	112.19499	119.84191	96.74565	95.11522	112.60318	98.69296	86.04526
##	[51,]	NA	76.72450	48.83484	87.71532	85.32196	72.79268	102.10028
##	[52,]	NA	NA	84.31540	62.98213	60.17483	86.53400	99.68407
##	[53,]	NA	NA	NA	75.56050	88.09337	91.07664	92.30666
##	[54,]	NA	NA	NA	NA	70.33343	82.37040	116.60192
##	[55,]	NA	NA	NA	NA	NA	87.36172	129.69164
##	[56,]	NA	NA	NA	NA	NA	NA	113.90305
##	[57,]	NA	NA	NA	NA	NA	NA	NA
##	[58,]	NA	NA	NA	NA	NA	NA	NA
##	[59,]	NA	NA	NA	NA	NA	NA	NA
##	[60,]	NA	NA	NA	NA	NA	NA	NA
##	[61,]	NA	NA	NA	NA	NA	NA	NA
##	[62,]	NA	NA	NA	NA	NA	NA	NA
##	[63,]	NA	NA	NA	NA	NA	NA	NA
##	[64,]	NA	NA	NA	NA	NA	NA	NA
##	[65,]	NA	NA	NA	NA	NA	NA	NA
##	[66,]	NA	NA	NA	NA	NA	NA	NA
##	[67,]	NA	NA	NA	NA	NA	NA	NA
##	[68,]	NA	NA	NA	NA	NA	NA	NA
##	[69,]	NA	NA	NA	NA	NA	NA	NA
##	[70,]	NA	NA	NA	NA	NA	NA	NA
##	[71,]	NA	NA	NA	NA	NA	NA	NA
##	[72,]	NA	NA	NA	NA	NA	NA	NA
##	[73,]	NA	NA	NA	NA	NA	NA	NA
##	[74,]	NA	NA	NA	NA	NA	NA	NA
##	[75,]	NA	NA	NA	NA	NA	NA	NA
##	[76,]	NA	NA	NA	NA	NA	NA	NA
##	[77,]	NA	NA	NA	NA	NA	NA	NA
##	[78,]	NA	NA	NA	NA	NA	NA	NA
##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
##	[84,]	NA	NA	NA	NA	NA	NA	NA
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA

##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,58]	[,59]	[,60]	[,61]	[,62]	[,63]	[,64]
##	[1,]	97.33077	96.32715	78.82567	127.71897	96.04685	73.40082	81.65395
##	[2,]	88.37382	111.40549	75.98478	101.32005	114.32408	66.83773	94.55020
##	[3,]	83.33077	63.41419	83.70184	127.54091	104.70079	59.75956	93.69216
##	[4,]	68.05102	107.61076	79.71694	93.50130	83.62880	114.24720	100.79990
##	[5,]	75.51885	124.33728	84.59100	66.74344	96.93690	114.23932	102.14988
##	[6,]	81.73859	71.59133	113.60169	80.57535	86.65941	84.88787	78.94730
##	[7,]	92.45274	86.33025	96.33559	86.81536	91.52738	72.07298	57.60756
##	[8,]	93.04949	103.76777	97.37806	90.19970	85.00330	110.68266	85.76004
##	[9,]	85.33458	99.30235	64.65275	110.95945	138.47044	97.85225	135.40313
##	[10,]	89.60457	89.65817	92.88196	92.34976	56.68976	107.79397	75.87743
##	[11,]	89.05306	69.86642	69.67929	109.37165	90.90886	72.32701	97.88698
##	[12,]	93.55005	85.03743	72.19945	118.08792	88.37812	62.59260	64.67498
##	[13,]	67.43216	105.97073	138.00149	81.19772	68.68909	104.80774	90.92342
##	[14,]	110.83631	62.43250	72.61764	99.18130	100.27516	83.05183	82.72599
##	[15,]	92.67008	84.01569	110.10223	106.17414	106.25761	71.23464	102.74096
##	[16,]	112.36114	52.11037	95.63270	84.76819	86.50194	57.75708	84.55889
##	[17,]	80.34578	95.74214	103.46583	93.31599	73.25874	87.97259	72.85947
##	[18,]	119.43166	75.69508	80.89715	91.13416	76.26065	72.27181	65.22597
##	[19,]	90.12778	105.52162	66.30488	113.79433	102.22039	74.96409	100.65673
##	[20,]	86.05405	86.85197	91.13307	96.01453	111.85781	80.62127	76.31897
##	[21,]	85.31751	70.69520	109.40259	73.83552	66.23388	126.26739	79.35922
##	[22,]	88.54177	129.02951	76.60653	86.25489	88.32042	116.19820	75.36645
##	[23,]	118.88404	81.02089	103.78907	76.65967	101.69119	79.92409	87.03846
##	[24,]	101.68473	132.04953	65.57962	112.87442	127.10368	66.96581	100.73083
##	[25,]	69.99931	68.54979	93.74708	114.89791	93.34079	70.26764	91.35195
##	[26,]	90.82347	55.19430	88.49525	75.30423	84.55988	75.03777	75.60695
##	[27,]	92.73057	75.24130	113.77422	94.65276	85.24001	83.90062	89.76213
##	[28,]	79.20775	65.92968	109.35448	82.40724	58.06575	109.56683	95.25595
##	[29,]	72.17215	95.65740	64.77586	94.89729	87.41570	96.66550	67.71046
##	[30,]	111.44598	98.79492	79.99995	81.73219	119.79397	93.40479	121.13879
##	[31,]	102.63916	86.17591	103.17205	43.60399	78.54483	99.22335	81.29923
##	[32,]	102.58228	99.07098	97.16843	78.21240	78.50915	57.58232	57.74565
##	[33,]	120.88110	90.51843	65.71961	105.39359	82.36533	75.84677	69.71918
##	[34,]	108.43588	87.02616	98.91179	59.87696	90.95232	88.85931	89.79394
##	[35,]	92.86568	83.36447	106.07939	78.62744	94.23236	67.01451	65.64710
##	[36,]	108.65798	80.26351	93.03423	95.38344	63.84149	65.87616	50.04483
##	[37,]	75.63815	103.77092	91.78878	77.23027	86.80979	149.03812	110.01708
##	[38,]	91.17873	84.90892	95.93793	74.85346	69.05324	101.54217	92.48044
##	[39,]	120.02266	79.10660	96.83338	79.72720	81.58243	81.65555	108.06671
##	[40,]	75.10750	99.31237	111.79877	62.10875	59.70764	112.70209	70.02930
##	[41,]	73.53972	81.36287	77.83427	111.01794	97.12666	81.46562	89.00774
##	[42,]	101.45353	84.27004	103.96405	67.17522	96.71636	126.30947	106.47815
##	[43,]	106.18030	93.00205	88.18521	80.54465	105.48452	93.50260	89.82714
##	[44,]	98.64143	65.92870	83.37427	114.12324	100.33028	59.92205	83.63193
##	[45,]	129.53168	80.26321	84.59688	83.78371	105.11776	79.05945	99.98390
##	[46,]	103.62927	101.00096	82.02733	93.83201	108.01324	119.69887	103.02809
##	[47,]	71.13390	50.66756	134.51280	54.12495	70.63353	94.91383	90.42470
##	[48,]	115.46330	111.75131	71.98873	101.43733	91.75094	91.59448	97.76548
##	[49,]	95.13641	135.16505	35.74430	131.64368	122.68578	81.42266	108.33679
##	[50,]	73.78627	61.97187	101.41362	106.58784	96.70301	88.05561	101.31608
##	[51,]	79.36519	131.32732	52.27890	102.01230	109.51660	104.27487	91.69917
##	[52,]	96.94306	120.24744	86.68612	76.68747	81.23119	104.48081	107.58014

##	[53,]	90.82358	113.00947	83.24681	87.11222	88.88908	105.28658	69.81355
##	[54,]	120.63771	109.23551	84.00995	87.05028	108.54795	82.56191	111.57215
##	[55,]	87.69615	91.66142	92.38555	56.04964	85.61224	81.63130	89.63541
##	[56,]	110.20461	117.84152	71.63035	106.03132	87.79866	71.97175	82.48592
##	[57,]	70.54179	94.57920	119.84420	94.99303	75.90563	112.49879	84.81510
##	[58,]	NA	90.54803	99.91155	91.14169	100.16831	108.22979	102.77096
##	[59,]	NA	NA	106.30353	72.80299	78.36854	85.03093	80.59949
##	[60,]	NA	NA	NA	127.50983	126.28279	71.24764	102.61064
##	[61,]	NA	NA	NA	NA	60.43001	117.84623	79.58965
##	[62,]	NA	NA	NA	NA	NA	99.08405	48.83878
##	[63,]	NA	NA	NA	NA	NA	NA	75.28951
##	[64,]	NA	NA	NA	NA	NA	NA	NA
##	[65,]	NA	NA	NA	NA	NA	NA	NA
##	[66,]	NA	NA	NA	NA	NA	NA	NA
##	[67,]	NA	NA	NA	NA	NA	NA	NA
##	[68,]	NA	NA	NA	NA	NA	NA	NA
##	[69,]	NA	NA	NA	NA	NA	NA	NA
##	[70,]	NA	NA	NA	NA	NA	NA	NA
##	[71,]	NA	NA	NA	NA	NA	NA	NA
##	[72,]	NA	NA	NA	NA	NA	NA	NA
##	[73,]	NA	NA	NA	NA	NA	NA	NA
##	[74,]	NA	NA	NA	NA	NA	NA	NA
##	[75,]	NA	NA	NA	NA	NA	NA	NA
##	[76,]	NA	NA	NA	NA	NA	NA	NA
##	[77,]	NA	NA	NA	NA	NA	NA	NA
##	[78,]	NA	NA	NA	NA	NA	NA	NA
##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
##	[84,]	NA	NA	NA	NA	NA	NA	NA
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,65]	[,66]	[,67]	[,68]	[,69]	[,70]	[,71]
##	[1,]	81.06385	129.72691	87.36518	76.69040	95.72479	97.75911	101.52657
##	[2,]	103.02566	81.55947	72.87008	84.31895	85.79129	67.91555	86.64210
##	[3,]	61.06450	101.60925	63.01587	55.63066	104.15940	100.96167	103.71745
##	[4,]	86.83997	80.30580	97.23719	128.16849	114.01233	119.61911	66.68248
##	[5,]	113.36772	70.75658	104.44053	114.39102	76.16852	87.43957	60.75353

##	[6,]	74.66475	84.44298	108.83562	74.16391	98.46233	88.72410	86.99593
##	[7,]	70.43730	91.81670	110.92124	84.47117	92.50151	66.02931	76.54315
##	[8,]	89.42943	122.77636	97.36264	74.42096	65.48309	124.28737	72.05345
##	[9,]	111.95504	95.59585	107.67730	77.57174	100.60752	87.63725	91.84966
##	[10,]	74.56106	105.00380	94.78941	116.17296	101.15259	121.37182	85.94564
##	[11,]	73.90229	74.83319	64.05610	100.78645	118.98481	90.90660	95.57694
##	[12,]	65.57640	105.84959	81.86887	101.22117	101.94102	67.29732	110.82210
##	[13,]	102.37957	99.65391	71.58138	77.34332	70.09176	122.85743	118.22252
##	[14,]	71.70043	107.85540	87.91546	72.60551	76.35331	72.89404	100.31181
##	[15,]	100.00218	99.94104	77.01574	37.25683	93.83264	98.47488	110.90692
##	[16,]	78.34441	81.10155	67.85259	51.72886	83.16861	86.21579	80.96644
##	[17,]	83.22486	86.68240	80.40417	110.64953	103.84492	85.17045	115.91968
##	[18,]	75.82134	85.86442	98.65607	102.78192	115.75023	77.54727	71.95242
##	[19,]	92.14537	107.66664	52.92022	73.61496	67.22986	107.37876	77.96353
##	[20,]	80.03666	94.26913	116.46824	82.38268	96.49954	51.98439	103.68722
##	[21,]	70.35637	98.56353	91.57804	96.58590	77.56228	109.36648	105.21110
##	[22,]	94.93460	111.44966	117.40462	119.72847	72.69441	88.25057	71.19585
##	[23,]	104.80647	93.20632	102.06492	50.73322	75.68232	72.27664	85.56593
##	[24,]	119.87399	97.54456	95.37996	80.59556	95.46504	73.24796	70.08815
##	[25,]	58.55383	88.81815	69.42452	72.25287	113.03382	111.03666	93.51936
##	[26,]	60.69655	57.95995	99.89973	95.79595	110.67582	74.27216	63.53743
##	[27,]	92.01529	86.45699	81.26587	79.56386	109.59128	86.45750	131.37205
##	[28,]	78.66887	81.67716	77.25236	104.28073	104.52341	120.19884	113.00394
##	[29,]	52.81405	91.76322	106.38120	125.34741	94.82700	88.19709	55.89758
##	[30,]	129.74377	85.32969	94.85771	65.15093	73.68640	80.32069	77.60372
##	[31,]	104.21107	63.63422	129.54497	103.64994	87.78466	65.63423	66.68196
##	[32,]	88.96816	88.76818	88.07332	82.15166	71.69976	69.51103	68.37162
##	[33,]	85.49218	114.74441	84.71574	101.16420	84.58712	71.51977	100.16831
##	[34,]	113.82844	58.52641	122.79053	101.08086	105.93579	53.17768	82.56201
##	[35,]	80.67852	85.01053	102.85158	69.21294	81.83671	62.85094	81.45424
##	[36,]	61.12510	118.72368	72.22131	71.02253	66.52343	105.09801	69.83629
##	[37,]	103.54424	98.36091	111.75656	109.90339	78.80534	112.88907	93.32099
##	[38,]	91.99558	81.49339	62.87105	97.83921	72.77569	105.07947	93.21160
##	[39,]	116.93434	86.94755	61.48816	63.02550	72.86595	102.29069	92.58414
##	[40,]	83.96574	94.44475	104.74110	106.23522	64.71488	101.82825	81.24037
##	[41,]	67.30580	76.17177	99.95505	112.44793	147.31459	86.33985	89.55816
##	[42,]	110.79805	100.69916	111.30419	70.81527	61.46076	92.46803	100.63661
##	[43,]	101.11081	108.02611	99.35953	61.34304	47.92170	76.61547	84.99936
##	[44,]	70.07702	96.52949	94.19487	71.48338	117.74482	81.43693	94.49838
##	[45,]	109.45133	85.08380	100.33071	64.27247	94.24425	79.49909	69.08742
##	[46,]	107.36188	104.29277	123.68326	95.39751	100.50779	87.46028	94.20248
##	[47,]	80.08951	50.04744	85.15608	83.53834	93.03882	86.50651	111.39397
##	[48,]	117.66931	92.57236	90.71732	113.07676	111.57555	84.23381	93.74653
##	[49,]	108.86251	108.97033	83.51378	102.09672	97.36244	89.89630	74.46423
##	[50,]	67.92731	104.28714	70.23897	51.08190	84.12804	115.69523	111.36986
##	[51,]	92.76234	99.85850	110.50304	121.29894	87.90243	86.17184	57.26369
##	[52,]	124.95347	73.13359	94.23818	113.72708	101.03819	110.28821	56.46954
##	[53,]	80.81350	111.84902	103.30991	95.74627	66.38069	98.25931	58.44654
##	[54,]	132.53451	90.46017	88.77719	62.78931	80.88070	94.83118	60.71132
##	[55,]	99.26927	46.53775	99.84824	101.21305	88.84629	74.44641	47.48812
##	[56,]	103.85343	119.23165	77.08400	84.52492	68.88021	95.14401	75.94110
##	[57,]	85.25967	105.98848	84.40548	93.06287	91.38074	109.00120	136.24754
##	[58,]	70.81634	71.24900	95.78871	104.47654	101.50275	97.92863	102.58016
##	[59,]	57.03117	70.84813	94.37109	79.00191	98.44250	74.80434	108.79443

##	[60,]	90.53052	93.44604	96.05172	107.78382	115.06468	72.54898	62.38866
##	[61,]	96.21320	60.41554	112.98521	100.41120	70.00097	79.93945	85.15072
##	[62,]	74.34977	98.20983	75.47868	99.34630	65.26462	111.00496	94.06334
##	[63,]	79.24860	92.50917	59.11290	67.93485	97.11619	72.81910	79.40909
##	[64,]	52.32825	108.76933	83.82894	95.72949	66.06613	82.30168	84.05814
##	[65,]	NA	94.28188	86.73613	97.00932	92.43340	85.31368	93.52437
##	[66,]	NA	NA	109.27278	110.06966	118.14287	63.87475	79.86926
##	[67,]	NA	NA	NA	62.56452	73.08615	119.34040	100.01681
##	[68,]	NA	NA	NA	NA	66.61836	100.95116	105.34947
##	[69,]	NA	NA	NA	NA	NA	103.64817	91.06209
##	[70,]	NA	NA	NA	NA	NA	NA	85.86106
##	[71,]	NA	NA	NA	NA	NA	NA	NA
##	[72,]	NA	NA	NA	NA	NA	NA	NA
##	[73,]	NA	NA	NA	NA	NA	NA	NA
##	[74,]	NA	NA	NA	NA	NA	NA	NA
##	[75,]	NA	NA	NA	NA	NA	NA	NA
##	[76,]	NA	NA	NA	NA	NA	NA	NA
##	[77,]	NA	NA	NA	NA	NA	NA	NA
##	[78,]	NA	NA	NA	NA	NA	NA	NA
##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
##	[84,]	NA	NA	NA	NA	NA	NA	NA
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,72]	[,73]	[,74]	[,75]	[,76]	[,77]	[,78]
##	[1,]	98.02430	90.26183	98.55119	94.69428	99.20790	55.17528	114.71743
##	[2,]	76.80288	100.96838	52.94138	90.63813	82.13801	85.05109	83.79174
##	[3,]	91.20786	58.86774	101.64944	85.20568	145.56098	86.42350	57.95534
##	[4,]	96.69363	105.38085	117.94660	106.75390	75.00409	85.01257	93.96162
##	[5,]	98.54065	128.18678	73.24358	82.41511	54.05986	109.73191	89.06219
##	[6,]	110.94125	54.40014	91.80616	73.98159	90.58727	82.71276	92.84527
##	[7,]	98.38880	66.31573	71.02198	85.23252	72.12117	67.65154	107.25352
##	[8,]	107.04899	104.09881	90.50845	99.22312	86.74181	109.09711	84.72529
##	[9,]	100.58967	97.61201	107.36670	75.82035	113.29714	97.27403	77.38701
##	[10,]	95.04172	96.28078	123.31653	108.72019	80.26240	73.33902	114.95924
##	[11,]	63.91391	76.43344	109.97055	98.63130	119.66836	83.74727	69.37613
##	[12,]	85.82492	86.80918	93.48123	94.51520	91.22001	44.40068	119.44543

##	[13,]	120.55294	102.69602	80.29596	91.66814	72.68072	91.86525	105.02197
##	[14,]	76.77491	79.14817	95.89127	91.46449	126.45612	110.08006	63.83860
##	[15,]	93.05355	60.76026	79.41776	91.13338	112.06476	85.36888	80.47148
##	[16,]	65.55824	56.03945	74.86828	72.11053	128.12751	110.38462	47.66776
##	[17,]	87.42396	85.35967	89.72462	118.52909	67.36974	59.01112	120.97243
##	[18,]	53.92625	60.98960	93.81387	114.86589	84.57711	62.42731	105.20908
##	[19,]	85.65737	123.39780	75.17440	77.98613	110.32888	107.20756	61.85150
##	[20,]	104.07291	67.60875	81.10093	89.68839	82.08594	69.66580	106.61743
##	[21,]	96.05011	83.76082	113.46084	118.72031	96.38461	121.42217	74.12891
##	[22,]	105.20759	133.22746	85.71623	103.19887	45.22851	83.29546	123.55148
##	[23,]	76.62850	64.39257	62.46633	89.98059	94.66015	103.31625	79.95799
##	[24,]	78.91540	104.35856	57.64545	92.26453	72.50139	63.47723	107.60499
##	[25,]	99.11115	58.37721	105.97121	86.84576	122.91304	82.76868	65.54240
##	[26,]	78.14746	49.28805	94.07806	77.84357	99.93837	93.42468	67.87877
##	[27,]	79.83550	55.35461	95.64022	117.59298	96.13039	72.29574	100.31630
##	[28,]	91.45376	79.48603	130.47721	101.50210	104.22202	96.00137	85.91403
##	[29,]	104.90587	103.57883	101.98847	87.66329	75.91313	84.32787	91.93825
##	[30,]	71.59610	97.89663	70.31131	83.68472	101.62872	124.92274	61.60711
##	[31,]	88.55701	82.51934	78.46148	69.61083	59.13434	91.80318	108.37340
##	[32,]	88.47111	92.87878	41.17053	63.77432	62.59084	70.38955	112.31374
##	[33,]	66.17100	103.47372	90.01304	102.78014	89.59064	67.10636	116.26807
##	[34,]	71.87277	69.40130	77.95205	88.03773	64.20559	76.70254	113.05034
##	[35,]	99.00228	65.15658	56.43620	70.99003	77.49260	80.23964	96.47199
##	[36,]	87.35366	88.17361	74.52477	81.73399	95.75960	86.21939	89.40795
##	[37,]	114.77740	121.84268	119.58852	94.29450	81.37226	115.33822	92.71054
##	[38,]	75.45868	105.91056	88.88043	97.58712	95.25640	120.90110	67.48223
##	[39,]	58.67452	91.91515	78.36017	82.91231	114.48558	117.74337	64.91865
##	[40,]	125.11090	113.42761	87.49417	69.19906	57.16551	94.60076	113.21582
##	[41,]	89.33731	61.83470	119.01975	105.43725	92.55430	52.59174	100.62249
##	[42,]	98.34417	93.83108	94.77482	90.92784	98.82041	137.53429	73.17693
##	[43,]	95.35175	102.05802	65.95712	73.86130	95.75478	121.71787	74.27582
##	[44,]	86.02927	48.47309	102.24538	84.87425	115.52403	61.06413	92.82772
##	[45,]	54.04159	64.71624	77.68872	98.20569	104.04699	102.36438	71.27324
##	[46,]	83.09129	86.76059	108.25731	132.62075	84.03677	91.47592	99.97677
##	[47,]	100.08803	53.89498	93.30595	71.16466	99.13733	111.18295	69.17020
##	[48,]	50.11718	99.91474	94.06112	136.90723	73.06596	62.62210	120.10090
##	[49,]	76.89661	131.88990	86.39356	103.31738	85.72236	70.77113	99.91781
##	[50,]	111.25078	70.53798	108.24536	77.67125	144.06536	114.50228	47.45748
##	[51,]	100.58730	133.85834	89.44521	94.32393	63.40312	84.02995	102.52362
##	[52,]	72.20525	112.02811	87.86696	102.22484	61.20073	87.43131	102.39746
##	[53,]	99.47638	111.30676	76.57396	105.60463	66.63825	101.50390	90.81543
##	[54,]	62.25150	94.83198	61.74152	93.95896	90.53260	105.33474	75.36259
##	[55,]	85.61804	91.42489	65.58888	52.37991	69.43559	98.90933	83.11157
##	[56,]	84.04791	127.88571	68.84859	78.61257	79.93426	73.19127	112.86518
##	[57,]	110.09841	86.81048	104.87925	125.80401	80.07098	80.66281	109.62701
##	[58,]	146.62442	91.85551	109.57612	69.37345	88.79597	95.25022	79.73335
##	[59,]	89.83548	35.56997	111.24279	72.12796	126.94754	107.14509	62.42175
##	[60,]	68.18503	104.87387	97.81183	92.34174	99.10359	68.76282	89.49723
##	[61,]	96.70776	82.89728	82.66265	74.46344	67.15681	122.08301	88.66072
##	[62,]	88.33264	93.21641	85.40338	99.52632	70.07923	93.41931	107.77451
##	[63,]	63.87256	76.07834	59.91157	75.88210	105.65011	60.67015	87.11202
##	[64,]	89.62489	87.51677	69.93850	94.56075	68.69224	75.48481	112.52315
##	[65,]	109.45205	69.19435	104.81643	79.93236	103.58935	84.62240	81.17374
##	[66,]	89.51283	67.54424	96.73611	60.75153	88.04507	98.44858	74.64004

##	[67,]	76.06333	99.90247	68.58529	94.75857	107.75774	88.08009	77.12974
##	[68,]	87.10129	73.52137	66.57552	82.27701	123.07541	107.80861	62.51124
##	[69,]	99.64592	115.68091	54.82453	85.01063	78.33536	120.55068	86.44647
##	[70,]	79.97867	69.80190	80.19072	70.29700	85.47690	78.13635	95.64736
##	[71,]	73.34967	106.05560	72.20258	79.95328	71.49048	88.30062	87.70522
##	[72,]	NA	84.68827	76.50712	112.10181	96.11440	78.46815	91.84632
##	[73,]	NA	NA	104.45482	82.59236	119.44941	89.60765	71.88110
##	[74,]	NA	NA	NA	80.08557	68.76937	88.79946	95.10294
##	[75,]	NA	NA	NA	NA	100.34933	103.70361	68.81564
##	[76,]	NA	NA	NA	NA	NA	73.46934	137.14581
##	[77,]	NA	NA	NA	NA	NA	NA	135.75796
##	[78,]	NA	NA	NA	NA	NA	NA	NA
##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
##	[84,]	NA	NA	NA	NA	NA	NA	NA
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,79]	[,80]	[,81]	[,82]	[,83]	[,84]	[,85]
##	[1,]	61.25120	88.17506	71.55586	98.58090	74.85725	85.24741	81.80184
##	[2,]	94.29078	98.52182	113.00092	100.81982	96.94128	104.09815	78.46119
##	[3,]	57.85006	85.46312	80.96421	80.83483	70.12004	100.42956	71.66126
##	[4,]	117.77523	88.39070	78.67526	92.17192	82.09726	95.25288	83.77174
##	[5,]	135.51721	115.09035	105.08198	105.74285	104.51442	103.64997	88.85663
##	[6,]	91.98606	82.77080	87.33260	74.79097	99.02876	83.92946	90.25774
##	[7,]	94.31562	75.26375	78.21065	63.34064	96.93397	71.07690	107.00639
##	[8,]	116.52033	118.21714	70.27217	83.51531	59.65130	72.63681	103.24567
##	[9,]	84.17057	119.20993	83.43806	107.98149	106.40040	129.44012	74.85532
##	[10,]	90.49523	72.37249	64.92770	86.02574	69.89739	68.61722	97.25135
##	[11,]	69.85972	61.70285	82.83434	83.37257	85.36963	102.00478	80.08301
##	[12,]	39.21415	64.04865	79.53230	88.18613	86.41085	81.91420	89.11542
##	[13,]	90.67424	117.67631	139.74246	123.68972	75.42769	83.85925	62.34474
##	[14,]	63.85616	88.83629	61.22382	60.06879	77.60722	80.91762	118.15169
##	[15,]	80.78528	100.95906	108.27864	94.77529	86.25212	94.65481	72.20774
##	[16,]	86.86474	71.85511	83.55913	72.51451	87.77351	90.03504	92.59286
##	[17,]	76.07163	72.34552	109.18898	87.45764	84.82072	70.99711	89.46143
##	[18,]	96.44474	33.63682	55.15433	50.36892	90.43092	62.15398	120.84277
##	[19,]	88.41606	113.55682	90.66904	116.33473	67.56625	110.35156	67.50278

##	[20,]	73.94780	90.08294	88.28565	68.64708	104.41565	82.41565	104.31546
##	[21,]	92.53062	95.96396	79.04113	54.65287	59.85055	57.39044	122.60591
##	[22,]	110.93195	107.70921	73.22317	90.53300	83.02442	73.69262	112.03680
##	[23,]	104.51846	93.55447	88.13660	68.07284	98.61468	76.88059	113.23639
##	[24,]	106.46517	99.76700	93.24519	108.19286	104.14665	105.59797	79.48478
##	[25,]	75.95230	80.92674	86.06563	81.10696	72.92986	98.26709	67.68646
##	[26,]	100.36156	53.21798	69.75101	50.01103	102.75296	86.99840	104.84281
##	[27,]	69.83580	74.36038	109.08244	78.40681	89.38446	75.45516	90.86101
##	[28,]	76.33043	75.43039	93.99960	89.87387	78.07717	83.77821	83.40574
##	[29,]	100.32870	83.37459	54.56789	69.49368	79.76143	84.30719	104.29585
##	[30,]	113.74214	115.32514	94.54526	95.16461	104.25234	107.78204	96.31931
##	[31,]	116.91826	75.10326	88.75138	83.01226	129.54847	84.47319	108.78757
##	[32,]	97.54432	76.43953	97.84042	99.87777	102.51316	82.27000	86.42635
##	[33,]	59.49171	68.78045	67.11191	87.71530	83.14200	73.44781	108.21929
##	[34,]	106.93210	65.46414	96.71313	79.71022	137.03975	86.36681	107.09788
##	[35,]	94.28627	84.08308	95.74643	74.97931	104.25401	80.29635	97.09675
##	[36,]	88.18555	76.24483	63.76193	79.79841	59.48542	64.32965	98.38458
##	[37,]	102.31547	123.08875	86.14338	101.52698	85.52832	93.55901	95.53576
##	[38,]	96.41004	92.52954	101.96099	93.56756	74.84316	85.96499	91.64963
##	[39,]	93.44089	90.14147	101.58412	107.21105	89.42897	97.59985	82.47166
##	[40,]	100.95686	101.23314	95.60435	104.67773	89.47331	78.95608	89.34886
##	[41,]	80.56767	59.29776	74.98743	71.05455	95.44843	93.05727	85.91776
##	[42,]	100.51432	124.62865	88.14566	80.95224	90.36513	83.65283	114.79377
##	[43,]	95.52615	121.27473	85.45026	87.22516	89.61500	88.43380	107.05103
##	[44,]	64.41497	63.76760	68.11094	73.92248	93.91688	90.75137	87.27607
##	[45,]	114.76674	79.70393	71.32016	65.15960	100.23177	85.46170	113.91240
##	[46,]	104.60303	100.35317	67.88856	63.41599	87.91544	74.09374	126.06188
##	[47,]	83.89890	80.62253	124.09181	82.14576	105.94556	91.92090	81.81828
##	[48,]	95.75173	70.63222	84.29809	90.78747	93.30001	80.16784	102.79307
##	[49,]	93.08983	103.37367	77.50545	114.11890	84.81139	110.97760	77.95667
##	[50,]	65.63717	109.88010	90.22219	87.08688	66.13517	99.57257	73.44146
##	[51,]	112.17696	108.49692	69.62644	95.33812	88.49067	98.33130	96.43335
##	[52,]	142.32156	85.73725	93.91791	109.19016	99.65258	96.38518	83.73720
##	[53,]	124.34935	108.48554	66.43737	69.05907	65.54053	66.10240	118.64048
##	[54,]	132.70135	102.16471	89.66615	96.65130	96.17013	97.64338	92.87823
##	[55,]	125.14342	78.79297	101.34812	98.85019	124.83613	107.55048	81.81340
##	[56,]	86.90417	95.24240	83.22998	125.13650	83.04132	93.39315	77.50589
##	[57,]	74.84072	102.01551	110.52051	87.46805	67.10903	66.90875	90.32919
##	[58,]	81.79831	114.33046	115.15497	102.74481	95.41904	116.17715	58.57984
##	[59,]	60.93162	64.60755	80.93420	54.68038	98.78846	84.49138	103.82987
##	[60,]	87.44243	79.34840	54.24494	90.62416	97.94672	113.83640	89.29028
##	[61,]	114.09932	87.32129	104.51706	77.52639	111.26729	74.79489	112.44823
##	[62,]	93.27173	70.80965	92.01972	83.20580	66.38090	44.38317	105.92006
##	[63,]	71.68921	62.31936	86.87688	95.58401	90.91768	98.39791	72.41985
##	[64,]	82.36517	64.79088	73.86432	65.09121	67.39690	39.81035	117.52029
##	[65,]	61.22615	71.05413	68.49837	58.27706	71.73407	74.53240	98.90565
##	[66,]	101.04416	73.38457	107.98746	87.89300	143.33019	120.28623	79.54626
##	[67,]	76.79062	91.33200	108.66888	114.48174	54.09403	88.31696	60.98775
##	[68,]	80.46480	108.96975	103.66822	95.00483	73.97215	90.31191	79.11036
##	[69,]	99.53545	117.72883	101.35976	96.70562	62.30435	63.59636	101.66567
##	[70,]	77.54192	67.65050	83.08884	69.93428	134.61970	98.69748	107.21369
##	[71,]	134.58582	78.78022	64.59308	86.95989	98.19820	95.86689	97.43768
##	[72,]	99.10683	54.49761	71.03962	81.27911	92.45909	81.03987	106.68724
##	[73,]	70.05099	61.66507	85.19614	53.51777	106.79880	87.71960	99.51186

##	[74,]	108.34231	95.01755	109.67547	104.43377	87.41788	81.38084	86.35112
##	[75,]	82.33055	94.02882	105.32021	105.00597	121.12928	124.49908	65.08919
##	[76,]	121.95603	89.84644	99.01072	98.25093	96.36618	70.06214	101.53555
##	[77,]	73.72788	59.22110	80.33786	97.45933	93.89844	87.64223	80.15842
##	[78,]	90.08313	104.97497	92.68965	80.96012	88.38180	113.54879	80.87421
##	[79,]	NA	79.23865	89.92937	87.58302	85.13024	93.28119	79.61539
##	[80,]	NA	NA	65.71920	65.59051	102.73816	75.47965	106.16786
##	[81,]	NA	NA	NA	52.65297	79.16362	72.72145	127.47088
##	[82,]	NA	NA	NA	NA	86.40192	58.37785	144.06069
##	[83,]	NA	NA	NA	NA	NA	56.21415	95.67606
##	[84,]	NA	NA	NA	NA	NA	NA	135.73381
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,86]	[,87]	[,88]	[,89]	[,90]	[,91]	[,92]
##	[1,]	93.05431	89.59873	64.59936	111.88497	93.30865	106.76198	107.65050
##	[2,]	104.39312	99.95862	60.28851	37.42203	90.57197	44.36235	119.06194
##	[3,]	110.98029	102.46862	58.32334	68.17250	85.43357	118.32162	115.94959
##	[4,]	93.57290	79.48508	110.58945	103.42737	58.84683	97.60439	80.00031
##	[5,]	79.85181	81.85531	105.23921	89.03587	75.45691	64.59222	75.39919
##	[6,]	116.62255	65.90495	82.72461	117.24133	91.78822	100.57108	83.71391
##	[7,]	108.09262	79.44513	67.10665	93.74503	93.45042	73.88536	98.79957
##	[8,]	76.25187	83.64075	91.81941	115.59866	59.17702	104.28692	57.22402
##	[9,]	76.81817	61.26631	66.87306	106.23812	94.07608	114.70115	105.10227
##	[10,]	81.97867	91.78746	120.17972	128.71464	76.25617	115.15289	69.94684
##	[11,]	95.78705	109.16033	91.11677	55.03117	86.45076	103.92419	114.33321
##	[12,]	89.05196	116.04013	71.98726	77.44023	118.38594	86.98373	128.36071
##	[13,]	115.55938	93.23340	102.35591	106.18870	95.74041	70.80661	67.51617
##	[14,]	50.68935	113.98604	77.44640	64.84689	104.73707	112.19866	98.10204
##	[15,]	127.42152	70.73188	55.42810	88.26221	91.44266	85.52040	98.68330
##	[16,]	101.20303	98.23021	84.26443	70.55917	76.40279	108.89048	89.60725
##	[17,]	109.21464	102.71985	91.47502	71.55639	110.05072	52.43582	101.33249
##	[18,]	96.75984	81.64598	88.77720	87.82587	77.64188	87.74002	95.66799
##	[19,]	79.95604	119.91501	79.71747	66.69446	65.05397	100.60096	98.80727
##	[20,]	96.96929	78.14899	52.78228	83.27506	122.68344	69.32923	113.41226
##	[21,]	63.32884	109.13604	116.19136	80.32037	93.73130	98.31638	57.62037
##	[22,]	58.03681	90.44795	95.77262	108.44323	85.59059	73.99584	77.79882
##	[23,]	94.14925	67.60571	68.47383	87.41891	90.22026	76.92735	81.94278
##	[24,]	106.77202	65.31752	44.75794	85.01035	76.72787	57.35196	117.75911
##	[25,]	126.23648	93.70963	73.45566	79.29124	75.17245	112.74617	104.92579
##	[26,]	103.68198	84.65033	94.24539	79.51105	78.17915	103.05450	92.91406

##	[27,]	116.41975	83.69992	79.57393	74.92943	114.31421	69.20093	99.37482
##	[28,]	90.74922	99.03312	129.98298	102.08458	94.11542	116.08274	71.21138
##	[29,]	73.35854	105.03809	94.97268	89.05009	73.61621	101.37771	93.67498
##	[30,]	74.03175	70.72194	78.21003	79.76739	80.51330	84.62560	84.12714
##	[31,]	87.40262	58.57518	112.12659	126.92092	94.61342	84.12563	68.70528
##	[32,]	109.65382	92.99809	82.83022	98.21192	85.63722	68.33405	93.72430
##	[33,]	58.40066	115.26436	87.92056	84.98156	107.32624	91.99432	105.62132
##	[34,]	100.26010	50.73993	94.23260	104.34058	104.98759	65.31923	88.65272
##	[35,]	114.48764	79.33812	66.47051	89.59801	97.60091	69.77738	96.36205
##	[36,]	90.00692	114.19476	90.73226	99.89474	64.26037	110.03788	78.80454
##	[37,]	51.45676	82.20672	120.50897	123.85574	91.72593	109.00435	58.41084
##	[38,]	74.52678	120.82540	121.44884	64.25060	82.33667	87.88696	71.63390
##	[39,]	84.64160	93.81293	105.27219	86.73078	78.11651	102.25836	74.04071
##	[40,]	80.68672	94.42440	123.97438	136.01095	91.24443	95.67254	57.34758
##	[41,]	116.04231	76.06526	77.35920	86.66708	89.83700	93.87230	116.95410
##	[42,]	51.51064	76.77422	99.52218	105.21724	101.29682	100.80976	56.67449
##	[43,]	59.65577	92.82634	77.67865	88.92300	95.03693	91.10338	79.17394
##	[44,]	111.04878	75.84288	61.89778	100.07776	94.05770	113.62884	114.56480
##	[45,]	90.25164	59.36831	75.12991	86.88145	70.53326	90.99659	84.77171
##	[46,]	66.54534	60.50424	79.16289	96.74580	93.49814	82.18278	82.63652
##	[47,]	113.82587	90.56231	113.52783	83.51166	111.11378	89.89428	75.85609
##	[48,]	84.47925	79.18313	88.81626	81.75132	89.04088	63.39755	100.44310
##	[49,]	77.06581	91.55537	63.80849	77.10170	72.87457	81.28433	119.86468
##	[50,]	94.96725	102.12562	79.41607	85.14755	90.02953	130.04728	88.56863
##	[51,]	65.66981	89.12067	82.72395	91.94578	73.46405	81.81791	97.47479
##	[52,]	98.68561	62.34340	114.70975	111.55854	51.07754	78.50891	70.05650
##	[53,]	70.54138	96.10817	86.13982	87.30086	63.39195	77.77844	72.14354
##	[54,]	95.59353	59.63351	76.03071	90.96524	53.96117	78.58315	80.01670
##	[55,]	105.55266	74.99358	107.29205	98.35278	72.55962	82.41667	81.89625
##	[56,]	79.92736	100.01061	84.82400	109.51631	76.37311	93.46809	94.29117
##	[57,]	99.01955	97.52301	92.24910	86.67316	112.19484	69.64096	82.32373
##	[58,]	107.30206	92.28428	91.55587	88.78276	104.17840	93.60401	97.65791
##	[59,]	86.95367	97.85151	101.52963	85.14455	116.01165	124.05115	87.63342
##	[60,]	74.71701	86.90746	63.43634	76.21821	75.00872	100.40536	130.84487
##	[61,]	79.26221	81.82789	136.68677	108.90024	102.03129	83.51870	45.08428
##	[62,]	85.80913	117.44172	138.54180	105.60104	86.13141	88.98999	48.87197
##	[63,]	119.68618	104.08320	55.05019	63.20462	79.73840	84.80888	130.47950
##	[64,]	84.75460	127.08063	99.15462	86.18787	92.25727	79.42235	80.66420
##	[65,]	88.59639	125.62530	90.26489	77.06933	100.04750	112.14596	99.50557
##	[66,]	107.59341	66.35841	105.23536	87.64866	101.00904	89.21294	96.17611
##	[67,]	111.87748	128.09141	83.48927	61.71264	69.93640	85.12494	95.93643
##	[68,]	105.52006	92.98311	63.37959	78.29538	85.49837	93.78655	88.56451
##	[69,]	70.74474	120.37829	103.07812	89.51958	85.11353	78.79457	54.83930
##	[70,]	83.60108	80.96452	73.44622	75.86909	123.08204	78.38040	119.28362
##	[71,]	87.88916	79.32890	92.00069	95.56813	42.93943	89.81634	87.87020
##	[72,]	86.34045	86.50834	86.08605	73.83748	70.17059	82.65453	98.29661
##	[73,]	109.20415	76.01147	80.63279	83.13698	111.02893	105.14914	100.12175
##	[74,]	106.23452	101.60333	75.80156	72.42748	74.89689	49.30989	89.42545
##	[75,]	100.67109	89.67054	91.50204	96.44598	100.46069	107.99673	98.43790
##	[76,]	89.79467	84.23680	107.91179	107.56423	85.17809	47.72528	72.83257
##	[77,]	112.34863	86.61134	67.50018	92.37417	91.41547	74.87800	127.25914
##	[78,]	90.25747	94.84030	84.60297	65.00383	81.22426	116.12132	89.69857
##	[79,]	89.81627	115.18993	74.52107	77.14088	131.17232	109.09297	120.02462
##	[80,]	97.69721	92.63257	98.09357	87.54324	90.96395	95.87985	104.17672

##	[81,]	57.46334	91.21862	85.65171	96.46871	75.08341	118.46376	94.72304
##	[82,]	70.69649	91.99105	90.95549	79.60659	99.82183	99.61191	84.31255
##	[83,]	82.30278	129.24120	89.74692	79.19027	67.80775	92.87426	74.20520
##	[84,]	73.18227	111.45402	107.33791	94.28398	89.78422	77.30445	58.88903
##	[85,]	131.29235	88.90266	76.92088	86.93480	83.24020	91.48283	112.31477
##	[86,]	NA	101.07719	108.48506	98.20361	99.23723	107.54317	71.21984
##	[87,]	NA	NA	83.22262	118.47895	87.66543	89.08809	89.66330
##	[88,]	NA	NA	NA	62.89538	90.12753	79.01949	139.14218
##	[89,]	NA	NA	NA	NA	91.36217	70.74691	119.45501
##	[90,]	NA	NA	NA	NA	NA	91.46575	79.41148
##	[91,]	NA	NA	NA	NA	NA	NA	93.12437
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,93]	[,94]	[,95]	[,96]	[,97]	[,98]	[,99]
##	[1,]	114.72325	76.51334	79.18578	71.13806	57.91276	103.06602	80.83394
##	[2,]	54.69772	104.76424	133.16204	104.11534	103.63213	77.18252	109.34096
##	[3,]	110.96244	114.59200	108.15635	109.65451	70.78593	88.98882	83.82391
##	[4,]	90.27923	120.37082	60.86233	96.47407	102.96804	99.90548	88.81822
##	[5,]	57.73777	85.76202	86.60747	92.27398	107.80786	88.00536	120.47112
##	[6,]	103.53298	71.35030	64.62454	109.80988	56.47060	110.87108	97.18248
##	[7,]	89.75654	71.56403	74.39922	115.25044	63.34564	98.92443	107.69852
##	[8,]	92.58843	85.52287	47.82793	96.55892	58.98521	82.87355	90.59921
##	[9,]	88.54393	80.03400	87.61837	57.57981	70.23023	128.00369	101.06431
##	[10,]	119.14576	93.60551	48.29616	79.11818	90.51073	92.47785	66.80378
##	[11,]	95.29269	134.08159	116.11764	93.21378	124.45042	82.40115	77.12887
##	[12,]	116.14599	83.07367	112.63135	80.29370	87.59315	90.30252	82.23204
##	[13,]	98.92718	83.66740	94.02747	102.24681	70.89632	79.98966	73.65950
##	[14,]	102.96003	89.56847	105.69211	84.57934	84.31537	76.16525	83.31056
##	[15,]	85.53041	95.66207	95.99117	102.43891	57.07279	99.02703	78.59050
##	[16,]	81.89534	95.81781	101.48741	103.97646	101.27348	70.47644	96.24801
##	[17,]	96.02520	108.77811	106.00355	106.08512	96.31281	83.11315	64.39442
##	[18,]	83.50296	105.49560	65.57423	94.70165	105.19329	90.75665	77.96169
##	[19,]	81.29191	100.54676	115.77081	84.79089	101.66017	62.97967	108.30837
##	[20,]	95.35271	71.98333	94.77388	103.38081	51.73675	111.37964	96.62867
##	[21,]	109.97692	112.67463	79.61785	112.52155	84.28307	68.52394	56.64668
##	[22,]	87.38009	70.63578	63.65308	79.20516	79.39104	90.98832	101.55359
##	[23,]	64.96231	76.60296	81.19903	97.35974	71.51931	90.16707	93.31768
##	[24,]	49.24540	85.28739	91.44856	79.24939	83.48089	105.17651	114.94325
##	[25,]	109.59229	120.75011	93.23661	123.27664	75.02460	93.28642	86.24824
##	[26,]	88.15221	100.98561	80.02630	119.13963	103.59905	92.86035	105.71107
##	[27,]	94.32482	111.72637	103.43183	103.03374	82.61380	93.80694	48.56176
##	[28,]	120.08023	110.57263	84.77204	88.36245	104.39499	86.35588	51.24266
##	[29,]	104.02627	93.37337	71.89549	106.92527	89.68114	89.35570	115.16855
##	[30,]	47.80702	87.09919	95.86054	74.13648	96.87326	89.99150	103.46130
##	[31,]	75.17299	46.79352	59.82779	77.89286	98.18313	107.32629	109.63274
##	[32,]	75.89508	50.53663	90.36728	93.80547	91.80976	80.12089	123.25488
##	[33,]	100.90075	77.28864	100.25274	54.49681	103.26497	78.47462	76.55599

##	[34,]	63.93417	69.99138	76.62159	78.73275	102.66921	113.49658	94.23864
##	[35,]	81.79898	63.04530	88.15039	115.39650	65.74613	94.28004	114.22484
##	[36,]	103.76310	76.40965	73.00248	99.26013	81.75070	61.71452	98.20902
##	[37,]	103.77302	79.96790	65.66460	67.47822	81.87162	100.65626	81.25977
##	[38,]	83.65555	113.01964	110.37802	95.13894	127.59919	52.39730	78.25620
##	[39,]	71.04330	92.05807	102.62028	66.92315	119.78722	68.41906	79.82022
##	[40,]	109.06919	46.01021	65.24271	86.42197	79.73492	87.57973	103.54797
##	[41,]	103.21548	119.37750	80.49143	105.78110	87.25329	117.35994	81.66517
##	[42,]	87.77220	71.23311	76.37142	75.80660	70.12248	91.88387	79.91128
##	[43,]	79.38862	58.30746	93.14541	81.43754	71.01013	80.42371	108.34208
##	[44,]	108.24276	87.15867	80.54214	89.75035	67.82072	113.21289	86.16318
##	[45,]	54.47547	96.90414	71.54779	86.02751	94.13579	94.50899	90.76651
##	[46,]	80.56471	102.65586	60.56355	80.45749	70.34174	109.96532	65.93974
##	[47,]	99.84452	91.12247	106.68166	118.55152	96.85047	87.08492	82.30698
##	[48,]	66.61469	114.46202	86.96115	64.19330	117.24629	93.35438	62.09453
##	[49,]	70.13486	104.12670	98.73849	63.09896	100.00487	94.97069	102.48983
##	[50,]	120.54355	100.75229	100.21767	107.06213	59.67244	86.33280	80.51805
##	[51,]	79.04258	87.93914	76.43894	82.36686	89.33498	97.69186	118.67041
##	[52,]	54.26259	103.09312	60.16000	75.31937	123.80693	94.68243	93.37566
##	[53,]	79.55187	92.28904	63.19179	111.54564	74.15343	73.94412	105.13384
##	[54,]	32.99229	94.85934	75.64157	80.07482	98.03866	88.12571	101.98043
##	[55,]	61.04253	71.24122	84.71378	95.10504	119.82847	92.63968	135.87888
##	[56,]	84.97374	60.65770	87.47903	52.78030	94.25411	80.67082	105.33368
##	[57,]	112.14634	108.09300	93.45769	108.44088	65.00735	86.68014	45.49149
##	[58,]	115.04643	94.74374	103.90163	119.10386	70.18958	108.22358	104.30937
##	[59,]	120.76955	85.31377	97.87828	102.80437	87.86985	92.18812	78.89234
##	[60,]	77.14975	102.77832	93.07023	65.60871	106.34511	105.92669	111.27268
##	[61,]	85.08471	62.09102	75.33799	96.57571	101.81197	84.04521	93.83016
##	[62,]	107.44253	81.12732	74.66468	98.62668	103.15666	52.54898	67.79859
##	[63,]	78.29830	92.94325	117.17506	93.94808	101.89251	78.67217	108.50356
##	[64,]	107.32511	72.98035	83.79805	110.85390	87.00383	55.78066	90.10982
##	[65,]	136.19385	91.43106	95.60391	124.08973	75.86037	79.51786	94.25483
##	[66,]	77.57788	88.95873	98.98672	97.24294	116.83356	115.01901	111.61951
##	[67,]	87.38650	114.15225	122.00258	100.67698	103.39768	45.99338	79.55097
##	[68,]	83.86163	88.73733	105.78625	99.57255	66.20131	74.24563	85.00394
##	[69,]	87.81975	65.73186	93.33374	97.46128	80.56589	43.02853	92.91365
##	[70,]	81.83894	66.23688	106.37523	84.38307	96.75836	110.33442	113.86081
##	[71,]	57.80674	88.18889	64.79604	88.57682	113.83404	88.04691	131.78778
##	[72,]	55.17164	108.55965	89.53259	66.93977	132.49617	76.44242	78.86206
##	[73,]	103.85932	94.75428	92.90291	109.01573	79.50866	107.17347	79.03191
##	[74,]	52.93424	74.67822	105.80889	100.64139	98.03558	58.01094	114.74473
##	[75,]	96.48741	54.85332	107.98042	93.61602	90.56196	101.44912	136.78812
##	[76,]	72.98789	72.03524	69.25586	90.33783	97.73744	85.78152	100.08769
##	[77,]	92.26543	93.21015	89.06710	79.37028	92.41420	104.74067	88.38043
##	[78,]	88.00300	108.17036	108.99775	109.85260	90.71659	83.85845	101.26730
##	[79,]	134.60868	85.63431	123.28827	86.44437	74.35444	94.10104	73.27715
##	[80,]	92.92722	93.50691	84.17185	84.65601	121.08660	90.57944	84.51368
##	[81,]	99.20477	93.63968	58.60612	76.81583	90.61122	94.34386	89.36446
##	[82,]	102.63614	96.05616	72.80585	110.58599	81.10240	89.21501	79.23931
##	[83,]	106.16496	112.47093	85.98364	106.78426	75.24284	46.10999	64.37155
##	[84,]	100.81717	86.11645	67.11017	101.52484	82.42053	55.80999	59.45205
##	[85,]	89.41760	98.25128	118.50019	91.79439	91.40726	99.29549	105.03763
##	[86,]	100.36037	76.00702	75.10139	64.67058	91.54049	83.67907	81.73306
##	[87,]	66.08900	86.30730	62.10974	72.02774	84.89873	141.56403	94.28162

```

## [88,] 78.47884 100.70278 110.58444 96.11951 65.68809 103.47792 103.35254
## [89,] 77.83487 122.21856 137.54834 116.96807 100.97949 66.55189 94.41217
## [90,] 60.42685 113.40859 67.39186 92.93465 107.81990 71.40682 102.66367
## [91,] 55.93587 92.80910 102.33904 103.23564 95.44492 76.65229 92.81394
## [92,] 91.42042 77.74490 56.81968 92.90617 88.93772 68.44050 72.68934
## [93,]      NA 99.30137 89.05612 81.24815 117.34249 86.05818 108.05375
## [94,]      NA      NA 82.43764 73.41636 77.49689 97.31855 111.52483
## [95,]      NA      NA      NA 79.05570 82.47076 102.65801 82.29692
## [96,]      NA      NA      NA      NA 107.57017 107.69406 82.07134
## [97,]      NA      NA      NA      NA      NA 103.76896 83.90678
## [98,]      NA      NA      NA      NA      NA      NA 81.26699
## [99,]      NA      NA      NA      NA      NA      NA      NA
## [100,]     NA      NA      NA      NA      NA      NA      NA
##      [,100]
## [1,] 87.68579
## [2,] 102.57720
## [3,] 92.36177
## [4,] 85.87497
## [5,] 97.85777
## [6,] 71.14450
## [7,] 65.82195
## [8,] 76.65946
## [9,] 134.67276
## [10,] 67.61763
## [11,] 95.35892
## [12,] 89.92481
## [13,] 86.09356
## [14,] 102.43832
## [15,] 93.96961
## [16,] 69.42447
## [17,] 86.47953
## [18,] 58.24415
## [19,] 96.38569
## [20,] 100.56970
## [21,] 89.26820
## [22,] 89.56297
## [23,] 83.47650
## [24,] 97.34898
## [25,] 80.75054
## [26,] 65.25431
## [27,] 95.13426
## [28,] 86.86858
## [29,] 77.00516
## [30,] 111.83209
## [31,] 71.98098
## [32,] 53.36680
## [33,] 89.28645
## [34,] 84.87033
## [35,] 69.69401
## [36,] 39.57105
## [37,] 112.31895
## [38,] 89.20771
## [39,] 87.70192
## [40,] 69.64432

```

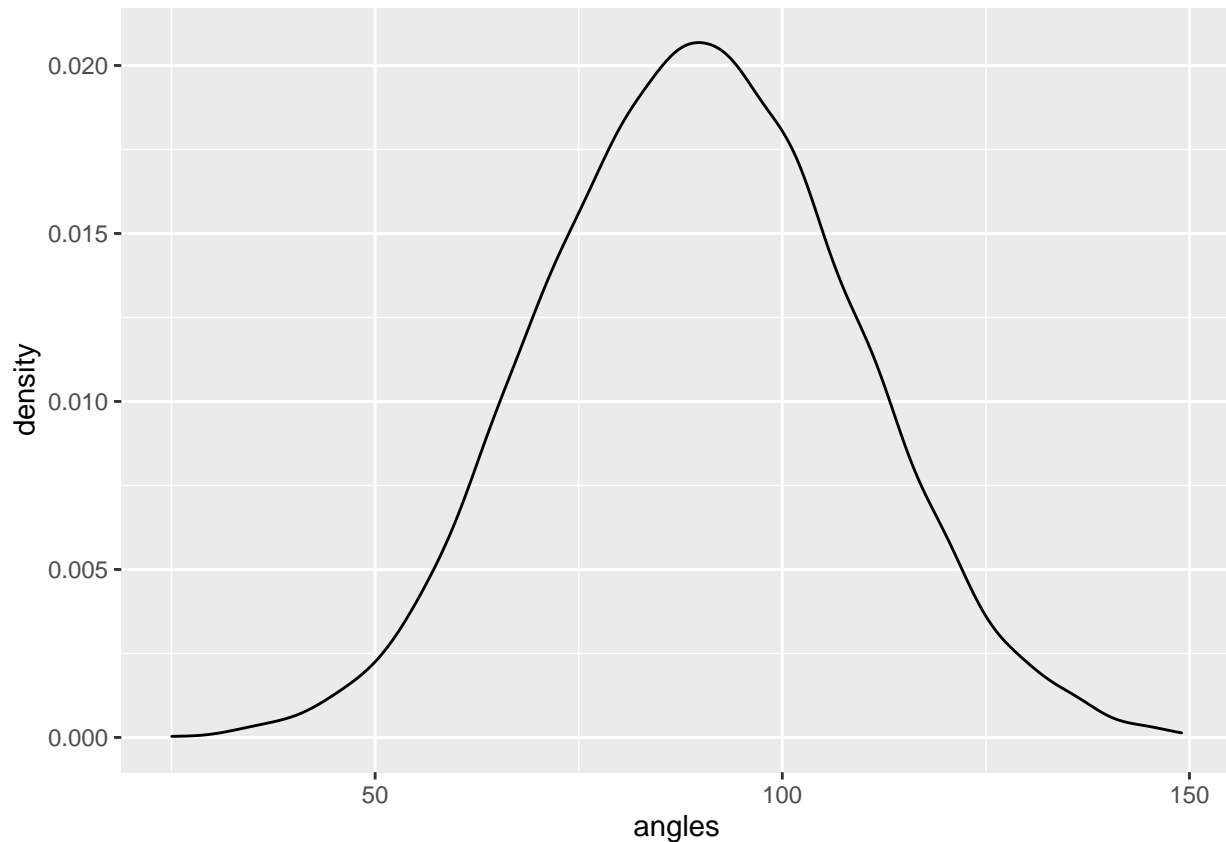
```
## [41,] 88.76130
## [42,] 111.58281
## [43,] 99.78413
## [44,] 81.15455
## [45,] 83.24572
## [46,] 111.66555
## [47,] 85.45153
## [48,] 97.98132
## [49,] 112.37935
## [50,] 99.86659
## [51,] 100.65746
## [52,] 77.69397
## [53,] 75.16968
## [54,] 86.34503
## [55,] 69.15634
## [56,] 78.56573
## [57,] 99.75771
## [58,] 111.66444
## [59,] 86.18471
## [60,] 105.94593
## [61,] 75.35778
## [62,] 42.64110
## [63,] 70.14455
## [64,] 40.35763
## [65,] 71.99914
## [66,] 98.94226
## [67,] 73.57645
## [68,] 88.64427
## [69,] 71.31118
## [70,] 100.89285
## [71,] 64.55072
## [72,] 75.69913
## [73,] 88.05128
## [74,] 64.17317
## [75,] 91.58818
## [76,] 70.46621
## [77,] 79.76707
## [78,] 104.16054
## [79,] 105.48334
## [80,] 60.26447
## [81,] 78.40926
## [82,] 79.32055
## [83,] 70.34524
## [84,] 52.60514
## [85,] 103.26930
## [86,] 101.58812
## [87,] 108.77435
## [88,] 108.11050
## [89,] 97.98374
## [90,] 62.41196
## [91,] 84.62179
## [92,] 69.14638
## [93,] 87.50429
## [94,] 82.12017
```

```
## [95,] 70.06870
## [96,] 105.59322
## [97,] 103.54268
## [98,] 54.89974
## [99,] 93.62767
## [100,] NA
```

Plot the density of these angles.

```
pacman :: p_load(ggplot2)
ggplot(data.frame(angles=c(all_angles(X)))) + aes(x=angles) + geom_density()
```

```
## Warning: Removed 5050 rows containing non-finite values (stat_density).
```



Write an Rcpp function `all_angles_cpp` that does the same thing. Use an IDE if you want, but write it below in-line.

```
cppFunction('
NumericMatrix all_angles_cpp(NumericMatrix X) {
  int n = X.nrow();
  int p = X.ncol();
  NumericMatrix A(n, n);
  std::fill(A.begin(), A.end(), NA_REAL);
  for (int i_1 = 0; i_1 < (n - 1); i_1++){
    //Rcout << "computing for row #: " << (i_1 + 1) << "\\n";
    for (int i_2 = i_1 + 1; i_2 < n; i_2++){
      double sum_sqd_u = 0;
      double sum_sqd_v = 0;
      double sum_u_v = 0;
```

```

        for (int j = 0; j < p; j++){

            //sqd_diff += pow(X(i_1, j) - X(i_2, j), 2); //by default the cmath library in std is loaded

            sum_sqd_u += pow(X(i_1, j), 2);
            sum_sqd_v += pow(X(i_2, j), 2);
            sum_u_v += X(i_1, j) * X(i_2, j);

        }
        A(i_1, i_2) = acos(sum_u_v / sqrt(sum_sqd_u * sum_sqd_v)) * (180 / M_PI); //by default the cmath library in std is loaded
    }
}
return A;
}
')
all_angles_cpp(X)

```

##		[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]
##	[1,]	NA	113.5936	67.76059	100.74627	129.76343	68.97517	73.89792	74.11845
##	[2,]	NA	NA	94.08441	105.50761	66.31817	117.95894	88.98072	117.61489
##	[3,]	NA	NA	NA	97.75807	134.72489	73.97497	85.74918	86.92631
##	[4,]	NA	NA	NA	NA	69.89119	92.79142	101.51382	75.51731
##	[5,]	NA	NA	NA	NA	NA	112.02531	100.30570	85.51378
##	[6,]	NA	NA	NA	NA	NA	NA	42.55337	68.57425
##	[7,]	NA	NA	NA	NA	NA	NA	NA	78.82892
##	[8,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[9,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[10,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[11,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[12,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[13,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[14,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[15,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[16,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[17,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[18,]	NA	NA	NA	NA	NA	NA	NA	NA
##	[19,]	NA	NA	NA	NA	NA	NA	NA	NA
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##	[21,]	NA	NA	NA	NA	NA	NA	NA	NA
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##	[34,]	NA	NA	NA	NA	NA	NA	NA	NA

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##	[100,]	NA	NA	NA	NA	NA	NA	NA	NA
##		[,9]	[,10]	[,11]	[,12]	[,13]	[,14]	[,15]	
##	[1,]	67.70004	67.20172	105.27831	57.97640	84.29694	87.66388	67.81588	
##	[2,]	98.01436	142.68772	79.13102	83.15495	94.37954	86.91218	88.36663	
##	[3,]	81.65677	92.39978	64.63802	79.29516	97.46846	69.81839	56.21255	
##	[4,]	96.46634	52.44792	76.36525	108.94261	89.32406	120.36632	112.42233	
##	[5,]	89.68551	105.75903	104.51559	120.15995	87.68251	108.29151	120.72435	
##	[6,]	89.77470	78.63009	118.03849	98.66885	79.16414	108.16267	55.41914	
##	[7,]	103.26963	93.90416	118.21512	80.65325	94.57351	97.99593	70.15756	
##	[8,]	76.76573	70.26019	124.69612	120.92194	82.32315	90.24182	80.57205	
##	[9,]	NA	99.55652	103.71724	97.52796	99.79872	78.74420	77.67848	
##	[10,]	NA	NA	87.58805	84.25653	83.05306	106.90844	105.65651	
##	[11,]	NA	NA	NA	74.85914	112.32540	75.74094	102.97249	
##	[12,]	NA	NA	NA	NA	97.94360	76.43763	96.28383	
##	[13,]	NA	NA	NA	NA	NA	126.59239	68.77606	
##	[14,]	NA	NA	NA	NA	NA	NA	96.29545	
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##	[70,]	NA	NA	NA	NA	NA	NA	NA
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##	[75,]	NA	NA	NA	NA	NA	NA	NA
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##	[83,]	NA	NA	NA	NA	NA	NA	NA
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##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##	[,16]	[,17]	[,18]	[,19]	[,20]	[,21]	[,22]	
##	[1,]	100.39325	95.95955	86.93167	92.23020	71.58400	112.87983	82.69240
##	[2,]	89.22895	70.56425	98.80037	71.08432	76.21994	103.08460	91.38770
##	[3,]	56.30093	98.27073	84.31423	75.39793	86.28564	88.93988	130.07458
##	[4,]	111.83200	84.51077	79.39582	92.95934	118.15334	74.58521	76.08685
##	[5,]	111.89633	95.56829	111.63490	77.38544	102.19326	90.06025	57.87276
##	[6,]	77.74826	99.71337	73.63987	124.87926	63.82769	100.74180	99.63021
##	[7,]	85.71012	84.14674	61.62010	122.05522	40.06349	103.17599	80.01537
##	[8,]	90.80773	123.36677	94.87205	82.94483	94.61783	75.47775	65.88725
##	[9,]	98.49077	128.88641	118.41889	74.34170	85.05352	111.59637	84.84956
##	[10,]	107.35106	85.82476	70.51798	105.10434	111.46725	76.06518	77.20487
##	[11,]	72.12936	73.31711	74.11503	75.38786	114.86746	77.37199	123.96842
##	[12,]	102.89270	60.87569	79.13015	93.95282	67.27732	104.20946	87.39601
##	[13,]	108.99559	70.82520	117.80639	96.64975	93.60609	90.49723	90.92745
##	[14,]	65.89933	108.53150	90.42405	69.68246	83.32375	69.71934	95.43478
##	[15,]	70.35097	91.93833	89.85873	100.29888	67.00296	104.63178	120.57881
##	[16,]	NA	113.26802	74.93080	77.26004	99.99777	88.76682	136.15416
##	[17,]	NA	NA	73.79056	115.60011	75.83687	80.42905	91.29543
##	[18,]	NA	NA	NA	121.47109	81.05896	84.29118	97.14163
##	[19,]	NA	NA	NA	NA	119.86529	95.38654	90.85068
##	[20,]	NA	NA	NA	NA	NA	101.68491	79.43286
##	[21,]	NA	NA	NA	NA	NA	NA	87.24218
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##	[25,]	NA	NA	NA	NA	NA	NA	NA
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##	[67,]	NA	NA	NA	NA	NA	NA	NA
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##	[72,]	NA	NA	NA	NA	NA	NA	NA
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##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
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##	[84,]	NA	NA	NA	NA	NA	NA	NA
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##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
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##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
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##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
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##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,23]	[,24]	[,25]	[,26]	[,27]	[,28]	[,29]
##	[1,]	90.92211	74.86248	77.08995	110.51129	88.70763	96.04256	91.65710

##	[2,]	82.41427	58.13859	101.47537	95.55796	81.38337	122.68186	96.88578
##	[3,]	86.27941	97.35712	31.36369	73.59705	76.67188	81.95884	92.68730
##	[4,]	124.31618	100.41413	74.24616	77.94378	101.28027	64.59987	56.51318
##	[5,]	97.14978	76.50387	121.93545	96.67957	119.88820	108.27034	73.22570
##	[6,]	63.20542	86.46929	61.35969	64.96233	81.39282	95.31052	89.62376
##	[7,]	57.21604	66.68924	79.17079	65.13357	81.60704	122.68344	75.90117
##	[8,]	74.37333	87.68599	82.38822	93.79468	115.51835	99.01148	73.23604
##	[9,]	85.05275	70.01103	95.26463	113.30442	110.13600	105.69359	98.64367
##	[10,]	119.72962	115.33360	77.82889	88.18247	94.86553	51.67805	69.12392
##	[11,]	118.30327	112.53967	66.96468	70.73869	75.39684	58.60282	86.52626
##	[12,]	108.83992	86.67942	91.09924	101.11837	74.63535	91.18292	85.57741
##	[13,]	96.91763	93.84244	87.21352	120.10806	72.96179	75.72228	114.61198
##	[14,]	77.11410	103.62679	95.31376	87.45303	96.69814	98.03376	87.05832
##	[15,]	53.51611	70.57490	60.87934	92.02453	58.24680	99.68379	127.43383
##	[16,]	61.89560	101.26186	65.15203	53.69636	88.42307	89.77511	102.78417
##	[17,]	106.46889	92.61431	89.56941	94.70045	43.39399	75.06315	95.71075
##	[18,]	77.20846	89.26471	75.89586	49.58975	69.71278	85.04680	78.27946
##	[19,]	105.32799	86.47592	89.37242	106.62348	124.35340	98.85106	83.56421
##	[20,]	59.72925	62.73766	92.45147	88.71374	69.06748	126.45397	91.11651
##	[21,]	94.89464	134.24753	85.34317	80.94760	80.26060	61.23787	77.29925
##	[22,]	97.94532	73.31600	126.08379	112.52072	118.80256	113.34543	57.85438
##	[23,]	NA	66.90656	94.15915	77.78243	78.49728	124.43118	112.83504
##	[24,]	NA	NA	101.83022	103.79100	92.87529	144.39375	96.60575
##	[25,]	NA	NA	NA	60.56920	75.16293	71.43868	82.43392
##	[26,]	NA	NA	NA	NA	88.28506	85.44597	68.04533
##	[27,]	NA	NA	NA	NA	NA	73.20232	123.71197
##	[28,]	NA	NA	NA	NA	NA	NA	95.55151
##	[29,]	NA	NA	NA	NA	NA	NA	NA
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##	[82,]	NA	NA	NA	NA	NA	NA	NA
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##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,30]	[,31]	[,32]	[,33]	[,34]	[,35]	[,36]
##	[1,]	111.16273	99.14328	79.37478	68.26727	102.11795	82.00595	64.10220
##	[2,]	68.61530	105.62524	80.29445	88.36627	85.12115	80.11495	113.39966
##	[3,]	99.15895	127.88756	102.51557	97.45943	120.43207	86.12672	69.51949
##	[4,]	109.93611	94.69418	113.52361	112.40604	101.37223	117.61396	96.11234
##	[5,]	66.64586	73.88157	86.51755	107.31129	83.20918	96.24468	112.91552
##	[6,]	106.52735	63.42675	67.19317	119.73560	72.31486	44.61569	66.63492
##	[7,]	104.20135	65.34315	51.55876	99.71989	64.88261	25.03361	68.40224
##	[8,]	82.10532	87.10335	91.87684	109.73825	109.95249	84.44829	59.36656

##	[9,]	61.19580	93.48005	105.13085	90.35388	98.02494	99.70950	103.20733
##	[10,]	131.71529	87.15468	100.17636	83.38663	100.89511	111.67155	68.75226
##	[11,]	100.80469	123.81250	118.93815	79.12009	106.24215	122.84480	99.68764
##	[12,]	123.15123	105.80556	79.22571	40.70061	93.52767	88.26090	84.94334
##	[13,]	105.43839	93.34462	83.17174	109.81322	95.48304	86.73996	94.33562
##	[14,]	70.09828	109.51645	106.52891	60.21940	108.91981	97.11029	80.42925
##	[15,]	82.55181	97.67568	83.60698	112.63550	84.43487	60.97964	84.98921
##	[16,]	72.54593	90.71033	81.65506	99.11570	91.87186	75.08707	62.75035
##	[17,]	124.17061	102.29463	91.97386	80.37029	77.88556	90.58650	111.64224
##	[18,]	108.16093	77.07016	82.95856	82.16650	64.73589	76.68924	74.18110
##	[19,]	68.13830	123.44151	95.73348	81.64581	136.61468	113.57732	78.14713
##	[20,]	93.96113	80.19720	71.47269	86.55368	66.64863	43.27285	96.18953
##	[21,]	95.59690	107.01747	129.41398	95.51501	108.84854	111.01659	92.46591
##	[22,]	91.54159	76.78000	81.84160	76.27551	90.43854	90.95242	89.56857
##	[23,]	56.20955	68.05716	70.94772	102.59913	61.70603	45.89748	81.47543
##	[24,]	68.75572	82.51391	63.56113	90.08178	70.89381	64.33760	96.71238
##	[25,]	114.12637	115.68031	100.27922	117.78047	112.69027	83.88014	70.62947
##	[26,]	98.19270	74.41442	83.82073	111.36024	75.87630	70.01649	74.31884
##	[27,]	105.27882	101.72811	100.65021	91.56127	70.86015	81.83133	110.39360
##	[28,]	118.83346	103.06215	123.35905	92.12699	103.68289	128.87521	94.24987
##	[29,]	111.06273	91.03801	90.18839	90.35728	108.48400	92.46164	72.44524
##	[30,]	NA	83.28148	94.85860	96.88516	81.68119	90.01251	105.03922
##	[31,]	NA	NA	56.21309	97.80288	38.05477	61.70947	87.13060
##	[32,]	NA	NA	NA	85.81616	66.21088	42.06912	62.04873
##	[33,]	NA	NA	NA	NA	92.71677	105.24793	83.47968
##	[34,]	NA	NA	NA	NA	NA	61.47668	108.56577
##	[35,]	NA	NA	NA	NA	NA	NA	72.14675
##	[36,]	NA	NA	NA	NA	NA	NA	NA
##	[37,]	NA	NA	NA	NA	NA	NA	NA
##	[38,]	NA	NA	NA	NA	NA	NA	NA
##	[39,]	NA	NA	NA	NA	NA	NA	NA
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##	[41,]	NA	NA	NA	NA	NA	NA	NA
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##	[70,]	NA	NA	NA	NA	NA	NA	NA
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##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
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##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
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##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,37]	[,38]	[,39]	[,40]	[,41]	[,42]	[,43]
##	[1,]	91.65247	134.62337	104.76881	80.96209	79.45156	97.28758	88.79468
##	[2,]	117.90463	75.61640	90.02326	120.10013	97.11391	103.07748	81.88137
##	[3,]	116.01531	99.01242	87.20907	119.09060	69.50747	103.63180	97.18852
##	[4,]	67.36505	80.78485	107.88129	81.34266	59.94205	108.34973	127.74236
##	[5,]	66.79073	70.48778	93.60744	74.14468	110.34183	80.27178	77.77930
##	[6,]	104.16279	137.41479	110.76018	73.11794	69.90815	92.42747	93.46544
##	[7,]	120.79170	136.28269	128.38898	82.71923	70.09800	101.92914	85.59177
##	[8,]	64.63140	104.72854	96.68063	67.64912	102.22601	63.03992	67.43583
##	[9,]	64.79153	112.82173	84.53375	94.01925	100.82559	62.79440	64.53545
##	[10,]	67.35387	95.54726	101.84184	63.06581	67.85608	102.50591	121.54929
##	[11,]	107.23779	56.50284	75.45436	128.66658	65.86013	118.91045	123.80127
##	[12,]	110.25339	102.75114	108.76919	95.78211	73.20269	119.59654	102.64473
##	[13,]	79.90038	90.24171	90.26577	64.10167	100.18676	89.74486	99.26286
##	[14,]	91.70748	77.63196	75.98283	113.32968	107.67555	64.74549	56.58633
##	[15,]	115.50672	119.79842	85.31490	108.74619	83.13863	86.11630	86.20116

##	[16,]	123.45374	79.89643	55.29723	112.35564	97.70198	88.24736	79.24250
##	[17,]	108.91669	82.26815	111.70747	100.51970	62.53805	121.96525	128.83822
##	[18,]	120.79778	101.36509	101.08194	107.82030	52.08749	113.91803	116.20973
##	[19,]	83.47514	63.02944	64.21215	96.92752	119.97563	87.62283	68.76915
##	[20,]	111.41183	133.93461	128.90334	96.67489	76.19426	88.26127	76.29253
##	[21,]	70.44745	57.75274	91.76538	94.43700	89.24005	69.53726	92.93492
##	[22,]	58.19699	100.21369	120.75776	58.75652	101.10148	78.27592	72.87834
##	[23,]	111.75221	111.89129	81.63743	103.92526	103.88522	62.44590	56.03739
##	[24,]	107.65190	122.52246	101.80573	101.41339	90.18620	96.94202	75.67458
##	[25,]	113.25114	99.96944	98.90491	106.35178	52.40201	116.57432	117.88025
##	[26,]	118.67174	90.69840	96.68848	101.89958	61.33654	107.99837	106.06495
##	[27,]	117.37509	93.79622	93.86268	119.67519	63.48371	101.82258	117.54379
##	[28,]	74.04314	63.50858	76.13603	86.47707	73.96935	98.10305	130.25957
##	[29,]	79.77805	91.43376	127.42625	73.68698	71.85403	105.86544	95.78573
##	[30,]	83.09291	79.83236	56.93543	109.12964	128.21414	48.96692	45.29677
##	[31,]	86.70007	109.65853	91.89932	59.53216	97.99114	79.20817	80.78216
##	[32,]	118.55821	113.96456	95.41586	65.53983	101.52448	106.75863	77.87839
##	[33,]	91.17195	85.72866	83.93519	93.59403	100.00397	93.36710	82.65005
##	[34,]	106.02265	109.32771	93.00907	90.63708	82.43960	89.43085	93.97354
##	[35,]	125.46879	128.69393	110.32236	83.29797	86.92728	94.03457	74.06507
##	[36,]	103.41000	101.37646	87.10714	70.65991	96.06952	97.99117	80.30364
##	[37,]	NA	79.92245	89.44672	59.90974	109.52745	54.71261	78.44135
##	[38,]	NA	NA	57.86314	99.53042	110.21111	86.04460	94.53470
##	[39,]	NA	NA	NA	102.00261	125.83926	71.59073	76.53331
##	[40,]	NA	NA	NA	NA	107.63862	83.27998	83.05862
##	[41,]	NA	NA	NA	NA	NA	130.53277	142.02353
##	[42,]	NA	NA	NA	NA	NA	NA	41.68464
##	[43,]	NA	NA	NA	NA	NA	NA	NA
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##	[45,]	NA	NA	NA	NA	NA	NA	NA
##	[46,]	NA	NA	NA	NA	NA	NA	NA
##	[47,]	NA	NA	NA	NA	NA	NA	NA
##	[48,]	NA	NA	NA	NA	NA	NA	NA
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##	[50,]	NA	NA	NA	NA	NA	NA	NA
##	[51,]	NA	NA	NA	NA	NA	NA	NA
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##	[53,]	NA	NA	NA	NA	NA	NA	NA
##	[54,]	NA	NA	NA	NA	NA	NA	NA
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##	[58,]	NA	NA	NA	NA	NA	NA	NA
##	[59,]	NA	NA	NA	NA	NA	NA	NA
##	[60,]	NA	NA	NA	NA	NA	NA	NA
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##	[62,]	NA	NA	NA	NA	NA	NA	NA
##	[63,]	NA	NA	NA	NA	NA	NA	NA
##	[64,]	NA	NA	NA	NA	NA	NA	NA
##	[65,]	NA	NA	NA	NA	NA	NA	NA
##	[66,]	NA	NA	NA	NA	NA	NA	NA
##	[67,]	NA	NA	NA	NA	NA	NA	NA
##	[68,]	NA	NA	NA	NA	NA	NA	NA
##	[69,]	NA	NA	NA	NA	NA	NA	NA

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##	[74,]	NA	NA	NA	NA	NA	NA	NA
##	[75,]	NA	NA	NA	NA	NA	NA	NA
##	[76,]	NA	NA	NA	NA	NA	NA	NA
##	[77,]	NA	NA	NA	NA	NA	NA	NA
##	[78,]	NA	NA	NA	NA	NA	NA	NA
##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
##	[84,]	NA	NA	NA	NA	NA	NA	NA
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,44]	[,45]	[,46]	[,47]	[,48]	[,49]	[,50]
##	[1,]	46.50984	97.95977	86.47776	122.36084	94.31444	77.57246	74.89131
##	[2,]	112.33079	88.31920	94.84612	91.70274	74.01611	65.21796	109.02846
##	[3,]	49.38212	82.54073	100.93734	84.82047	110.74702	95.28530	36.35780
##	[4,]	101.20070	101.53129	82.11221	95.88808	79.90794	80.27798	97.07231
##	[5,]	144.23672	95.91704	87.68675	95.05152	87.20850	72.37711	120.04128
##	[6,]	46.18325	74.72589	89.42135	75.07200	120.64669	127.94794	74.51002
##	[7,]	57.93983	74.29403	82.03565	91.94490	103.13978	107.74675	99.52637
##	[8,]	86.77200	76.10671	70.36429	113.00362	113.56269	91.64646	69.70293
##	[9,]	79.36389	81.93122	74.13178	115.98693	98.59040	63.33390	71.97816
##	[10,]	77.60012	106.75635	86.95752	99.89825	84.67681	96.47156	89.11100
##	[11,]	88.72360	95.00878	104.11903	77.24758	71.35386	82.25303	81.90910
##	[12,]	69.57005	117.34476	100.43847	103.77023	75.06338	76.10112	98.83469
##	[13,]	101.79932	116.92196	102.49289	71.52427	98.80294	106.51585	82.54744
##	[14,]	85.76469	76.33495	80.25968	100.32943	96.16146	84.60852	68.64414
##	[15,]	54.69768	66.47527	83.83891	79.75192	100.54362	105.34324	61.86398
##	[16,]	70.38047	53.62888	110.01320	67.98260	111.56586	114.38497	63.11067
##	[17,]	96.38172	114.05874	87.75831	74.85621	56.16321	94.11437	114.11172
##	[18,]	61.30789	62.02719	75.15444	90.86547	65.91078	101.73094	108.63593
##	[19,]	110.03115	98.49841	113.19187	110.70587	102.88488	56.00343	70.59015
##	[20,]	65.47079	83.26378	68.70595	94.52130	92.17545	95.06650	97.10620
##	[21,]	109.51029	91.64404	68.74808	75.10508	88.96334	109.60524	75.20736
##	[22,]	112.96681	105.23544	67.37604	130.30889	82.12691	64.41776	119.90772

##	[23,]	73.43454	35.62615	68.42604	86.19129	97.39678	108.53197	87.42832
##	[24,]	82.35708	72.22408	76.70080	123.12876	75.19223	55.53076	113.30466
##	[25,]	53.21503	87.17783	103.00608	74.42542	111.34901	105.85871	48.25393
##	[26,]	69.70248	64.58474	97.36767	65.33271	103.46289	118.79706	86.95860
##	[27,]	73.45553	84.75107	76.22602	63.39492	64.14313	110.50640	89.94820
##	[28,]	91.51401	109.29041	99.67535	62.39574	83.87773	111.92313	74.17384
##	[29,]	93.90681	104.97227	89.93568	109.88612	102.16003	77.85386	96.07448
##	[30,]	108.90529	51.76117	74.04838	98.18533	88.93138	75.60480	89.80477
##	[31,]	88.20066	72.63766	88.46751	80.17099	95.42953	113.44521	121.09688
##	[32,]	79.22024	87.27117	117.00427	92.10385	104.56408	98.23714	111.81775
##	[33,]	88.30045	102.25704	89.77322	117.64941	64.39571	66.77401	107.13286
##	[34,]	83.13079	64.86376	76.29556	75.57476	69.27601	107.03435	131.21900
##	[35,]	64.83359	70.76016	93.09204	80.73620	112.06411	113.70512	94.87770
##	[36,]	65.43495	83.30387	110.43006	102.00967	118.81566	102.12065	71.90655
##	[37,]	118.31889	108.43563	72.52036	103.63003	93.46179	80.22713	86.73679
##	[38,]	136.83447	100.21581	104.48865	71.97417	80.33012	89.33526	90.18431
##	[39,]	101.83596	70.38488	106.58020	78.05484	87.68111	93.84143	78.67395
##	[40,]	101.06324	118.14387	106.73094	90.89244	116.26727	104.31659	97.52697
##	[41,]	57.52799	92.26864	80.19023	85.21663	75.25215	93.22208	92.29633
##	[42,]	105.90910	70.28551	61.06134	92.78432	101.16586	97.57676	76.54038
##	[43,]	100.69507	72.11228	81.13183	107.06289	112.45118	83.55923	81.24454
##	[44,]	NA	72.69825	88.83875	92.94639	100.10745	102.71838	69.24320
##	[45,]	NA	NA	64.64035	92.04920	83.86682	97.74859	89.50503
##	[46,]	NA	NA	NA	111.40265	62.56475	79.79287	99.29605
##	[47,]	NA	NA	NA	NA	105.89562	144.39616	78.49652
##	[48,]	NA	NA	NA	NA	NA	64.45862	129.52538
##	[49,]	NA	NA	NA	NA	NA	NA	105.12561
##	[50,]	NA	NA	NA	NA	NA	NA	NA
##	[51,]	NA	NA	NA	NA	NA	NA	NA
##	[52,]	NA	NA	NA	NA	NA	NA	NA
##	[53,]	NA	NA	NA	NA	NA	NA	NA
##	[54,]	NA	NA	NA	NA	NA	NA	NA
##	[55,]	NA	NA	NA	NA	NA	NA	NA
##	[56,]	NA	NA	NA	NA	NA	NA	NA
##	[57,]	NA	NA	NA	NA	NA	NA	NA
##	[58,]	NA	NA	NA	NA	NA	NA	NA
##	[59,]	NA	NA	NA	NA	NA	NA	NA
##	[60,]	NA	NA	NA	NA	NA	NA	NA
##	[61,]	NA	NA	NA	NA	NA	NA	NA
##	[62,]	NA	NA	NA	NA	NA	NA	NA
##	[63,]	NA	NA	NA	NA	NA	NA	NA
##	[64,]	NA	NA	NA	NA	NA	NA	NA
##	[65,]	NA	NA	NA	NA	NA	NA	NA
##	[66,]	NA	NA	NA	NA	NA	NA	NA
##	[67,]	NA	NA	NA	NA	NA	NA	NA
##	[68,]	NA	NA	NA	NA	NA	NA	NA
##	[69,]	NA	NA	NA	NA	NA	NA	NA
##	[70,]	NA	NA	NA	NA	NA	NA	NA
##	[71,]	NA	NA	NA	NA	NA	NA	NA
##	[72,]	NA	NA	NA	NA	NA	NA	NA
##	[73,]	NA	NA	NA	NA	NA	NA	NA
##	[74,]	NA	NA	NA	NA	NA	NA	NA
##	[75,]	NA	NA	NA	NA	NA	NA	NA
##	[76,]	NA	NA	NA	NA	NA	NA	NA

##	[77,]	NA	NA	NA	NA	NA	NA	NA
##	[78,]	NA	NA	NA	NA	NA	NA	NA
##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
##	[84,]	NA	NA	NA	NA	NA	NA	NA
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,51]	[,52]	[,53]	[,54]	[,55]	[,56]	[,57]
##	[1,]	89.80825	109.47102	96.11567	100.12246	120.62419	56.24617	84.20291
##	[2,]	78.53077	94.39642	85.62340	77.43181	82.32021	94.56539	90.75806
##	[3,]	113.59639	120.89887	101.94155	95.15703	112.72432	99.85350	89.16086
##	[4,]	65.49991	48.04231	73.38152	94.89157	82.66162	103.68989	83.30584
##	[5,]	50.02410	58.14227	63.32001	73.80367	56.80373	89.64213	101.89982
##	[6,]	108.88758	96.53916	87.24655	86.71147	79.46643	99.41204	89.32756
##	[7,]	88.64820	103.62299	68.18403	87.20787	80.20641	95.45545	90.18244
##	[8,]	72.76441	82.57327	45.96410	68.68132	96.54777	79.93174	92.38880
##	[9,]	74.16281	95.49155	96.91779	74.03022	100.36349	71.78747	107.47091
##	[10,]	87.10789	71.22877	87.36961	111.54285	101.30454	82.06784	78.12430
##	[11,]	103.22357	90.85386	114.25350	106.13719	98.07925	109.29973	90.81170
##	[12,]	90.99752	122.28924	108.77834	130.26828	115.53734	73.30401	78.23875
##	[13,]	106.75749	84.07901	99.19873	97.84664	95.98136	86.52993	52.19215
##	[14,]	91.93696	132.16910	85.05441	93.39667	114.90025	90.73490	102.68910
##	[15,]	123.86978	104.13457	103.01461	69.01954	103.76135	97.00353	76.30535
##	[16,]	125.45364	102.12495	99.22354	68.63586	75.36651	98.62311	119.04985
##	[17,]	100.01990	91.02937	101.37296	119.42209	105.55165	110.36530	42.64347
##	[18,]	100.03538	79.70899	84.63413	86.26426	87.23225	105.48940	92.72418
##	[19,]	72.52154	94.21676	83.13974	79.29331	91.17907	62.90261	113.52527
##	[20,]	87.75748	123.50022	81.75444	96.48459	102.20061	99.26932	75.76903
##	[21,]	94.37525	96.77629	69.69342	104.62795	112.95555	126.88749	62.60490
##	[22,]	33.39962	80.00513	47.05328	93.20279	92.21299	68.80094	87.09613
##	[23,]	106.61855	100.05203	77.52605	48.91125	83.79167	97.64551	99.90893
##	[24,]	66.89347	80.51211	78.27452	56.52062	82.03336	68.01249	101.93628
##	[25,]	111.19496	99.70468	96.11222	97.52585	98.24372	111.39905	82.77257
##	[26,]	102.13077	86.91939	83.56143	87.04580	61.98404	122.49533	110.65966
##	[27,]	130.38020	100.50123	115.64225	99.57954	114.71435	122.15204	45.73558
##	[28,]	117.25349	79.71122	117.39307	117.77171	102.61233	108.31851	68.21284
##	[29,]	45.79064	87.90655	50.09600	108.55344	81.79789	91.47507	101.57496

##	[30,]	83.69989	83.45267	82.35145	38.51960	78.34249	86.05260	117.41308
##	[31,]	90.36712	69.56039	87.77258	75.70310	47.19141	84.80077	112.42612
##	[32,]	90.74955	90.55422	85.74520	81.01854	56.66761	60.76359	111.32683
##	[33,]	83.80436	108.62949	101.00043	109.06638	113.33574	58.84370	93.58447
##	[34,]	101.39233	72.83565	101.48053	74.14085	63.12075	99.79558	95.95201
##	[35,]	99.30480	106.84590	78.09088	78.36804	71.01410	92.76072	96.33187
##	[36,]	95.19622	100.06545	72.34729	87.59828	86.48058	64.80847	109.12806
##	[37,]	64.73177	75.65801	78.42278	96.19146	99.14051	81.88313	84.10177
##	[38,]	94.43228	79.62947	93.04098	94.20227	86.46905	102.11181	88.41229
##	[39,]	118.33688	79.72665	115.44205	63.38785	81.36784	77.54009	111.82770
##	[40,]	76.78487	80.80501	78.28022	105.34472	71.90923	65.74133	92.14716
##	[41,]	92.57742	85.48802	96.24621	109.43517	98.01728	118.01817	73.01472
##	[42,]	89.14275	98.14210	77.31951	69.69242	99.93505	91.44881	92.52193
##	[43,]	77.47712	111.81627	68.62546	65.97770	89.17371	70.09416	112.42418
##	[44,]	112.45134	109.93411	105.37842	92.83391	101.69125	88.57737	94.83729
##	[45,]	102.37545	80.21023	80.56075	36.27369	79.07709	100.93963	113.95902
##	[46,]	74.59615	85.19600	66.62405	74.17991	116.93854	108.01014	71.19785
##	[47,]	135.52116	94.42328	116.66076	102.47719	72.39705	129.72733	77.75757
##	[48,]	84.41660	66.60736	98.49511	84.60699	104.93641	92.10282	73.79251
##	[49,]	44.97220	80.41115	79.63206	80.27169	101.89642	60.49684	100.80736
##	[50,]	112.19499	119.84191	96.74565	95.11522	112.60318	98.69296	86.04526
##	[51,]	NA	76.72450	48.83484	87.71532	85.32196	72.79268	102.10028
##	[52,]	NA	NA	84.31540	62.98213	60.17483	86.53400	99.68407
##	[53,]	NA	NA	NA	75.56050	88.09337	91.07664	92.30666
##	[54,]	NA	NA	NA	NA	70.33343	82.37040	116.60192
##	[55,]	NA	NA	NA	NA	NA	87.36172	129.69164
##	[56,]	NA	NA	NA	NA	NA	NA	113.90305
##	[57,]	NA	NA	NA	NA	NA	NA	NA
##	[58,]	NA	NA	NA	NA	NA	NA	NA
##	[59,]	NA	NA	NA	NA	NA	NA	NA
##	[60,]	NA	NA	NA	NA	NA	NA	NA
##	[61,]	NA	NA	NA	NA	NA	NA	NA
##	[62,]	NA	NA	NA	NA	NA	NA	NA
##	[63,]	NA	NA	NA	NA	NA	NA	NA
##	[64,]	NA	NA	NA	NA	NA	NA	NA
##	[65,]	NA	NA	NA	NA	NA	NA	NA
##	[66,]	NA	NA	NA	NA	NA	NA	NA
##	[67,]	NA	NA	NA	NA	NA	NA	NA
##	[68,]	NA	NA	NA	NA	NA	NA	NA
##	[69,]	NA	NA	NA	NA	NA	NA	NA
##	[70,]	NA	NA	NA	NA	NA	NA	NA
##	[71,]	NA	NA	NA	NA	NA	NA	NA
##	[72,]	NA	NA	NA	NA	NA	NA	NA
##	[73,]	NA	NA	NA	NA	NA	NA	NA
##	[74,]	NA	NA	NA	NA	NA	NA	NA
##	[75,]	NA	NA	NA	NA	NA	NA	NA
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##	[77,]	NA	NA	NA	NA	NA	NA	NA
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##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA

##	[84,]	NA	NA	NA	NA	NA	NA	NA
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,58]	[,59]	[,60]	[,61]	[,62]	[,63]	[,64]
##	[1,]	97.33077	96.32715	78.82567	127.71897	96.04685	73.40082	81.65395
##	[2,]	88.37382	111.40549	75.98478	101.32005	114.32408	66.83773	94.55020
##	[3,]	83.33077	63.41419	83.70184	127.54091	104.70079	59.75956	93.69216
##	[4,]	68.05102	107.61076	79.71694	93.50130	83.62880	114.24720	100.79990
##	[5,]	75.51885	124.33728	84.59100	66.74344	96.93690	114.23932	102.14988
##	[6,]	81.73859	71.59133	113.60169	80.57535	86.65941	84.88787	78.94730
##	[7,]	92.45274	86.33025	96.33559	86.81536	91.52738	72.07298	57.60756
##	[8,]	93.04949	103.76777	97.37806	90.19970	85.00330	110.68266	85.76004
##	[9,]	85.33458	99.30235	64.65275	110.95945	138.47044	97.85225	135.40313
##	[10,]	89.60457	89.65817	92.88196	92.34976	56.68976	107.79397	75.87743
##	[11,]	89.05306	69.86642	69.67929	109.37165	90.90886	72.32701	97.88698
##	[12,]	93.55005	85.03743	72.19945	118.08792	88.37812	62.59260	64.67498
##	[13,]	67.43216	105.97073	138.00149	81.19772	68.68909	104.80774	90.92342
##	[14,]	110.83631	62.43250	72.61764	99.18130	100.27516	83.05183	82.72599
##	[15,]	92.67008	84.01569	110.10223	106.17414	106.25761	71.23464	102.74096
##	[16,]	112.36114	52.11037	95.63270	84.76819	86.50194	57.75708	84.55889
##	[17,]	80.34578	95.74214	103.46583	93.31599	73.25874	87.97259	72.85947
##	[18,]	119.43166	75.69508	80.89715	91.13416	76.26065	72.27181	65.22597
##	[19,]	90.12778	105.52162	66.30488	113.79433	102.22039	74.96409	100.65673
##	[20,]	86.05405	86.85197	91.13307	96.01453	111.85781	80.62127	76.31897
##	[21,]	85.31751	70.69520	109.40259	73.83552	66.23388	126.26739	79.35922
##	[22,]	88.54177	129.02951	76.60653	86.25489	88.32042	116.19820	75.36645
##	[23,]	118.88404	81.02089	103.78907	76.65967	101.69119	79.92409	87.03846
##	[24,]	101.68473	132.04953	65.57962	112.87442	127.10368	66.96581	100.73083
##	[25,]	69.99931	68.54979	93.74708	114.89791	93.34079	70.26764	91.35195
##	[26,]	90.82347	55.19430	88.49525	75.30423	84.55988	75.03777	75.60695
##	[27,]	92.73057	75.24130	113.77422	94.65276	85.24001	83.90062	89.76213
##	[28,]	79.20775	65.92968	109.35448	82.40724	58.06575	109.56683	95.25595
##	[29,]	72.17215	95.65740	64.77586	94.89729	87.41570	96.66550	67.71046
##	[30,]	111.44598	98.79492	79.99995	81.73219	119.79397	93.40479	121.13879
##	[31,]	102.63916	86.17591	103.17205	43.60399	78.54483	99.22335	81.29923
##	[32,]	102.58228	99.07098	97.16843	78.21240	78.50915	57.58232	57.74565
##	[33,]	120.88110	90.51843	65.71961	105.39359	82.36533	75.84677	69.71918
##	[34,]	108.43588	87.02616	98.91179	59.87696	90.95232	88.85931	89.79394
##	[35,]	92.86568	83.36447	106.07939	78.62744	94.23236	67.01451	65.64710
##	[36,]	108.65798	80.26351	93.03423	95.38344	63.84149	65.87616	50.04483

##	[37,]	75.63815	103.77092	91.78878	77.23027	86.80979	149.03812	110.01708
##	[38,]	91.17873	84.90892	95.93793	74.85346	69.05324	101.54217	92.48044
##	[39,]	120.02266	79.10660	96.83338	79.72720	81.58243	81.65555	108.06671
##	[40,]	75.10750	99.31237	111.79877	62.10875	59.70764	112.70209	70.02930
##	[41,]	73.53972	81.36287	77.83427	111.01794	97.12666	81.46562	89.00774
##	[42,]	101.45353	84.27004	103.96405	67.17522	96.71636	126.30947	106.47815
##	[43,]	106.18030	93.00205	88.18521	80.54465	105.48452	93.50260	89.82714
##	[44,]	98.64143	65.92870	83.37427	114.12324	100.33028	59.92205	83.63193
##	[45,]	129.53168	80.26321	84.59688	83.78371	105.11776	79.05945	99.98390
##	[46,]	103.62927	101.00096	82.02733	93.83201	108.01324	119.69887	103.02809
##	[47,]	71.13390	50.66756	134.51280	54.12495	70.63353	94.91383	90.42470
##	[48,]	115.46330	111.75131	71.98873	101.43733	91.75094	91.59448	97.76548
##	[49,]	95.13641	135.16505	35.74430	131.64368	122.68578	81.42266	108.33679
##	[50,]	73.78627	61.97187	101.41362	106.58784	96.70301	88.05561	101.31608
##	[51,]	79.36519	131.32732	52.27890	102.01230	109.51660	104.27487	91.69917
##	[52,]	96.94306	120.24744	86.68612	76.68747	81.23119	104.48081	107.58014
##	[53,]	90.82358	113.00947	83.24681	87.11222	88.88908	105.28658	69.81355
##	[54,]	120.63771	109.23551	84.00995	87.05028	108.54795	82.56191	111.57215
##	[55,]	87.69615	91.66142	92.38555	56.04964	85.61224	81.63130	89.63541
##	[56,]	110.20461	117.84152	71.63035	106.03132	87.79866	71.97175	82.48592
##	[57,]	70.54179	94.57920	119.84420	94.99303	75.90563	112.49879	84.81510
##	[58,]	NA	90.54803	99.91155	91.14169	100.16831	108.22979	102.77096
##	[59,]	NA	NA	106.30353	72.80299	78.36854	85.03093	80.59949
##	[60,]	NA	NA	NA	127.50983	126.28279	71.24764	102.61064
##	[61,]	NA	NA	NA	NA	60.43001	117.84623	79.58965
##	[62,]	NA	NA	NA	NA	NA	99.08405	48.83878
##	[63,]	NA	NA	NA	NA	NA	NA	75.28951
##	[64,]	NA	NA	NA	NA	NA	NA	NA
##	[65,]	NA	NA	NA	NA	NA	NA	NA
##	[66,]	NA	NA	NA	NA	NA	NA	NA
##	[67,]	NA	NA	NA	NA	NA	NA	NA
##	[68,]	NA	NA	NA	NA	NA	NA	NA
##	[69,]	NA	NA	NA	NA	NA	NA	NA
##	[70,]	NA	NA	NA	NA	NA	NA	NA
##	[71,]	NA	NA	NA	NA	NA	NA	NA
##	[72,]	NA	NA	NA	NA	NA	NA	NA
##	[73,]	NA	NA	NA	NA	NA	NA	NA
##	[74,]	NA	NA	NA	NA	NA	NA	NA
##	[75,]	NA	NA	NA	NA	NA	NA	NA
##	[76,]	NA	NA	NA	NA	NA	NA	NA
##	[77,]	NA	NA	NA	NA	NA	NA	NA
##	[78,]	NA	NA	NA	NA	NA	NA	NA
##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
##	[84,]	NA	NA	NA	NA	NA	NA	NA
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA

##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,65]	[,66]	[,67]	[,68]	[,69]	[,70]	[,71]
##	[1,]	81.06385	129.72691	87.36518	76.69040	95.72479	97.75911	101.52657
##	[2,]	103.02566	81.55947	72.87008	84.31895	85.79129	67.91555	86.64210
##	[3,]	61.06450	101.60925	63.01587	55.63066	104.15940	100.96167	103.71745
##	[4,]	86.83997	80.30580	97.23719	128.16849	114.01233	119.61911	66.68248
##	[5,]	113.36772	70.75658	104.44053	114.39102	76.16852	87.43957	60.75353
##	[6,]	74.66475	84.44298	108.83562	74.16391	98.46233	88.72410	86.99593
##	[7,]	70.43730	91.81670	110.92124	84.47117	92.50151	66.02931	76.54315
##	[8,]	89.42943	122.77636	97.36264	74.42096	65.48309	124.28737	72.05345
##	[9,]	111.95504	95.59585	107.67730	77.57174	100.60752	87.63725	91.84966
##	[10,]	74.56106	105.00380	94.78941	116.17296	101.15259	121.37182	85.94564
##	[11,]	73.90229	74.83319	64.05610	100.78645	118.98481	90.90660	95.57694
##	[12,]	65.57640	105.84959	81.86887	101.22117	101.94102	67.29732	110.82210
##	[13,]	102.37957	99.65391	71.58138	77.34332	70.09176	122.85743	118.22252
##	[14,]	71.70043	107.85540	87.91546	72.60551	76.35331	72.89404	100.31181
##	[15,]	100.00218	99.94104	77.01574	37.25683	93.83264	98.47488	110.90692
##	[16,]	78.34441	81.10155	67.85259	51.72886	83.16861	86.21579	80.96644
##	[17,]	83.22486	86.68240	80.40417	110.64953	103.84492	85.17045	115.91968
##	[18,]	75.82134	85.86442	98.65607	102.78192	115.75023	77.54727	71.95242
##	[19,]	92.14537	107.66664	52.92022	73.61496	67.22986	107.37876	77.96353
##	[20,]	80.03666	94.26913	116.46824	82.38268	96.49954	51.98439	103.68722
##	[21,]	70.35637	98.56353	91.57804	96.58590	77.56228	109.36648	105.21110
##	[22,]	94.93460	111.44966	117.40462	119.72847	72.69441	88.25057	71.19585
##	[23,]	104.80647	93.20632	102.06492	50.73322	75.68232	72.27664	85.56593
##	[24,]	119.87399	97.54456	95.37996	80.59556	95.46504	73.24796	70.08815
##	[25,]	58.55383	88.81815	69.42452	72.25287	113.03382	111.03666	93.51936
##	[26,]	60.69655	57.95995	99.89973	95.79595	110.67582	74.27216	63.53743
##	[27,]	92.01529	86.45699	81.26587	79.56386	109.59128	86.45750	131.37205
##	[28,]	78.66887	81.67716	77.25236	104.28073	104.52341	120.19884	113.00394
##	[29,]	52.81405	91.76322	106.38120	125.34741	94.82700	88.19709	55.89758
##	[30,]	129.74377	85.32969	94.85771	65.15093	73.68640	80.32069	77.60372
##	[31,]	104.21107	63.63422	129.54497	103.64994	87.78466	65.63423	66.68196
##	[32,]	88.96816	88.76818	88.07332	82.15166	71.69976	69.51103	68.37162
##	[33,]	85.49218	114.74441	84.71574	101.16420	84.58712	71.51977	100.16831
##	[34,]	113.82844	58.52641	122.79053	101.08086	105.93579	53.17768	82.56201
##	[35,]	80.67852	85.01053	102.85158	69.21294	81.83671	62.85094	81.45424
##	[36,]	61.12510	118.72368	72.22131	71.02253	66.52343	105.09801	69.83629
##	[37,]	103.54424	98.36091	111.75656	109.90339	78.80534	112.88907	93.32099
##	[38,]	91.99558	81.49339	62.87105	97.83921	72.77569	105.07947	93.21160
##	[39,]	116.93434	86.94755	61.48816	63.02550	72.86595	102.29069	92.58414
##	[40,]	83.96574	94.44475	104.74110	106.23522	64.71488	101.82825	81.24037
##	[41,]	67.30580	76.17177	99.95505	112.44793	147.31459	86.33985	89.55816
##	[42,]	110.79805	100.69916	111.30419	70.81527	61.46076	92.46803	100.63661
##	[43,]	101.11081	108.02611	99.35953	61.34304	47.92170	76.61547	84.99936

##	[44,]	70.07702	96.52949	94.19487	71.48338	117.74482	81.43693	94.49838
##	[45,]	109.45133	85.08380	100.33071	64.27247	94.24425	79.49909	69.08742
##	[46,]	107.36188	104.29277	123.68326	95.39751	100.50779	87.46028	94.20248
##	[47,]	80.08951	50.04744	85.15608	83.53834	93.03882	86.50651	111.39397
##	[48,]	117.66931	92.57236	90.71732	113.07676	111.57555	84.23381	93.74653
##	[49,]	108.86251	108.97033	83.51378	102.09672	97.36244	89.89630	74.46423
##	[50,]	67.92731	104.28714	70.23897	51.08190	84.12804	115.69523	111.36986
##	[51,]	92.76234	99.85850	110.50304	121.29894	87.90243	86.17184	57.26369
##	[52,]	124.95347	73.13359	94.23818	113.72708	101.03819	110.28821	56.46954
##	[53,]	80.81350	111.84902	103.30991	95.74627	66.38069	98.25931	58.44654
##	[54,]	132.53451	90.46017	88.77719	62.78931	80.88070	94.83118	60.71132
##	[55,]	99.26927	46.53775	99.84824	101.21305	88.84629	74.44641	47.48812
##	[56,]	103.85343	119.23165	77.08400	84.52492	68.88021	95.14401	75.94110
##	[57,]	85.25967	105.98848	84.40548	93.06287	91.38074	109.00120	136.24754
##	[58,]	70.81634	71.24900	95.78871	104.47654	101.50275	97.92863	102.58016
##	[59,]	57.03117	70.84813	94.37109	79.00191	98.44250	74.80434	108.79443
##	[60,]	90.53052	93.44604	96.05172	107.78382	115.06468	72.54898	62.38866
##	[61,]	96.21320	60.41554	112.98521	100.41120	70.00097	79.93945	85.15072
##	[62,]	74.34977	98.20983	75.47868	99.34630	65.26462	111.00496	94.06334
##	[63,]	79.24860	92.50917	59.11290	67.93485	97.11619	72.81910	79.40909
##	[64,]	52.32825	108.76933	83.82894	95.72949	66.06613	82.30168	84.05814
##	[65,]	NA	94.28188	86.73613	97.00932	92.43340	85.31368	93.52437
##	[66,]	NA	NA	109.27278	110.06966	118.14287	63.87475	79.86926
##	[67,]	NA	NA	NA	62.56452	73.08615	119.34040	100.01681
##	[68,]	NA	NA	NA	NA	66.61836	100.95116	105.34947
##	[69,]	NA	NA	NA	NA	NA	103.64817	91.06209
##	[70,]	NA	NA	NA	NA	NA	NA	85.86106
##	[71,]	NA	NA	NA	NA	NA	NA	NA
##	[72,]	NA	NA	NA	NA	NA	NA	NA
##	[73,]	NA	NA	NA	NA	NA	NA	NA
##	[74,]	NA	NA	NA	NA	NA	NA	NA
##	[75,]	NA	NA	NA	NA	NA	NA	NA
##	[76,]	NA	NA	NA	NA	NA	NA	NA
##	[77,]	NA	NA	NA	NA	NA	NA	NA
##	[78,]	NA	NA	NA	NA	NA	NA	NA
##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
##	[84,]	NA	NA	NA	NA	NA	NA	NA
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA

##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,72]	[,73]	[,74]	[,75]	[,76]	[,77]	[,78]
##	[1,]	98.02430	90.26183	98.55119	94.69428	99.20790	55.17528	114.71743
##	[2,]	76.80288	100.96838	52.94138	90.63813	82.13801	85.05109	83.79174
##	[3,]	91.20786	58.86774	101.64944	85.20568	145.56098	86.42350	57.95534
##	[4,]	96.69363	105.38085	117.94660	106.75390	75.00409	85.01257	93.96162
##	[5,]	98.54065	128.18678	73.24358	82.41511	54.05986	109.73191	89.06219
##	[6,]	110.94125	54.40014	91.80616	73.98159	90.58727	82.71276	92.84527
##	[7,]	98.38880	66.31573	71.02198	85.23252	72.12117	67.65154	107.25352
##	[8,]	107.04899	104.09881	90.50845	99.22312	86.74181	109.09711	84.72529
##	[9,]	100.58967	97.61201	107.36670	75.82035	113.29714	97.27403	77.38701
##	[10,]	95.04172	96.28078	123.31653	108.72019	80.26240	73.33902	114.95924
##	[11,]	63.91391	76.43344	109.97055	98.63130	119.66836	83.74727	69.37613
##	[12,]	85.82492	86.80918	93.48123	94.51520	91.22001	44.40068	119.44543
##	[13,]	120.55294	102.69602	80.29596	91.66814	72.68072	91.86525	105.02197
##	[14,]	76.77491	79.14817	95.89127	91.46449	126.45612	110.08006	63.83860
##	[15,]	93.05355	60.76026	79.41776	91.13338	112.06476	85.36888	80.47148
##	[16,]	65.55824	56.03945	74.86828	72.11053	128.12751	110.38462	47.66776
##	[17,]	87.42396	85.35967	89.72462	118.52909	67.36974	59.01112	120.97243
##	[18,]	53.92625	60.98960	93.81387	114.86589	84.57711	62.42731	105.20908
##	[19,]	85.65737	123.39780	75.17440	77.98613	110.32888	107.20756	61.85150
##	[20,]	104.07291	67.60875	81.10093	89.68839	82.08594	69.66580	106.61743
##	[21,]	96.05011	83.76082	113.46084	118.72031	96.38461	121.42217	74.12891
##	[22,]	105.20759	133.22746	85.71623	103.19887	45.22851	83.29546	123.55148
##	[23,]	76.62850	64.39257	62.46633	89.98059	94.66015	103.31625	79.95799
##	[24,]	78.91540	104.35856	57.64545	92.26453	72.50139	63.47723	107.60499
##	[25,]	99.11115	58.37721	105.97121	86.84576	122.91304	82.76868	65.54240
##	[26,]	78.14746	49.28805	94.07806	77.84357	99.93837	93.42468	67.87877
##	[27,]	79.83550	55.35461	95.64022	117.59298	96.13039	72.29574	100.31630
##	[28,]	91.45376	79.48603	130.47721	101.50210	104.22202	96.00137	85.91403
##	[29,]	104.90587	103.57883	101.98847	87.66329	75.91313	84.32787	91.93825
##	[30,]	71.59610	97.89663	70.31131	83.68472	101.62872	124.92274	61.60711
##	[31,]	88.55701	82.51934	78.46148	69.61083	59.13434	91.80318	108.37340
##	[32,]	88.47111	92.87878	41.17053	63.77432	62.59084	70.38955	112.31374
##	[33,]	66.17100	103.47372	90.01304	102.78014	89.59064	67.10636	116.26807
##	[34,]	71.87277	69.40130	77.95205	88.03773	64.20559	76.70254	113.05034
##	[35,]	99.00228	65.15658	56.43620	70.99003	77.49260	80.23964	96.47199
##	[36,]	87.35366	88.17361	74.52477	81.73399	95.75960	86.21939	89.40795
##	[37,]	114.77740	121.84268	119.58852	94.29450	81.37226	115.33822	92.71054
##	[38,]	75.45868	105.91056	88.88043	97.58712	95.25640	120.90110	67.48223
##	[39,]	58.67452	91.91515	78.36017	82.91231	114.48558	117.74337	64.91865
##	[40,]	125.11090	113.42761	87.49417	69.19906	57.16551	94.60076	113.21582
##	[41,]	89.33731	61.83470	119.01975	105.43725	92.55430	52.59174	100.62249
##	[42,]	98.34417	93.83108	94.77482	90.92784	98.82041	137.53429	73.17693
##	[43,]	95.35175	102.05802	65.95712	73.86130	95.75478	121.71787	74.27582
##	[44,]	86.02927	48.47309	102.24538	84.87425	115.52403	61.06413	92.82772
##	[45,]	54.04159	64.71624	77.68872	98.20569	104.04699	102.36438	71.27324
##	[46,]	83.09129	86.76059	108.25731	132.62075	84.03677	91.47592	99.97677
##	[47,]	100.08803	53.89498	93.30595	71.16466	99.13733	111.18295	69.17020
##	[48,]	50.11718	99.91474	94.06112	136.90723	73.06596	62.62210	120.10090
##	[49,]	76.89661	131.88990	86.39356	103.31738	85.72236	70.77113	99.91781
##	[50,]	111.25078	70.53798	108.24536	77.67125	144.06536	114.50228	47.45748

##	[51,]	100.58730	133.85834	89.44521	94.32393	63.40312	84.02995	102.52362
##	[52,]	72.20525	112.02811	87.86696	102.22484	61.20073	87.43131	102.39746
##	[53,]	99.47638	111.30676	76.57396	105.60463	66.63825	101.50390	90.81543
##	[54,]	62.25150	94.83198	61.74152	93.95896	90.53260	105.33474	75.36259
##	[55,]	85.61804	91.42489	65.58888	52.37991	69.43559	98.90933	83.11157
##	[56,]	84.04791	127.88571	68.84859	78.61257	79.93426	73.19127	112.86518
##	[57,]	110.09841	86.81048	104.87925	125.80401	80.07098	80.66281	109.62701
##	[58,]	146.62442	91.85551	109.57612	69.37345	88.79597	95.25022	79.73335
##	[59,]	89.83548	35.56997	111.24279	72.12796	126.94754	107.14509	62.42175
##	[60,]	68.18503	104.87387	97.81183	92.34174	99.10359	68.76282	89.49723
##	[61,]	96.70776	82.89728	82.66265	74.46344	67.15681	122.08301	88.66072
##	[62,]	88.33264	93.21641	85.40338	99.52632	70.07923	93.41931	107.77451
##	[63,]	63.87256	76.07834	59.91157	75.88210	105.65011	60.67015	87.11202
##	[64,]	89.62489	87.51677	69.93850	94.56075	68.69224	75.48481	112.52315
##	[65,]	109.45205	69.19435	104.81643	79.93236	103.58935	84.62240	81.17374
##	[66,]	89.51283	67.54424	96.73611	60.75153	88.04507	98.44858	74.64004
##	[67,]	76.06333	99.90247	68.58529	94.75857	107.75774	88.08009	77.12974
##	[68,]	87.10129	73.52137	66.57552	82.27701	123.07541	107.80861	62.51124
##	[69,]	99.64592	115.68091	54.82453	85.01063	78.33536	120.55068	86.44647
##	[70,]	79.97867	69.80190	80.19072	70.29700	85.47690	78.13635	95.64736
##	[71,]	73.34967	106.05560	72.20258	79.95328	71.49048	88.30062	87.70522
##	[72,]	NA	84.68827	76.50712	112.10181	96.11440	78.46815	91.84632
##	[73,]	NA	NA	104.45482	82.59236	119.44941	89.60765	71.88110
##	[74,]	NA	NA	NA	80.08557	68.76937	88.79946	95.10294
##	[75,]	NA	NA	NA	NA	100.34933	103.70361	68.81564
##	[76,]	NA	NA	NA	NA	NA	73.46934	137.14581
##	[77,]	NA	NA	NA	NA	NA	NA	135.75796
##	[78,]	NA	NA	NA	NA	NA	NA	NA
##	[79,]	NA	NA	NA	NA	NA	NA	NA
##	[80,]	NA	NA	NA	NA	NA	NA	NA
##	[81,]	NA	NA	NA	NA	NA	NA	NA
##	[82,]	NA	NA	NA	NA	NA	NA	NA
##	[83,]	NA	NA	NA	NA	NA	NA	NA
##	[84,]	NA	NA	NA	NA	NA	NA	NA
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,79]	[,80]	[,81]	[,82]	[,83]	[,84]	[,85]
##	[1,]	61.25120	88.17506	71.55586	98.58090	74.85725	85.24741	81.80184
##	[2,]	94.29078	98.52182	113.00092	100.81982	96.94128	104.09815	78.46119
##	[3,]	57.85006	85.46312	80.96421	80.83483	70.12004	100.42956	71.66126

##	[4,]	117.77523	88.39070	78.67526	92.17192	82.09726	95.25288	83.77174
##	[5,]	135.51721	115.09035	105.08198	105.74285	104.51442	103.64997	88.85663
##	[6,]	91.98606	82.77080	87.33260	74.79097	99.02876	83.92946	90.25774
##	[7,]	94.31562	75.26375	78.21065	63.34064	96.93397	71.07690	107.00639
##	[8,]	116.52033	118.21714	70.27217	83.51531	59.65130	72.63681	103.24567
##	[9,]	84.17057	119.20993	83.43806	107.98149	106.40040	129.44012	74.85532
##	[10,]	90.49523	72.37249	64.92770	86.02574	69.89739	68.61722	97.25135
##	[11,]	69.85972	61.70285	82.83434	83.37257	85.36963	102.00478	80.08301
##	[12,]	39.21415	64.04865	79.53230	88.18613	86.41085	81.91420	89.11542
##	[13,]	90.67424	117.67631	139.74246	123.68972	75.42769	83.85925	62.34474
##	[14,]	63.85616	88.83629	61.22382	60.06879	77.60722	80.91762	118.15169
##	[15,]	80.78528	100.95906	108.27864	94.77529	86.25212	94.65481	72.20774
##	[16,]	86.86474	71.85511	83.55913	72.51451	87.77351	90.03504	92.59286
##	[17,]	76.07163	72.34552	109.18898	87.45764	84.82072	70.99711	89.46143
##	[18,]	96.44474	33.63682	55.15433	50.36892	90.43092	62.15398	120.84277
##	[19,]	88.41606	113.55682	90.66904	116.33473	67.56625	110.35156	67.50278
##	[20,]	73.94780	90.08294	88.28565	68.64708	104.41565	82.41565	104.31546
##	[21,]	92.53062	95.96396	79.04113	54.65287	59.85055	57.39044	122.60591
##	[22,]	110.93195	107.70921	73.22317	90.53300	83.02442	73.69262	112.03680
##	[23,]	104.51846	93.55447	88.13660	68.07284	98.61468	76.88059	113.23639
##	[24,]	106.46517	99.76700	93.24519	108.19286	104.14665	105.59797	79.48478
##	[25,]	75.95230	80.92674	86.06563	81.10696	72.92986	98.26709	67.68646
##	[26,]	100.36156	53.21798	69.75101	50.01103	102.75296	86.99840	104.84281
##	[27,]	69.83580	74.36038	109.08244	78.40681	89.38446	75.45516	90.86101
##	[28,]	76.33043	75.43039	93.99960	89.87387	78.07717	83.77821	83.40574
##	[29,]	100.32870	83.37459	54.56789	69.49368	79.76143	84.30719	104.29585
##	[30,]	113.74214	115.32514	94.54526	95.16461	104.25234	107.78204	96.31931
##	[31,]	116.91826	75.10326	88.75138	83.01226	129.54847	84.47319	108.78757
##	[32,]	97.54432	76.43953	97.84042	99.87777	102.51316	82.27000	86.42635
##	[33,]	59.49171	68.78045	67.11191	87.71530	83.14200	73.44781	108.21929
##	[34,]	106.93210	65.46414	96.71313	79.71022	137.03975	86.36681	107.09788
##	[35,]	94.28627	84.08308	95.74643	74.97931	104.25401	80.29635	97.09675
##	[36,]	88.18555	76.24483	63.76193	79.79841	59.48542	64.32965	98.38458
##	[37,]	102.31547	123.08875	86.14338	101.52698	85.52832	93.55901	95.53576
##	[38,]	96.41004	92.52954	101.96099	93.56756	74.84316	85.96499	91.64963
##	[39,]	93.44089	90.14147	101.58412	107.21105	89.42897	97.59985	82.47166
##	[40,]	100.95686	101.23314	95.60435	104.67773	89.47331	78.95608	89.34886
##	[41,]	80.56767	59.29776	74.98743	71.05455	95.44843	93.05727	85.91776
##	[42,]	100.51432	124.62865	88.14566	80.95224	90.36513	83.65283	114.79377
##	[43,]	95.52615	121.27473	85.45026	87.22516	89.61500	88.43380	107.05103
##	[44,]	64.41497	63.76760	68.11094	73.92248	93.91688	90.75137	87.27607
##	[45,]	114.76674	79.70393	71.32016	65.15960	100.23177	85.46170	113.91240
##	[46,]	104.60303	100.35317	67.88856	63.41599	87.91544	74.09374	126.06188
##	[47,]	83.89890	80.62253	124.09181	82.14576	105.94556	91.92090	81.81828
##	[48,]	95.75173	70.63222	84.29809	90.78747	93.30001	80.16784	102.79307
##	[49,]	93.08983	103.37367	77.50545	114.11890	84.81139	110.97760	77.95667
##	[50,]	65.63717	109.88010	90.22219	87.08688	66.13517	99.57257	73.44146
##	[51,]	112.17696	108.49692	69.62644	95.33812	88.49067	98.33130	96.43335
##	[52,]	142.32156	85.73725	93.91791	109.19016	99.65258	96.38518	83.73720
##	[53,]	124.34935	108.48554	66.43737	69.05907	65.54053	66.10240	118.64048
##	[54,]	132.70135	102.16471	89.66615	96.65130	96.17013	97.64338	92.87823
##	[55,]	125.14342	78.79297	101.34812	98.85019	124.83613	107.55048	81.81340
##	[56,]	86.90417	95.24240	83.22998	125.13650	83.04132	93.39315	77.50589
##	[57,]	74.84072	102.01551	110.52051	87.46805	67.10903	66.90875	90.32919

##	[58,]	81.79831	114.33046	115.15497	102.74481	95.41904	116.17715	58.57984
##	[59,]	60.93162	64.60755	80.93420	54.68038	98.78846	84.49138	103.82987
##	[60,]	87.44243	79.34840	54.24494	90.62416	97.94672	113.83640	89.29028
##	[61,]	114.09932	87.32129	104.51706	77.52639	111.26729	74.79489	112.44823
##	[62,]	93.27173	70.80965	92.01972	83.20580	66.38090	44.38317	105.92006
##	[63,]	71.68921	62.31936	86.87688	95.58401	90.91768	98.39791	72.41985
##	[64,]	82.36517	64.79088	73.86432	65.09121	67.39690	39.81035	117.52029
##	[65,]	61.22615	71.05413	68.49837	58.27706	71.73407	74.53240	98.90565
##	[66,]	101.04416	73.38457	107.98746	87.89300	143.33019	120.28623	79.54626
##	[67,]	76.79062	91.33200	108.66888	114.48174	54.09403	88.31696	60.98775
##	[68,]	80.46480	108.96975	103.66822	95.00483	73.97215	90.31191	79.11036
##	[69,]	99.53545	117.72883	101.35976	96.70562	62.30435	63.59636	101.66567
##	[70,]	77.54192	67.65050	83.08884	69.93428	134.61970	98.69748	107.21369
##	[71,]	134.58582	78.78022	64.59308	86.95989	98.19820	95.86689	97.43768
##	[72,]	99.10683	54.49761	71.03962	81.27911	92.45909	81.03987	106.68724
##	[73,]	70.05099	61.66507	85.19614	53.51777	106.79880	87.71960	99.51186
##	[74,]	108.34231	95.01755	109.67547	104.43377	87.41788	81.38084	86.35112
##	[75,]	82.33055	94.02882	105.32021	105.00597	121.12928	124.49908	65.08919
##	[76,]	121.95603	89.84644	99.01072	98.25093	96.36618	70.06214	101.53555
##	[77,]	73.72788	59.22110	80.33786	97.45933	93.89844	87.64223	80.15842
##	[78,]	90.08313	104.97497	92.68965	80.96012	88.38180	113.54879	80.87421
##	[79,]	NA	79.23865	89.92937	87.58302	85.13024	93.28119	79.61539
##	[80,]	NA	NA	65.71920	65.59051	102.73816	75.47965	106.16786
##	[81,]	NA	NA	NA	52.65297	79.16362	72.72145	127.47088
##	[82,]	NA	NA	NA	NA	86.40192	58.37785	144.06069
##	[83,]	NA	NA	NA	NA	NA	56.21415	95.67606
##	[84,]	NA	NA	NA	NA	NA	NA	135.73381
##	[85,]	NA	NA	NA	NA	NA	NA	NA
##	[86,]	NA	NA	NA	NA	NA	NA	NA
##	[87,]	NA	NA	NA	NA	NA	NA	NA
##	[88,]	NA	NA	NA	NA	NA	NA	NA
##	[89,]	NA	NA	NA	NA	NA	NA	NA
##	[90,]	NA	NA	NA	NA	NA	NA	NA
##	[91,]	NA	NA	NA	NA	NA	NA	NA
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,86]	[,87]	[,88]	[,89]	[,90]	[,91]	[,92]
##	[1,]	93.05431	89.59873	64.59936	111.88497	93.30865	106.76198	107.65050
##	[2,]	104.39312	99.95862	60.28851	37.42203	90.57197	44.36235	119.06194
##	[3,]	110.98029	102.46862	58.32334	68.17250	85.43357	118.32162	115.94959
##	[4,]	93.57290	79.48508	110.58945	103.42737	58.84683	97.60439	80.00031
##	[5,]	79.85181	81.85531	105.23921	89.03587	75.45691	64.59222	75.39919
##	[6,]	116.62255	65.90495	82.72461	117.24133	91.78822	100.57108	83.71391
##	[7,]	108.09262	79.44513	67.10665	93.74503	93.45042	73.88536	98.79957
##	[8,]	76.25187	83.64075	91.81941	115.59866	59.17702	104.28692	57.22402
##	[9,]	76.81817	61.26631	66.87306	106.23812	94.07608	114.70115	105.10227
##	[10,]	81.97867	91.78746	120.17972	128.71464	76.25617	115.15289	69.94684

##	[11,]	95.78705	109.16033	91.11677	55.03117	86.45076	103.92419	114.33321
##	[12,]	89.05196	116.04013	71.98726	77.44023	118.38594	86.98373	128.36071
##	[13,]	115.55938	93.23340	102.35591	106.18870	95.74041	70.80661	67.51617
##	[14,]	50.68935	113.98604	77.44640	64.84689	104.73707	112.19866	98.10204
##	[15,]	127.42152	70.73188	55.42810	88.26221	91.44266	85.52040	98.68330
##	[16,]	101.20303	98.23021	84.26443	70.55917	76.40279	108.89048	89.60725
##	[17,]	109.21464	102.71985	91.47502	71.55639	110.05072	52.43582	101.33249
##	[18,]	96.75984	81.64598	88.77720	87.82587	77.64188	87.74002	95.66799
##	[19,]	79.95604	119.91501	79.71747	66.69446	65.05397	100.60096	98.80727
##	[20,]	96.96929	78.14899	52.78228	83.27506	122.68344	69.32923	113.41226
##	[21,]	63.32884	109.13604	116.19136	80.32037	93.73130	98.31638	57.62037
##	[22,]	58.03681	90.44795	95.77262	108.44323	85.59059	73.99584	77.79882
##	[23,]	94.14925	67.60571	68.47383	87.41891	90.22026	76.92735	81.94278
##	[24,]	106.77202	65.31752	44.75794	85.01035	76.72787	57.35196	117.75911
##	[25,]	126.23648	93.70963	73.45566	79.29124	75.17245	112.74617	104.92579
##	[26,]	103.68198	84.65033	94.24539	79.51105	78.17915	103.05450	92.91406
##	[27,]	116.41975	83.69992	79.57393	74.92943	114.31421	69.20093	99.37482
##	[28,]	90.74922	99.03312	129.98298	102.08458	94.11542	116.08274	71.21138
##	[29,]	73.35854	105.03809	94.97268	89.05009	73.61621	101.37771	93.67498
##	[30,]	74.03175	70.72194	78.21003	79.76739	80.51330	84.62560	84.12714
##	[31,]	87.40262	58.57518	112.12659	126.92092	94.61342	84.12563	68.70528
##	[32,]	109.65382	92.99809	82.83022	98.21192	85.63722	68.33405	93.72430
##	[33,]	58.40066	115.26436	87.92056	84.98156	107.32624	91.99432	105.62132
##	[34,]	100.26010	50.73993	94.23260	104.34058	104.98759	65.31923	88.65272
##	[35,]	114.48764	79.33812	66.47051	89.59801	97.60091	69.77738	96.36205
##	[36,]	90.00692	114.19476	90.73226	99.89474	64.26037	110.03788	78.80454
##	[37,]	51.45676	82.20672	120.50897	123.85574	91.72593	109.00435	58.41084
##	[38,]	74.52678	120.82540	121.44884	64.25060	82.33667	87.88696	71.63390
##	[39,]	84.64160	93.81293	105.27219	86.73078	78.11651	102.25836	74.04071
##	[40,]	80.68672	94.42440	123.97438	136.01095	91.24443	95.67254	57.34758
##	[41,]	116.04231	76.06526	77.35920	86.66708	89.83700	93.87230	116.95410
##	[42,]	51.51064	76.77422	99.52218	105.21724	101.29682	100.80976	56.67449
##	[43,]	59.65577	92.82634	77.67865	88.92300	95.03693	91.10338	79.17394
##	[44,]	111.04878	75.84288	61.89778	100.07776	94.05770	113.62884	114.56480
##	[45,]	90.25164	59.36831	75.12991	86.88145	70.53326	90.99659	84.77171
##	[46,]	66.54534	60.50424	79.16289	96.74580	93.49814	82.18278	82.63652
##	[47,]	113.82587	90.56231	113.52783	83.51166	111.11378	89.89428	75.85609
##	[48,]	84.47925	79.18313	88.81626	81.75132	89.04088	63.39755	100.44310
##	[49,]	77.06581	91.55537	63.80849	77.10170	72.87457	81.28433	119.86468
##	[50,]	94.96725	102.12562	79.41607	85.14755	90.02953	130.04728	88.56863
##	[51,]	65.66981	89.12067	82.72395	91.94578	73.46405	81.81791	97.47479
##	[52,]	98.68561	62.34340	114.70975	111.55854	51.07754	78.50891	70.05650
##	[53,]	70.54138	96.10817	86.13982	87.30086	63.39195	77.77844	72.14354
##	[54,]	95.59353	59.63351	76.03071	90.96524	53.96117	78.58315	80.01670
##	[55,]	105.55266	74.99358	107.29205	98.35278	72.55962	82.41667	81.89625
##	[56,]	79.92736	100.01061	84.82400	109.51631	76.37311	93.46809	94.29117
##	[57,]	99.01955	97.52301	92.24910	86.67316	112.19484	69.64096	82.32373
##	[58,]	107.30206	92.28428	91.55587	88.78276	104.17840	93.60401	97.65791
##	[59,]	86.95367	97.85151	101.52963	85.14455	116.01165	124.05115	87.63342
##	[60,]	74.71701	86.90746	63.43634	76.21821	75.00872	100.40536	130.84487
##	[61,]	79.26221	81.82789	136.68677	108.90024	102.03129	83.51870	45.08428
##	[62,]	85.80913	117.44172	138.54180	105.60104	86.13141	88.98999	48.87197
##	[63,]	119.68618	104.08320	55.05019	63.20462	79.73840	84.80888	130.47950
##	[64,]	84.75460	127.08063	99.15462	86.18787	92.25727	79.42235	80.66420

##	[65,]	88.59639	125.62530	90.26489	77.06933	100.04750	112.14596	99.50557
##	[66,]	107.59341	66.35841	105.23536	87.64866	101.00904	89.21294	96.17611
##	[67,]	111.87748	128.09141	83.48927	61.71264	69.93640	85.12494	95.93643
##	[68,]	105.52006	92.98311	63.37959	78.29538	85.49837	93.78655	88.56451
##	[69,]	70.74474	120.37829	103.07812	89.51958	85.11353	78.79457	54.83930
##	[70,]	83.60108	80.96452	73.44622	75.86909	123.08204	78.38040	119.28362
##	[71,]	87.88916	79.32890	92.00069	95.56813	42.93943	89.81634	87.87020
##	[72,]	86.34045	86.50834	86.08605	73.83748	70.17059	82.65453	98.29661
##	[73,]	109.20415	76.01147	80.63279	83.13698	111.02893	105.14914	100.12175
##	[74,]	106.23452	101.60333	75.80156	72.42748	74.89689	49.30989	89.42545
##	[75,]	100.67109	89.67054	91.50204	96.44598	100.46069	107.99673	98.43790
##	[76,]	89.79467	84.23680	107.91179	107.56423	85.17809	47.72528	72.83257
##	[77,]	112.34863	86.61134	67.50018	92.37417	91.41547	74.87800	127.25914
##	[78,]	90.25747	94.84030	84.60297	65.00383	81.22426	116.12132	89.69857
##	[79,]	89.81627	115.18993	74.52107	77.14088	131.17232	109.09297	120.02462
##	[80,]	97.69721	92.63257	98.09357	87.54324	90.96395	95.87985	104.17672
##	[81,]	57.46334	91.21862	85.65171	96.46871	75.08341	118.46376	94.72304
##	[82,]	70.69649	91.99105	90.95549	79.60659	99.82183	99.61191	84.31255
##	[83,]	82.30278	129.24120	89.74692	79.19027	67.80775	92.87426	74.20520
##	[84,]	73.18227	111.45402	107.33791	94.28398	89.78422	77.30445	58.88903
##	[85,]	131.29235	88.90266	76.92088	86.93480	83.24020	91.48283	112.31477
##	[86,]	NA	101.07719	108.48506	98.20361	99.23723	107.54317	71.21984
##	[87,]	NA	NA	83.22262	118.47895	87.66543	89.08809	89.66330
##	[88,]	NA	NA	NA	62.89538	90.12753	79.01949	139.14218
##	[89,]	NA	NA	NA	NA	91.36217	70.74691	119.45501
##	[90,]	NA	NA	NA	NA	NA	91.46575	79.41148
##	[91,]	NA	NA	NA	NA	NA	NA	93.12437
##	[92,]	NA	NA	NA	NA	NA	NA	NA
##	[93,]	NA	NA	NA	NA	NA	NA	NA
##	[94,]	NA	NA	NA	NA	NA	NA	NA
##	[95,]	NA	NA	NA	NA	NA	NA	NA
##	[96,]	NA	NA	NA	NA	NA	NA	NA
##	[97,]	NA	NA	NA	NA	NA	NA	NA
##	[98,]	NA	NA	NA	NA	NA	NA	NA
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##		[,93]	[,94]	[,95]	[,96]	[,97]	[,98]	[,99]
##	[1,]	114.72325	76.51334	79.18578	71.13806	57.91276	103.06602	80.83394
##	[2,]	54.69772	104.76424	133.16204	104.11534	103.63213	77.18252	109.34096
##	[3,]	110.96244	114.59200	108.15635	109.65451	70.78593	88.98882	83.82391
##	[4,]	90.27923	120.37082	60.86233	96.47407	102.96804	99.90548	88.81822
##	[5,]	57.73777	85.76202	86.60747	92.27398	107.80786	88.00536	120.47112
##	[6,]	103.53298	71.35030	64.62454	109.80988	56.47060	110.87108	97.18248
##	[7,]	89.75654	71.56403	74.39922	115.25044	63.34564	98.92443	107.69852
##	[8,]	92.58843	85.52287	47.82793	96.55892	58.98521	82.87355	90.59921
##	[9,]	88.54393	80.03400	87.61837	57.57981	70.23023	128.00369	101.06431
##	[10,]	119.14576	93.60551	48.29616	79.11818	90.51073	92.47785	66.80378
##	[11,]	95.29269	134.08159	116.11764	93.21378	124.45042	82.40115	77.12887
##	[12,]	116.14599	83.07367	112.63135	80.29370	87.59315	90.30252	82.23204
##	[13,]	98.92718	83.66740	94.02747	102.24681	70.89632	79.98966	73.65950
##	[14,]	102.96003	89.56847	105.69211	84.57934	84.31537	76.16525	83.31056
##	[15,]	85.53041	95.66207	95.99117	102.43891	57.07279	99.02703	78.59050
##	[16,]	81.89534	95.81781	101.48741	103.97646	101.27348	70.47644	96.24801
##	[17,]	96.02520	108.77811	106.00355	106.08512	96.31281	83.11315	64.39442

##	[18,]	83.50296	105.49560	65.57423	94.70165	105.19329	90.75665	77.96169
##	[19,]	81.29191	100.54676	115.77081	84.79089	101.66017	62.97967	108.30837
##	[20,]	95.35271	71.98333	94.77388	103.38081	51.73675	111.37964	96.62867
##	[21,]	109.97692	112.67463	79.61785	112.52155	84.28307	68.52394	56.64668
##	[22,]	87.38009	70.63578	63.65308	79.20516	79.39104	90.98832	101.55359
##	[23,]	64.96231	76.60296	81.19903	97.35974	71.51931	90.16707	93.31768
##	[24,]	49.24540	85.28739	91.44856	79.24939	83.48089	105.17651	114.94325
##	[25,]	109.59229	120.75011	93.23661	123.27664	75.02460	93.28642	86.24824
##	[26,]	88.15221	100.98561	80.02630	119.13963	103.59905	92.86035	105.71107
##	[27,]	94.32482	111.72637	103.43183	103.03374	82.61380	93.80694	48.56176
##	[28,]	120.08023	110.57263	84.77204	88.36245	104.39499	86.35588	51.24266
##	[29,]	104.02627	93.37337	71.89549	106.92527	89.68114	89.35570	115.16855
##	[30,]	47.80702	87.09919	95.86054	74.13648	96.87326	89.99150	103.46130
##	[31,]	75.17299	46.79352	59.82779	77.89286	98.18313	107.32629	109.63274
##	[32,]	75.89508	50.53663	90.36728	93.80547	91.80976	80.12089	123.25488
##	[33,]	100.90075	77.28864	100.25274	54.49681	103.26497	78.47462	76.55599
##	[34,]	63.93417	69.99138	76.62159	78.73275	102.66921	113.49658	94.23864
##	[35,]	81.79898	63.04530	88.15039	115.39650	65.74613	94.28004	114.22484
##	[36,]	103.76310	76.40965	73.00248	99.26013	81.75070	61.71452	98.20902
##	[37,]	103.77302	79.96790	65.66460	67.47822	81.87162	100.65626	81.25977
##	[38,]	83.65555	113.01964	110.37802	95.13894	127.59919	52.39730	78.25620
##	[39,]	71.04330	92.05807	102.62028	66.92315	119.78722	68.41906	79.82022
##	[40,]	109.06919	46.01021	65.24271	86.42197	79.73492	87.57973	103.54797
##	[41,]	103.21548	119.37750	80.49143	105.78110	87.25329	117.35994	81.66517
##	[42,]	87.77220	71.23311	76.37142	75.80660	70.12248	91.88387	79.91128
##	[43,]	79.38862	58.30746	93.14541	81.43754	71.01013	80.42371	108.34208
##	[44,]	108.24276	87.15867	80.54214	89.75035	67.82072	113.21289	86.16318
##	[45,]	54.47547	96.90414	71.54779	86.02751	94.13579	94.50899	90.76651
##	[46,]	80.56471	102.65586	60.56355	80.45749	70.34174	109.96532	65.93974
##	[47,]	99.84452	91.12247	106.68166	118.55152	96.85047	87.08492	82.30698
##	[48,]	66.61469	114.46202	86.96115	64.19330	117.24629	93.35438	62.09453
##	[49,]	70.13486	104.12670	98.73849	63.09896	100.00487	94.97069	102.48983
##	[50,]	120.54355	100.75229	100.21767	107.06213	59.67244	86.33280	80.51805
##	[51,]	79.04258	87.93914	76.43894	82.36686	89.33498	97.69186	118.67041
##	[52,]	54.26259	103.09312	60.16000	75.31937	123.80693	94.68243	93.37566
##	[53,]	79.55187	92.28904	63.19179	111.54564	74.15343	73.94412	105.13384
##	[54,]	32.99229	94.85934	75.64157	80.07482	98.03866	88.12571	101.98043
##	[55,]	61.04253	71.24122	84.71378	95.10504	119.82847	92.63968	135.87888
##	[56,]	84.97374	60.65770	87.47903	52.78030	94.25411	80.67082	105.33368
##	[57,]	112.14634	108.09300	93.45769	108.44088	65.00735	86.68014	45.49149
##	[58,]	115.04643	94.74374	103.90163	119.10386	70.18958	108.22358	104.30937
##	[59,]	120.76955	85.31377	97.87828	102.80437	87.86985	92.18812	78.89234
##	[60,]	77.14975	102.77832	93.07023	65.60871	106.34511	105.92669	111.27268
##	[61,]	85.08471	62.09102	75.33799	96.57571	101.81197	84.04521	93.83016
##	[62,]	107.44253	81.12732	74.66468	98.62668	103.15666	52.54898	67.79859
##	[63,]	78.29830	92.94325	117.17506	93.94808	101.89251	78.67217	108.50356
##	[64,]	107.32511	72.98035	83.79805	110.85390	87.00383	55.78066	90.10982
##	[65,]	136.19385	91.43106	95.60391	124.08973	75.86037	79.51786	94.25483
##	[66,]	77.57788	88.95873	98.98672	97.24294	116.83356	115.01901	111.61951
##	[67,]	87.38650	114.15225	122.00258	100.67698	103.39768	45.99338	79.55097
##	[68,]	83.86163	88.73733	105.78625	99.57255	66.20131	74.24563	85.00394
##	[69,]	87.81975	65.73186	93.33374	97.46128	80.56589	43.02853	92.91365
##	[70,]	81.83894	66.23688	106.37523	84.38307	96.75836	110.33442	113.86081
##	[71,]	57.80674	88.18889	64.79604	88.57682	113.83404	88.04691	131.78778

##	[72,]	55.17164	108.55965	89.53259	66.93977	132.49617	76.44242	78.86206
##	[73,]	103.85932	94.75428	92.90291	109.01573	79.50866	107.17347	79.03191
##	[74,]	52.93424	74.67822	105.80889	100.64139	98.03558	58.01094	114.74473
##	[75,]	96.48741	54.85332	107.98042	93.61602	90.56196	101.44912	136.78812
##	[76,]	72.98789	72.03524	69.25586	90.33783	97.73744	85.78152	100.08769
##	[77,]	92.26543	93.21015	89.06710	79.37028	92.41420	104.74067	88.38043
##	[78,]	88.00300	108.17036	108.99775	109.85260	90.71659	83.85845	101.26730
##	[79,]	134.60868	85.63431	123.28827	86.44437	74.35444	94.10104	73.27715
##	[80,]	92.92722	93.50691	84.17185	84.65601	121.08660	90.57944	84.51368
##	[81,]	99.20477	93.63968	58.60612	76.81583	90.61122	94.34386	89.36446
##	[82,]	102.63614	96.05616	72.80585	110.58599	81.10240	89.21501	79.23931
##	[83,]	106.16496	112.47093	85.98364	106.78426	75.24284	46.10999	64.37155
##	[84,]	100.81717	86.11645	67.11017	101.52484	82.42053	55.80999	59.45205
##	[85,]	89.41760	98.25128	118.50019	91.79439	91.40726	99.29549	105.03763
##	[86,]	100.36037	76.00702	75.10139	64.67058	91.54049	83.67907	81.73306
##	[87,]	66.08900	86.30730	62.10974	72.02774	84.89873	141.56403	94.28162
##	[88,]	78.47884	100.70278	110.58444	96.11951	65.68809	103.47792	103.35254
##	[89,]	77.83487	122.21856	137.54834	116.96807	100.97949	66.55189	94.41217
##	[90,]	60.42685	113.40859	67.39186	92.93465	107.81990	71.40682	102.66367
##	[91,]	55.93587	92.80910	102.33904	103.23564	95.44492	76.65229	92.81394
##	[92,]	91.42042	77.74490	56.81968	92.90617	88.93772	68.44050	72.68934
##	[93,]	NA	99.30137	89.05612	81.24815	117.34249	86.05818	108.05375
##	[94,]	NA	NA	82.43764	73.41636	77.49689	97.31855	111.52483
##	[95,]	NA	NA	NA	79.05570	82.47076	102.65801	82.29692
##	[96,]	NA	NA	NA	NA	107.57017	107.69406	82.07134
##	[97,]	NA	NA	NA	NA	NA	103.76896	83.90678
##	[98,]	NA	NA	NA	NA	NA	NA	81.26699
##	[99,]	NA	NA	NA	NA	NA	NA	NA
##	[100,]	NA	NA	NA	NA	NA	NA	NA
##	[,100]							
##	[1,]	87.68579						
##	[2,]	102.57720						
##	[3,]	92.36177						
##	[4,]	85.87497						
##	[5,]	97.85777						
##	[6,]	71.14450						
##	[7,]	65.82195						
##	[8,]	76.65946						
##	[9,]	134.67276						
##	[10,]	67.61763						
##	[11,]	95.35892						
##	[12,]	89.92481						
##	[13,]	86.09356						
##	[14,]	102.43832						
##	[15,]	93.96961						
##	[16,]	69.42447						
##	[17,]	86.47953						
##	[18,]	58.24415						
##	[19,]	96.38569						
##	[20,]	100.56970						
##	[21,]	89.26820						
##	[22,]	89.56297						
##	[23,]	83.47650						
##	[24,]	97.34898						

```
## [25,] 80.75054
## [26,] 65.25431
## [27,] 95.13426
## [28,] 86.86858
## [29,] 77.00516
## [30,] 111.83209
## [31,] 71.98098
## [32,] 53.36680
## [33,] 89.28645
## [34,] 84.87033
## [35,] 69.69401
## [36,] 39.57105
## [37,] 112.31895
## [38,] 89.20771
## [39,] 87.70192
## [40,] 69.64432
## [41,] 88.76130
## [42,] 111.58281
## [43,] 99.78413
## [44,] 81.15455
## [45,] 83.24572
## [46,] 111.66555
## [47,] 85.45153
## [48,] 97.98132
## [49,] 112.37935
## [50,] 99.86659
## [51,] 100.65746
## [52,] 77.69397
## [53,] 75.16968
## [54,] 86.34503
## [55,] 69.15634
## [56,] 78.56573
## [57,] 99.75771
## [58,] 111.66444
## [59,] 86.18471
## [60,] 105.94593
## [61,] 75.35778
## [62,] 42.64110
## [63,] 70.14455
## [64,] 40.35763
## [65,] 71.99914
## [66,] 98.94226
## [67,] 73.57645
## [68,] 88.64427
## [69,] 71.31118
## [70,] 100.89285
## [71,] 64.55072
## [72,] 75.69913
## [73,] 88.05128
## [74,] 64.17317
## [75,] 91.58818
## [76,] 70.46621
## [77,] 79.76707
## [78,] 104.16054
```

```
## [79,] 105.48334
## [80,] 60.26447
## [81,] 78.40926
## [82,] 79.32055
## [83,] 70.34524
## [84,] 52.60514
## [85,] 103.26930
## [86,] 101.58812
## [87,] 108.77435
## [88,] 108.11050
## [89,] 97.98374
## [90,] 62.41196
## [91,] 84.62179
## [92,] 69.14638
## [93,] 87.50429
## [94,] 82.12017
## [95,] 70.06870
## [96,] 105.59322
## [97,] 103.54268
## [98,] 54.89974
## [99,] 93.62767
## [100,] NA
```

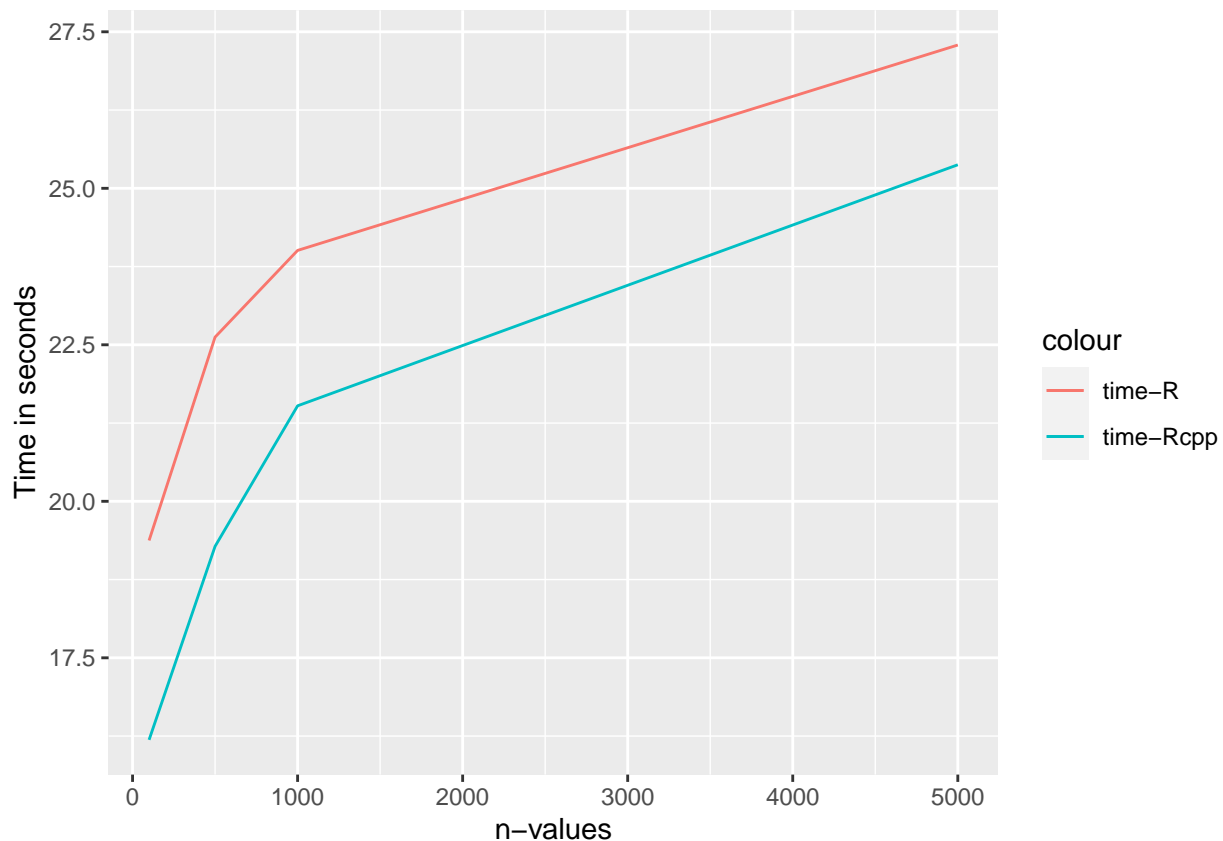
Test the time difference between these functions for $n = 1000$ and $Nvec = 100, 500, 1000, 5000$ using the package `microbenchmark`. Store the results in a matrix with rows representing $Nvec$ and two columns for base R and Rcpp.

```
pacman::p_load(microbenchmark)
```

```
n = 1000
Nvec = c(100,500,1000,5000)
time_r = c()
time_cpp = c()
for (i in 1:length(Nvec)){
  X = c()
  for (j in 1:n){
    x = rnorm(Nvec[i])
    X = cbind(X, x)
  }
  time_r = c(time_r, mean(microbenchmark(angles_r = all_angles(X), times = 3, unit = "s")$time))
  time_cpp = c(time_cpp, mean(microbenchmark(angles_cpp = all_angles_cpp(X), times = 3, unit = "s")$time))
}
```

Plot the divergence of performance (in log seconds) over $nvec$ using a line geometry. Use two different colors for the R and CPP functions. Make sure there's a color legend on your plot. We will see later how to create "long" matrices that make such plots easier.

```
pacman::p_load(ggplot2)
ggplot() +
  geom_line(aes(x = Nvec, y = log(time_r), col = "time-R")) +
  geom_line(aes(x = Nvec, y = log(time_cpp), col = "time-Rcpp")) +
  xlab("n-values") +
  ylab("Time in seconds")
```

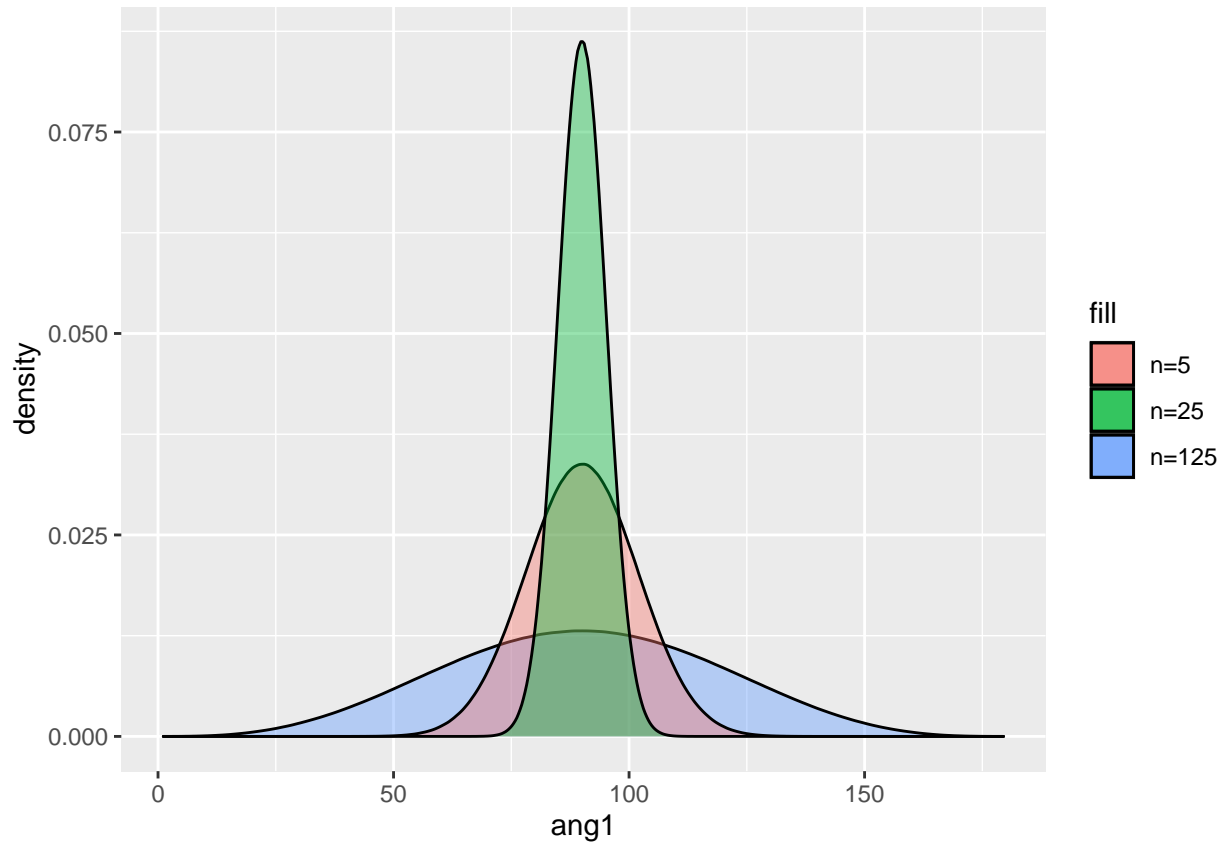


Let `Nvec = 10000` and vary `n` to be 10, 100, 1000. Plot the density of angles for all three values of `n` on one plot using color to signify `n`. Make sure you have a color legend. This is not easy.

```
Nvec = 10000
X <- c()
for (i in 1:5){
  x <- rnorm(Nvec)
  X <- cbind(X, x)
}
ang1 <- all_angles(X)
X <- c()
for (i in 1:25){
  x <- rnorm(Nvec)
  X <- cbind(X, x)
}
ang2 <- all_angles(X)
X <- c()
for (i in 1:125){
  x <- rnorm(Nvec)
  X <- cbind(X, x)
}
ang3 <- all_angles(X)

ggplot() +
  geom_density(aes(x = ang1, fill = "red"), alpha = .4) +
  geom_density(aes(x = ang2, fill = "blue"), alpha = .4) +
  geom_density(aes(x = ang3, fill = "purple"), alpha = .4) +
  scale_fill_discrete(labels = c("n=5", "n=25", "n=125"))
```

```
## Warning: Removed 50005000 rows containing non-finite values (stat_density).
## Warning: Removed 50005000 rows containing non-finite values (stat_density).
## Warning: Removed 50005000 rows containing non-finite values (stat_density).
```



Write an R function `nth_fibonnaci` that finds the `nth` Fibonnaci number via recursion but allows you to specify the starting number. For instance, if the sequeency started at 1, you get the familiar 1, 1, 2, 3, 5, etc. But if it started at 0.01, you would get 0.01, 0.01, 0.02, 0.03, 0.05, etc.

```
nth_fibonacci <- function(n, start){
  if (n == 1 | n == 2) return(start)
  else return(nth_fibonacci(n-1, start) + nth_fibonacci(n-2, start))
}
nth_fibonacci(15, 1)
```

```
## [1] 610
```

Write an Rcpp function `nth_fibonnaci_cpp` that does the same thing. Use an IDE if ou want, but write it below in-line.

```
cppFunction(
  'double nth_fibonacci_cpp(int n, double start){
    if (n == 1 || n == 2) return start;
    else return (nth_fibonacci_cpp(n-1, start) + nth_fibonacci_cpp(n-2, start));
  }'
)
nth_fibonacci_cpp(15, 1)
```

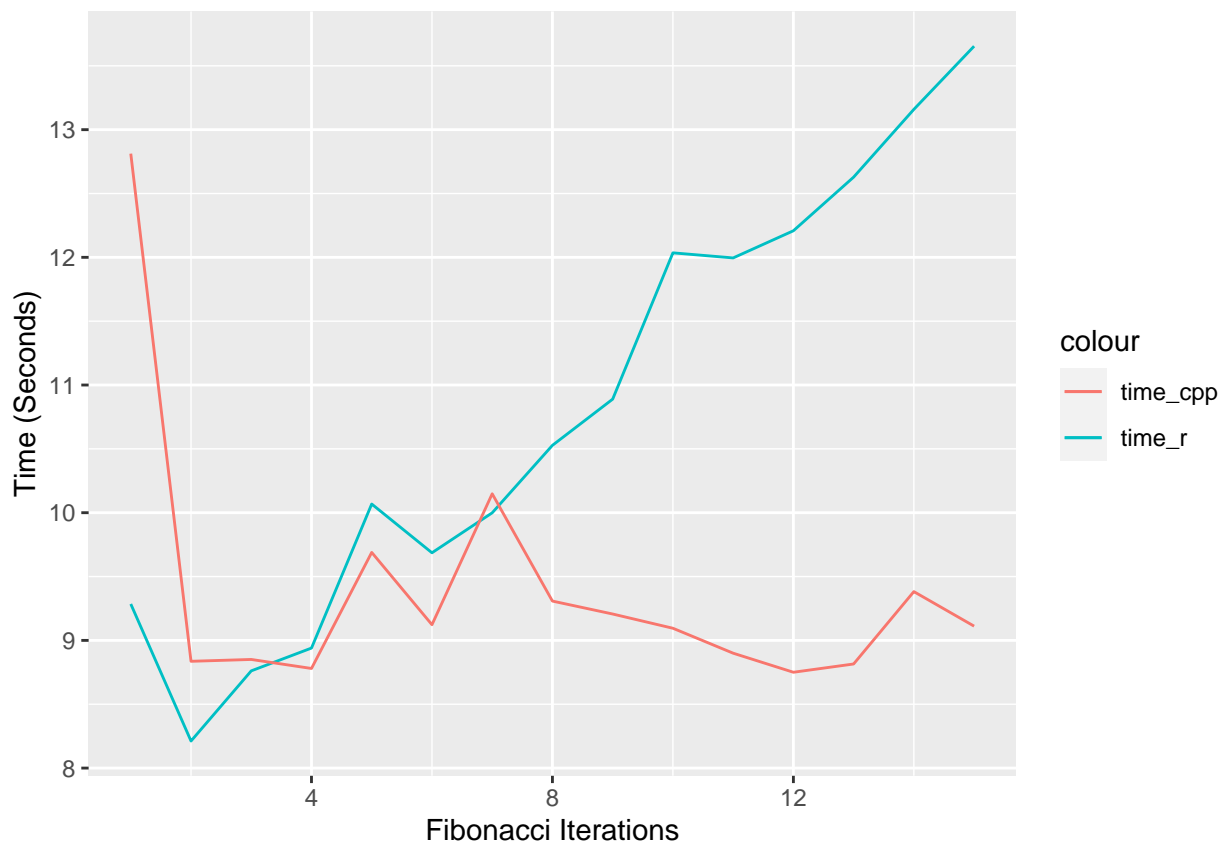
```
## [1] 610
```

Time the difference in these functions for $n = 100, 200, \dots, 1500$ while starting the sequence at the smallest possible floating point value in R. Store the results in a matrix.

```
n = 15 #Tried setting n to 100, etc., was taking too long to run
time_r <- c()
time_cpp <- c()
for (i in 1:n){
  time_r <- c(time_r, mean(microbenchmark(fib_r = nth_fibonacci(i, .Machine$double.xmin), times = 3, un
  time_cpp <- c(time_cpp, mean(microbenchmark(fib_cpp = nth_fibonacci_cpp(i, .Machine$double.xmin), tim
})
```

Plot the divergence of performance (in log seconds) over n using a line geometry. Use two different colors for the R and CPP functions. Make sure there's a color legend on your plot.

```
ggplot() +
  geom_line(aes(x = 1:n, y = log(time_r), col = "time_r")) +
  geom_line(aes(x = 1:n, y = log(time_cpp), col = "time_cpp")) +
  xlab("Fibonacci Iterations") +
  ylab("Time (Seconds)")
```



Data Wrangling / Munging / Carpentry

Throughout this assignment you can use either the `tidyverse` package suite or `data.table` to answer but not base R. You can mix `data.table` with `magrittr` piping if you wish but don't go back and forth between `tbl_df`'s and `data.table` objects.

```
pacman::p_load(tidyverse, magrittr, data.table)
```

Load the `storms` dataset from the `dplyr` package and investigate it using `str` and `summary` and `head`. Which two columns should be converted to type factor? Do so below.

```
data(storms)
str(storms)
```

```
## tibble[,13] [10,010 x 13] (S3: tbl_df/tbl/data.frame)
## $ name      : chr [1:10010] "Amy" "Amy" "Amy" "Amy" ...
## $ year      : num [1:10010] 1975 1975 1975 1975 1975 ...
## $ month     : num [1:10010] 6 6 6 6 6 6 6 6 6 6 ...
## $ day       : int [1:10010] 27 27 27 27 28 28 28 28 29 29 ...
## $ hour      : num [1:10010] 0 6 12 18 0 6 12 18 0 6 ...
## $ lat       : num [1:10010] 27.5 28.5 29.5 30.5 31.5 32.4 33.3 34 34.4 34 ...
## $ long      : num [1:10010] -79 -79 -79 -79 -78.8 -78.7 -78 -77 -75.8 -74.8 ...
## $ status    : chr [1:10010] "tropical depression" "tropical depression" "tropical depression" "trop
## $ category   : Ord.factor w/ 7 levels "-1"<"0"<"1"<"2"<...: 1 1 1 1 1 1 1 1 2 2 ...
## $ wind      : int [1:10010] 25 25 25 25 25 25 25 30 35 40 ...
## $ pressure  : int [1:10010] 1013 1013 1013 1013 1012 1012 1011 1006 1004 1002 ...
## $ ts_diameter: num [1:10010] NA NA NA NA NA NA NA NA NA NA ...
## $ hu_diameter: num [1:10010] NA NA NA NA NA NA NA NA NA NA ...
```

```
head(storms)
```

```
## # A tibble: 6 x 13
##   name    year month   day hour   lat long status      category wind pressure
##   <chr> <dbl> <dbl> <int> <dbl> <dbl> <dbl> <chr>      <ord>    <int>    <int>
## 1 Amy    1975     6    27     0  27.5 -79 tropical de~ -1         25     1013
## 2 Amy    1975     6    27     6  28.5 -79 tropical de~ -1         25     1013
## 3 Amy    1975     6    27    12  29.5 -79 tropical de~ -1         25     1013
## 4 Amy    1975     6    27    18  30.5 -79 tropical de~ -1         25     1013
## 5 Amy    1975     6    28     0  31.5 -78.8 tropical de~ -1         25     1012
## 6 Amy    1975     6    28     6  32.4 -78.7 tropical de~ -1         25     1012
## # ... with 2 more variables: ts_diameter <dbl>, hu_diameter <dbl>
```

Reorder the columns so name is first, status is second, category is third and the rest are the same.

```
storms%<>%
  select(name, status, category, everything())
```

Find a subset of the data of storms only in the 1970's.

```
storms%>%
  filter(year >= 1970 & year <= 1979)
```

```
## # A tibble: 546 x 13
##   name status      category year month   day hour   lat long wind pressure
##   <chr> <chr>      <ord>    <dbl> <dbl> <int> <dbl> <dbl> <dbl> <int>    <int>
## 1 Amy tropical d~ -1      1975     6    27     0  27.5 -79     25     1013
## 2 Amy tropical d~ -1      1975     6    27     6  28.5 -79     25     1013
## 3 Amy tropical d~ -1      1975     6    27    12  29.5 -79     25     1013
## 4 Amy tropical d~ -1      1975     6    27    18  30.5 -79     25     1013
## 5 Amy tropical d~ -1      1975     6    28     0  31.5 -78.8    25     1012
## 6 Amy tropical d~ -1      1975     6    28     6  32.4 -78.7    25     1012
## 7 Amy tropical d~ -1      1975     6    28    12  33.3 -78     25     1011
## 8 Amy tropical d~ -1      1975     6    28    18   34   -77     30     1006
```

```
## 9 Amy tropical s~ 0 1975 6 29 0 34.4 -75.8 35 1004
## 10 Amy tropical s~ 0 1975 6 29 6 34 -74.8 40 1002
## # ... with 536 more rows, and 2 more variables: ts_diameter <dbl>,
## # hu_diameter <dbl>
```

Find a subset of the data of storm observations only with category 4 and above and wind speed 100MPH and above.

```
storms%>%
  filter(category >= 4 & wind >= 100)
```

```
## # A tibble: 416 x 13
##   name status category year month day hour lat long wind pressure
##   <chr> <chr> <ord> <dbl> <dbl> <int> <dbl> <dbl> <dbl> <int> <int>
## 1 Anita hurricane 5 1977 9 2 0 24.6 -96.2 140 931
## 2 Anita hurricane 5 1977 9 2 6 24.2 -97.1 150 926
## 3 Anita hurricane 4 1977 9 2 12 23.7 -98 120 940
## 4 David hurricane 4 1979 8 28 0 12.2 -52.9 115 947
## 5 David hurricane 4 1979 8 28 6 12.5 -54.4 125 941
## 6 David hurricane 4 1979 8 28 12 12.8 -55.7 130 938
## 7 David hurricane 4 1979 8 28 18 13.2 -56.9 125 941
## 8 David hurricane 4 1979 8 29 0 13.7 -58 120 944
## 9 David hurricane 4 1979 8 29 6 14.2 -59.2 120 942
## 10 David hurricane 4 1979 8 29 12 14.8 -60.3 125 938
## # ... with 406 more rows, and 2 more variables: ts_diameter <dbl>,
## # hu_diameter <dbl>
```

Create a new feature `wind_speed_per_unit_pressure`.

```
storms %<>%
  rowwise() %>%
  arrange(desc(year)) %>%
  mutate(wind_speed_per_unit_pressure = wind / pressure)
```

Create a new feature: `average_diameter` which averages the two diameter metrics. If one is missing, then use the value of the one that is present. If both are missing, leave missing.

```
storms %<>%
  mutate(average_diameter = ifelse(!is.na(ts_diameter) & !is.na(hu_diameter), (ts_diameter + hu_diameter) / 2,
    ifelse(is.na(ts_diameter), hu_diameter,
    ifelse(is.na(hu_diameter), ts_diameter, NA))))
```

For each storm, summarize the maximum wind speed. “Summarize” means create a new dataframe with only the summary metrics you care about.

```
storms %>%
  group_by(name) %>%
  summarize(max_wind = max(wind, na.rm = TRUE))
```

```
## # A tibble: 198 x 2
##   name max_wind
##   * <chr> <int>
## 1 AL011993 30
## 2 AL012000 25
## 3 AL021992 30
## 4 AL021994 30
## 5 AL021999 30
## 6 AL022000 30
```



```
## 7 AL022001      25
## 8 AL022003      30
## 9 AL022006      45
## 10 AL031987     40
## # ... with 188 more rows
```

Order your dataset by maximum wind speed storm but within the rows of storm show the observations in time order from early to late.

```
storms %>%
  group_by(name) %>%
  mutate(max_wind_by_storm = max(wind, na.rm = TRUE)) %>%
  select(name, max_wind_by_storm, everything()) %>%
  arrange(desc(max_wind_by_storm), year, month, day, hour)
```

```
## # A tibble: 10,010 x 16
## # Groups:   name [198]
##   name max_wind_by_storm status category year month day hour lat long
##   <chr>          <int> <chr>   <ord>   <dbl> <dbl> <int> <dbl> <dbl> <dbl>
## 1 Gilbe~          160 tropica~ -1      1988     9     8    18  12  -54
## 2 Gilbe~          160 tropica~ -1      1988     9     9     0 12.7 -55.6
## 3 Gilbe~          160 tropica~ -1      1988     9     9     6 13.3 -57.1
## 4 Gilbe~          160 tropica~ -1      1988     9     9    12  14  -58.6
## 5 Gilbe~          160 tropica~  0      1988     9     9    18 14.5 -60.1
## 6 Gilbe~          160 tropica~  0      1988     9    10     0 14.8 -61.5
## 7 Gilbe~          160 tropica~  0      1988     9    10     6  15  -62.8
## 8 Gilbe~          160 tropica~  0      1988     9    10    12 15.3 -64.1
## 9 Gilbe~          160 tropica~  0      1988     9    10    18 15.7 -65.4
## 10 Gilbe~         160 hurrica~ 1      1988     9    11     0 15.9 -66.8
## # ... with 10,000 more rows, and 6 more variables: wind <int>, pressure <int>,
## #   ts_diameter <dbl>, hu_diameter <dbl>, wind_speed_per_unit_pressure <dbl>,
## #   average_diameter <dbl>
```

Find the strongest storm by wind speed per year.

```
storms %>%
  group_by(year) %>%
  arrange(year, desc(wind)) %>%
  slice(1) %>%
  select(name, year, wind)
```

```
## # A tibble: 41 x 3
## # Groups:   year [41]
##   name year wind
##   <chr> <dbl> <int>
## 1 Caroline 1975 100
## 2 Belle 1976 105
## 3 Anita 1977 150
## 4 Cora 1978 80
## 5 David 1979 150
## 6 Ivan 1980 90
## 7 Harvey 1981 115
## 8 Debby 1982 115
## 9 Alicia 1983 100
## 10 Diana 1984 115
## # ... with 31 more rows
```

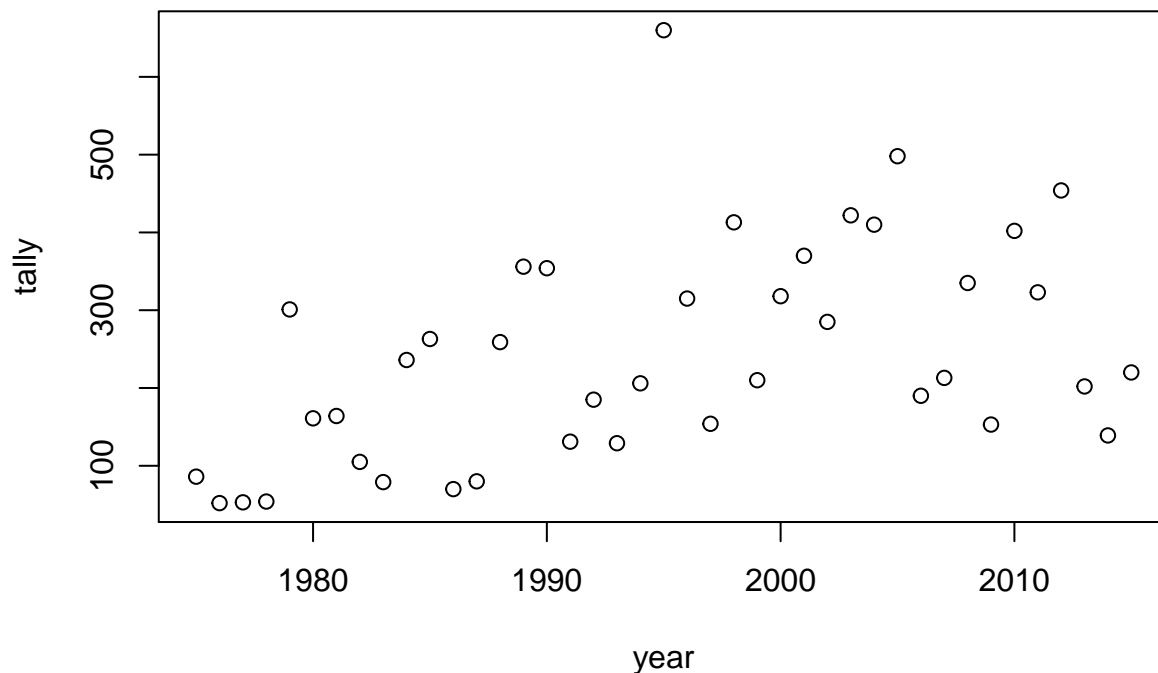
For each named storm, find its maximum category, wind speed, pressure and diameters. Do not allow the max to be NA (unless all the measurements for that storm were NA).

```
storms %>%
  group_by(name) %>%
  summarize(max_category = max(category),
            max_wind_speed = max(wind),
            max_pressure = max(pressure),
            max_ts_diameter = max(ts_diameter),
            max_hu_diameter = max(hu_diameter)) %>%
  na.omit()
```

```
## # A tibble: 54 x 6
##   name      max_category max_wind_speed max_pressure max_ts_diameter
##   <chr>      <ord>          <int>         <int>         <dbl>
## 1 AL022006  0                45          1008          69.0
## 2 AL102004 -1                30          1013           0
## 3 AL202011  0                40          1011          69.0
## 4 Andrea    0                55          1006         207.
## 5 Beta      3               100          1007         127.
## 6 Colin     0                50          1013         104.
## 7 Don       0                45          1007          69.0
## 8 Dorian    0                50          1013          80.6
## 9 Eight     -1                30          1009           0
## 10 Epsilon  1                75          1005         276.
## # ... with 44 more rows, and 1 more variable: max_hu_diameter <dbl>
```

For each year in the dataset, tally the number of storms. “Tally” is a fancy word for “count the number of”. Plot the number of storms by year. Any pattern?

```
storms %>%
  group_by(year) %>%
  summarise(tally = n()) %>%
  plot()
```



For each year in the dataset, tally the storms by category. #slack one

```
storms %>%
  group_by(year, category) %>%
  summarize(num_storm = n_distinct(name))
```

`summarise()` has grouped output by 'year'. You can override using the `.groups` argument.

```
## # A tibble: 233 x 3
## # Groups:   year [41]
##   year category num_storm
##   <dbl> <ord>      <int>
## 1  1975 -1          2
## 2  1975 0          3
## 3  1975 1          2
## 4  1975 2          2
## 5  1975 3          1
## 6  1976 -1          2
## 7  1976 0          2
## 8  1976 1          2
## 9  1976 2          2
## 10 1976 3          1
## # ... with 223 more rows
```

For each year in the dataset, find the maximum wind speed per status level.

```
storms %>%
  group_by(year, status) %>%
  summarise(max_wind_speed = max(wind, na.rm = TRUE))
```

`summarise()` has grouped output by 'year'. You can override using the `.groups` argument.

```
## # A tibble: 123 x 3
## # Groups:   year [41]
##   year status      max_wind_speed
##   <dbl> <chr>          <int>
## 1  1975 hurricane      100
## 2  1975 tropical depression  30
## 3  1975 tropical storm     60
## 4  1976 hurricane     105
## 5  1976 tropical depression  30
## 6  1976 tropical storm     60
## 7  1977 hurricane     150
## 8  1977 tropical depression  30
## 9  1977 tropical storm     60
## 10 1978 hurricane      80
## # ... with 113 more rows
```

For each storm, summarize its average location in latitude / longitude coordinates.

```
storms %>%
  group_by(name) %>%
  summarize(average_latitude = mean(lat), average_longitude = mean(long))
```

```
## # A tibble: 198 x 3
##   name      average_latitude average_longitude
##   * <chr>          <dbl>          <dbl>
## 1 AL011993      24.7          -78.0
```

```
## 2 AL012000      20.8      -93.1
## 3 AL021992      26.7      -84.5
## 4 AL021994      33.6      -79.7
## 5 AL021999      20.4      -96.4
## 6 AL022000       9.9      -28.5
## 7 AL022001      11.9      -45.3
## 8 AL022003       9.62     -43.4
## 9 AL022006      41.3      -63.5
## 10 AL031987     30.8      -88.7
## # ... with 188 more rows
```

For each storm, summarize its duration in number of hours (to the nearest 6hr increment).

```
storms %>%
  group_by(name) %>%
  mutate(duration = (n()-1)*6) %>%
  select(name, duration) %>%
  distinct
```

```
## # A tibble: 198 x 2
## # Groups:   name [198]
##   name      duration
##   <chr>      <dbl>
## 1 Ana         594
## 2 Bill        450
## 3 Claudette  1074
## 4 Danny       870
## 5 Erika       618
## 6 Fred        300
## 7 Henri       570
## 8 Nine        72
## 9 Ida         372
## 10 Joaquin    246
## # ... with 188 more rows
```

For storm in a category, create a variable `storm_number` that enumerates the storms 1, 2, ... (in date order).

```
storms %>%
  group_by(category, name) %>%
  slice(1) %>%
  group_by(category) %>%
  mutate(storm_number = dense_rank(paste(year, as.numeric(month), day))) %>%
  select(category, storm_number, year, month, day, name) %>%
  distinct %>%
  arrange(category, storm_number)
```

```
## # A tibble: 687 x 6
## # Groups:   category [7]
##   category storm_number year month day name
##   <ord>      <int> <dbl> <dbl> <int> <chr>
## 1 -1          1  1975     6    27 Amy
## 2 -1          2  1975     8    24 Caroline
## 3 -1          3  1976     8     6 Belle
## 4 -1          4  1977    10    13 Evelyn
## 5 -1          5  1977     8    29 Anita
## 6 -1          6  1977     9     5 Clara
## 7 -1          7  1978    10     7 Juliet
```

```
## 8 -1          8 1978      7    30 Amelia
## 9 -1          9 1978      8     5 Bess
## 10 -1         10 1978     8     7 Cora
## # ... with 677 more rows
```

Convert year, month, day, hour into the variable `timestamp` using the `lubridate` package. Although the new package `clock` just came out, `lubridate` still seems to be standard. Next year I'll probably switch the class to be using `clock`.

```
pacman::p_load(lubridate)
```

```
storms %<>%
  mutate(timestamp = make_datetime(year, month, day, hour)) %>%
  select(timestamp, everything())
storms
```

```
## # A tibble: 10,010 x 16
## # Rowwise:
##   timestamp          name status category year month  day hour  lat long
##   <dtm>             <chr> <chr>  <ord>   <dbl> <dbl> <int> <dbl> <dbl> <dbl>
## 1 2015-05-09 06:00:00 Ana  tropi~ 0      2015     5     9     6 32.2 -77.5
## 2 2015-05-09 12:00:00 Ana  tropi~ 0      2015     5     9    12 32.5 -77.8
## 3 2015-05-09 18:00:00 Ana  tropi~ 0      2015     5     9    18 32.7 -78
## 4 2015-05-10 00:00:00 Ana  tropi~ 0      2015     5    10     0 33.1 -78.3
## 5 2015-05-10 06:00:00 Ana  tropi~ 0      2015     5    10     6 33.5 -78.6
## 6 2015-05-10 10:00:00 Ana  tropi~ 0      2015     5    10    10 33.8 -78.8
## 7 2015-05-10 12:00:00 Ana  tropi~ 0      2015     5    10    12 33.9 -78.8
## 8 2015-05-10 18:00:00 Ana  tropi~ -1     2015     5    10    18 34.3 -78.7
## 9 2015-05-11 00:00:00 Ana  tropi~ -1     2015     5    11     0 34.7 -78.5
## 10 2015-05-11 06:00:00 Ana  tropi~ -1     2015     5    11     6 35.5 -78
## # ... with 10,000 more rows, and 6 more variables: wind <int>, pressure <int>,
## #   ts_diameter <dbl>, hu_diameter <dbl>, wind_speed_per_unit_pressure <dbl>,
## #   average_diameter <dbl>
```

Using the `lubridate` package, create new variables `day_of_week` which is a factor with levels “Sunday”, “Monday”, ... “Saturday” and `week_of_year` which is integer 1, 2, ..., 52.

```
storms %<>%
  mutate(day_of_week = weekdays(timestamp),
         week_of_year = week(timestamp))
```

For each storm, summarize the day in which is started in the following format “Friday, June 27, 1975”.

```
storms %>%
  group_by(name) %>%
  summarise(start_date = min(timestamp)) %>%
  mutate(start_date = paste(wday(start_date), paste(months(start_date), day(start_date), sep = " "), year = year(start_date)))
```

```
## # A tibble: 198 x 2
##   name      start_date
##   * <chr>    <chr>
## 1 AL011993 2, May 31, 1993
## 2 AL012000 4, June 7, 2000
## 3 AL021992 5, June 25, 1992
## 4 AL021994 4, July 20, 1994
## 5 AL021999 6, July 2, 1999
## 6 AL022000 6, June 23, 2000
```

```
## 7 AL022001 4, July 11, 2001
## 8 AL022003 4, June 11, 2003
## 9 AL022006 2, July 17, 2006
## 10 AL031987 1, August 9, 1987
## # ... with 188 more rows
```

Create a new factor variable `decile_windspeed` by binning wind speed into 10 bins.

```
bins <- 0:10
storms %<>%
  mutate(decile_windspeed = factor(ntile(wind, 10)))
```

Create a new data frame `serious_storms` which are category 3 and above hurricanes.

```
serious_storms = storms %>%
  filter(category >= 3)
serious_storms
```

```
## # A tibble: 779 x 19
## # Rowwise:
##   timestamp          name status category year month  day  hour  lat long
##   <dtm>             <chr> <chr>  <ord>   <dbl> <dbl> <int> <dbl> <dbl> <dbl>
## 1 2015-08-21 12:00:00 Danny hurri~ 3      2015     8   21   12  13.8 -47.8
## 2 2015-08-21 18:00:00 Danny hurri~ 3      2015     8   21   18  14.3 -48.6
## 3 2015-10-01 00:00:00 Joaq~ hurri~ 3      2015    10    1    0  23.9 -72.9
## 4 2015-10-01 06:00:00 Joaq~ hurri~ 3      2015    10    1    6  23.5 -73.3
## 5 2015-10-01 12:00:00 Joaq~ hurri~ 4      2015    10    1   12  23.1 -73.7
## 6 2015-10-01 18:00:00 Joaq~ hurri~ 4      2015    10    1   18  23   -74.2
## 7 2015-10-02 00:00:00 Joaq~ hurri~ 4      2015    10    2    0  22.9 -74.4
## 8 2015-10-02 06:00:00 Joaq~ hurri~ 4      2015    10    2    6  23   -74.7
## 9 2015-10-02 12:00:00 Joaq~ hurri~ 4      2015    10    2   12  23.4 -74.8
## 10 2015-10-02 16:00:00 Joaq~ hurri~ 3      2015    10    2   16  23.6 -74.8
## # ... with 769 more rows, and 9 more variables: wind <int>, pressure <int>,
## #   ts_diameter <dbl>, hu_diameter <dbl>, wind_speed_per_unit_pressure <dbl>,
## #   average_diameter <dbl>, day_of_week <chr>, week_of_year <dbl>,
## #   decile_windspeed <fct>
```

In `serious_storms`, merge the variables `lat` and `long` together into `lat_long` with values `lat / long` as a string.

```
serious_storms %<>%
  unite(lat_long, lat, long, sep = " / ")
```

Let's return now to the original storms data frame. For each category, find the average wind speed, pressure and diameters (do not count the NA's in your averaging).

```
storms %>%
  group_by(category) %>%
  summarize(avg_wind_speed = mean(wind),
            avg_pressure = mean(pressure),
            avg_ts_diam = mean(ts_diameter, na.rm = TRUE),
            avg_hu_diam = mean(hu_diameter, na.rm = TRUE))
```

```
## # A tibble: 7 x 5
##   category avg_wind_speed avg_pressure avg_ts_diam avg_hu_diam
## * <ord>         <dbl>         <dbl>         <dbl>         <dbl>
## 1 -1             27.3           1008.           0             0
## 2 0              45.8           999.           160.           0
```

```
## 3 1          70.9          982.          278.          57.3
## 4 2          89.4          967.          282.          78.8
## 5 3          105.          954.          307.          91.4
## 6 4          122.          940.          315.          102.
## 7 5          145.          916.          317.          120.
```

For each named storm, find its maximum category, wind speed, pressure and diameters (do not allow the max to be NA) and the number of readings (i.e. observations).

```
storms %<>%
  filter(!is.na(ts_diameter), !is.na(hu_diameter)) %>%
  group_by(name) %>%
  mutate(max_category = max(category),
         max_wind = max(wind),
         max_pressure = max(pressure),
         max_ts_diam = max(ts_diameter),
         max_hu_diam = max(hu_diameter))
```

Calculate the distance from each storm observation to Miami in a new variable `distance_to_miami`. This is very challenging. You will need a function that computes distances from two sets of latitude / longitude coordinates.

```
MIAMI_LAT_LONG_COORDS = c(25.7617, -80.1918)

distance <- function(lat1, long1, lat2, long2){

  lat1 = lat1 * 180/pi
  lat2 = lat2 * 180/pi
  long1 = long1 * 180/pi
  long2 = long2 * 180/pi
  a = sin(lat2 - lat1 / 2)^2 + (cos(lat2) * cos(lat1)) * sin(long2 - long1 / 2)^2
  b = 2 * atan2(sqrt(a), sqrt(1 - a))
  distance = 6373.0 * b # Multiplying by radius of earth in KM
  return(distance)
}
```

For each storm observation, use the function from the previous question to calculate the distance it moved since the previous observation.

```
storms %<>%
  group_by(name) %>%
  mutate(dist_from_prev = ifelse(name != lag(name), 0, distance(lat, long, lag(lat), lag(long)))) %>%
  mutate(dist_from_prev = ifelse(is.na(dist_from_prev), 0, dist_from_prev))

## Warning in sqrt(a): NaNs produced
## Warning in sqrt(1 - a): NaNs produced
## Warning in sqrt(a): NaNs produced
## Warning in sqrt(1 - a): NaNs produced

## Warning in sqrt(1 - a): NaNs produced
## Warning in sqrt(a): NaNs produced
## Warning in sqrt(1 - a): NaNs produced
## Warning in sqrt(a): NaNs produced
```

[illegible]

[illegible]

[illegible]

[illegible]

```
## Warning in sqrt(1 - a): NaNs produced
## Warning in sqrt(a): NaNs produced

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```

```
## Warning in sqrt(a): NaNs produced
## Warning in sqrt(a): NaNs produced
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## Warning in sqrt(a): NaNs produced
## Warning in sqrt(1 - a): NaNs produced
## Warning in sqrt(a): NaNs produced
## Warning in sqrt(1 - a): NaNs produced
```

```
storms
```

```
## # A tibble: 3,482 x 25
## # Groups:   name [114]
##   timestamp          name status category year month day hour lat long
##   <dtm>              <chr> <chr> <ord>   <dbl> <dbl> <int> <dbl> <dbl> <dbl>
## 1 2015-05-09 06:00:00 Ana tropi~ 0      2015     5     9     6 32.2 -77.5
## 2 2015-05-09 12:00:00 Ana tropi~ 0      2015     5     9    12 32.5 -77.8
## 3 2015-05-09 18:00:00 Ana tropi~ 0      2015     5     9    18 32.7 -78
## 4 2015-05-10 00:00:00 Ana tropi~ 0      2015     5    10     0 33.1 -78.3
## 5 2015-05-10 06:00:00 Ana tropi~ 0      2015     5    10     6 33.5 -78.6
## 6 2015-05-10 10:00:00 Ana tropi~ 0      2015     5    10    10 33.8 -78.8
## 7 2015-05-10 12:00:00 Ana tropi~ 0      2015     5    10    12 33.9 -78.8
## 8 2015-05-10 18:00:00 Ana tropi~ -1     2015     5    10    18 34.3 -78.7
## 9 2015-05-11 00:00:00 Ana tropi~ -1     2015     5    11     0 34.7 -78.5
## 10 2015-05-11 06:00:00 Ana tropi~ -1     2015     5    11     6 35.5 -78
## # ... with 3,472 more rows, and 15 more variables: wind <int>, pressure <int>,
## #   ts_diameter <dbl>, hu_diameter <dbl>, wind_speed_per_unit_pressure <dbl>,
## #   average_diameter <dbl>, day_of_week <chr>, week_of_year <dbl>,
## #   decile_windspeed <fct>, max_category <ord>, max_wind <int>,
## #   max_pressure <int>, max_ts_diam <dbl>, max_hu_diam <dbl>,
## #   dist_from_prev <dbl>
```

For each storm, find the total distance it moved over its observations and its total displacement. “Distance” is a scalar quantity that refers to “how much ground an object has covered” during its motion. “Displacement” is a vector quantity that refers to “how far out of place an object is”; it is the object’s overall change in position.

```
storms %>%
  group_by(name) %>%
  summarize(Distance = sum(dist_from_prev),
            Displacement = paste(round(last(lat) - first(lat), 2), round(last(long) - first(long), 2),
```

```
## # A tibble: 114 x 3
##   name      Distance Displacement
## * <chr>      <dbl> <chr>
## 1 AL022006    24361. 4.6 / 6.3
## 2 AL102004    36454. 4.7 / 5.4
## 3 AL202011    29375. 1.7 / 2.1
## 4 Alberto    209015. 0 / -4.8
## 5 Alex        382264. 30.6 / 45.6
## 6 Ana         209918. -17.6 / 22.7
## 7 Andrea       30050. 8.4 / 6.4
## 8 Arthur      201019. -9.9 / -11.9
## 9 Barry       164705. 13.7 / 4.9
## 10 Beryl      179627. 12.3 / 11.4
## # ... with 104 more rows
```

For each storm observation, calculate the average speed the storm moved in location.

```
storms %<>%
  mutate(speed = dist_from_prev / 6)
```

For each storm, calculate its average ground speed (how fast its eye is moving which is different from windspeed around the eye).

```
storms %>%
  group_by(name) %>%
  summarize(avg_ground_speed = mean(speed))
```

```
## # A tibble: 114 x 2
##   name      avg_ground_speed
## * <chr>      <dbl>
## 1 AL022006          812.
## 2 AL102004          759.
## 3 AL202011          612.
## 4 Alberto         1161.
## 5 Alex             1225.
## 6 Ana              1296.
## 7 Andrea            556.
## 8 Arthur           1155.
## 9 Barry            1194.
## 10 Beryl            1109.
## # ... with 104 more rows
```

Is there a relationship between average ground speed and maximum category attained? Use a dataframe summary (not a regression).

```
speed_and_category <- storms %>%
  group_by(name) %>%
  summarize(avg_ground_speed = mean(speed), maximum_category = as.numeric(max(category)))
cor(speed_and_category[,2], speed_and_category[,3])
```

```
##           maximum_category
## avg_ground_speed      0.2412369
```

Now we want to transition to building real design matrices for prediction. This is more in tune with what happens in the real world. Large data dump and you convert it into X and y how you see fit.

Suppose we wish to predict the following: given the first three readings of a storm, can you predict its maximum wind speed? Identify the y and identify which features you need x_1, \dots, x_p and build that matrix

with `dplyr` functions. This is not easy, but it is what it's all about. Feel free to “featurize” as creatively as you would like. You aren't going to overfit if you only build a few features relative to the total 198 storms.

```
storms_m = storms %>%
  group_by(name) %>%
  summarize(y = max(wind),
            avg_pressure = mean(pressure),
            avg_distance = mean(dist_from_prev),
            final_status = last(status)) %>%
  select(-name)
head(storms_m)

## # A tibble: 6 x 4
##       y avg_pressure avg_distance final_status
##   <int>      <dbl>      <dbl> <chr>
## 1   45      1002.      4872. tropical storm
## 2   30      1011      4557. tropical depression
## 3   40      1005      3672. tropical storm
## 4   60      1002.      6967. tropical depression
## 5  105       984.      7351. tropical storm
## 6   50      1005.      7775. tropical depression
```

Fit your model. Validate it.

```
n = nrow(storms_m)
K = 10 # 1/10 data will be used for testing
test_indices = sample(1:n, 1/K*n)
train_indices = setdiff(1:n, test_indices)
X = select(storms_m, -y)
y = storms_m$y

Xtest = X[test_indices,]
ytest = y[test_indices]
Xtrain = X[train_indices,]
ytrain = y[train_indices]

modv = lm(ytrain ~ ., data.frame(Xtrain))
yhat = predict(modv, data.frame(Xtrain))
mod = lm(ytrain ~ ., data.frame(Xtrain))
summary(mod)$r.squared #in-sample R^2

## [1] 0.8306194
sd(mod$residuals) #in sample standard error

## [1] 13.85967
y_hat_oos = predict(mod, data.frame(Xtest))
oos_residuals = ytest - y_hat_oos #oos e's
1 - sum(oos_residuals^2) / sum((ytest - mean(ytest))^2) #oos R^2

## [1] 0.8924656
sd(oos_residuals) #oos standard error

## [1] 12.68796
```

Assess your level of success at this endeavor.

This model has a in sample R^2 of 0.857 and Se of 13.145; oos R^2 of 0.532 and oos Se of 19.066. Based on using 3 features, I believe that there is more room for improvement in constructing this model, i.e. I can add more features to improve it since the oos R^2 is so low. This model as constructed is underfit.

The Forward Stepwise Procedure for Probability Estimation Models

Set a seed and load the `adult` dataset and remove missingness and randomize the order.

```
set.seed(1)
pacman::p_load_gh("coatless/ucidata")
data(adult)
adult = na.omit(adult)
adult = adult[sample(1 : nrow(adult)), ]
```

Copy from the previous lab all cleanups you did to this dataset.

```
adult$fnlwgt = NULL

adult$marital_status = as.character(adult$marital_status)
adult$marital_status = ifelse(adult$marital_status == "Married-AF-spouse" | adult$marital_status == "Married", "Married", adult$marital_status)
adult$marital_status = as.factor(adult$marital_status)

adult$education = as.character(adult$education)
adult$education = ifelse(adult$education == "1st-4th" | adult$education == "Preschool", "<=4th", adult$education)
adult$education = as.factor(adult$education)
adult$education = NULL

tab = sort(table(adult$native_country))
adult$native_country = as.character(adult$native_country)
adult$native_country = ifelse(adult$native_country %in% names(tab[tab<50]), "Other", adult$native_country)
adult$native_country = as.factor(adult$native_country)

adult$worktype = paste(adult$occupation, adult$workclass, sep = ":")
tab_worktype = sort(table(adult$worktype))
adult$occupation = NULL
adult$workclass = NULL

adult$worktype = as.character(adult$worktype)
adult$worktype = ifelse(adult$worktype %in% names(tab_worktype[tab_worktype<100]), "Other", adult$worktype)
adult$worktype = as.factor(adult$worktype)

adult$status = paste(as.character(adult$relationship), as.character(adult$marital_status), sep = ":")
adult$status = as.character(adult$status)
tab_status = sort(table(adult$status))
adult$relationship = NULL
adult$marital_status = NULL
adult$status = as.factor(adult$status)
```

We will be doing model selection. We will split the dataset into 3 distinct subsets. Set the size of our splits here. For simplicity, all three splits will be identically sized. We are making it small so the stepwise algorithm can compute quickly. If you have a faster machine, feel free to increase this.

```
Nsplitsize = 1000
```


Now create the following variables: Xtrain, ytrain, Xselect, yselect, Xtest, ytest with Nsplitsize observations. Binarize the y values.

```
Xtrain = adult[1 : Nsplitsize, ]
Xtrain$income = NULL
ytrain = ifelse(adult[1 : Nsplitsize, "income"] == ">50K", 1, 0)
Xselect = adult[(Nsplitsize + 1) : (2 * Nsplitsize), ]
Xselect$income = NULL
yselect = ifelse(adult[(Nsplitsize + 1) : (2 * Nsplitsize), "income"] == ">50K", 1, 0)
Xtest = adult[(2 * Nsplitsize + 1) : (3 * Nsplitsize), ]
Xtest$income = NULL
ytest = ifelse(adult[(2 * Nsplitsize + 1) : (3 * Nsplitsize), "income"] == ">50K", 1, 0)
```

Fit a vanilla logistic regression on the training set.

```
logistic_mod = glm(ytrain ~ ., Xtrain, family = binomial(link = logit))
```

```
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
```

and report the log scoring rule, the Brier scoring rule.

```
p_hat_train = predict(logistic_mod, Xtrain, type = 'response')
```

```
## Warning in predict.lm(object, newdata, se.fit, scale = 1, type = if (type == :
## prediction from a rank-deficient fit may be misleading
```

```
mean(ytrain * log(p_hat_train) + (1 - ytrain) * log(1 - p_hat_train)) #in sample log scoring rule
```

```
## [1] -0.2671121
```

```
mean(-(ytrain - p_hat_train)^2) #in sample Brier scoring rule
```

```
## [1] -0.08715781
```

We will be doing model selection using a basis of linear features consisting of all first-order interactions of the 14 raw features (this will include square terms as squares are interactions with oneself).

Create a model matrix from the training data containing all these features. Make sure it has an intercept column too (the one vector is usually an important feature). Cast it as a data frame so we can use it more easily for modeling later on. We're going to need those model matrices (as data frames) for both the select and test sets. So make them here too (copy-paste). Make sure their dimensions are sensible.

```
Xmm_train = data.frame(model.matrix( ~ . , Xtrain))
Xmm_select = data.frame(model.matrix( ~ . , Xselect))
Xmm_test = data.frame(model.matrix( ~ . , Xtest))
```

```
dim(Xmm_train)
```

```
## [1] 1000 93
```

```
dim(Xmm_select)
```

```
## [1] 1000 93
```

```
dim(Xmm_test)
```

```
## [1] 1000 93
```

Write code that will fit a model stepwise. You can refer to the chunk in the practice lecture. Use the negative Brier score to do the selection. The negative of the Brier score is always positive and lower means better making this metric kind of like `s_e` so the picture will be the same as the canonical U-shape for oos performance.

Run the code and hit “stop” when you begin to see the Brier score degrade appreciably oos. Be patient as it will wobble.

```
pacman::p_load(Matrix)
p_plus_one = ncol(Xmm_train)
predictor_by_iteration = c() #keep a growing list of predictors by iteration
in_sample_brier_by_iteration = c() #keep a growing list of briers by iteration
oos_brier_by_iteration = c() #keep a growing list of briers by iteration
i = 1

repeat {

  #get all predictors left to try
  all_briers = array(NA, p_plus_one) #record all possibilities
  for (j_try in 1 : p_plus_one){
    if (j_try %in% predictor_by_iteration){
      next
    }
    Xmm_sub = Xmm_train[, c(predictor_by_iteration, j_try), drop = FALSE]
    logistic_mod = suppressWarnings(glm(ytrain ~ ., Xmm_sub, family = "binomial"))
    phat_train = suppressWarnings(predict(logistic_mod, Xmm_sub, type = 'response'))
    all_briers[j_try] = -mean(-(ytrain - phat_train)^2)
  }
  j_star = which.max(all_briers)
  predictor_by_iteration = c(predictor_by_iteration, j_star)
  in_sample_brier_by_iteration = c(in_sample_brier_by_iteration, all_briers[j_star])

  #now let's look at oos
  Xmm_sub = Xmm_train[, predictor_by_iteration, drop = FALSE]

  logistic_mod = suppressWarnings(glm(ytrain ~ ., Xmm_sub, family = "binomial"))
  phat_train = suppressWarnings(predict(logistic_mod, Xmm_sub, type = 'response'))
  all_briers[j_try] = -mean(-(ytrain - phat_train)^2)

  phat_select = suppressWarnings(predict(logistic_mod, Xmm_select[, predictor_by_iteration, drop = FALSE], type = 'response'))
  oos_brier = -mean(-(yselect - phat_select)^2)
  oos_brier_by_iteration = c(oos_brier_by_iteration, oos_brier)

  cat("i =", i, "in-sample_brier =", all_briers[j_star], "oos_brier =", oos_brier, "\n" predictor added)

  i = i + 1

  if (i > Nsplitsize || i > p_plus_one){
    break
  }
}

## i = 1 in-sample_brier = 0.181356 oos_brier = 0.185548
##   predictor added: X.Intercept.
## i = 2 in-sample_brier = 0.181356 oos_brier = 0.185548
##   predictor added: native_countryPoland
## i = 3 in-sample_brier = 0.181356 oos_brier = 0.185548
##   predictor added: statusNot.in.family.Married
## i = 4 in-sample_brier = 0.181356 oos_brier = 0.185548
```

```

## predictor added: statusOther.relative.Separated
## i = 5 in-sample_brier = 0.181356 oos_brier = 0.185548
## predictor added: statusOther.relative.Widowed
## i = 6 in-sample_brier = 0.181356 oos_brier = 0.185548
## predictor added: statusOwn.child.Widowed
## i = 7 in-sample_brier = 0.1813554 oos_brier = 0.1855417
## predictor added: worktypeTransport.moving.Self.emp.not.inc
## i = 8 in-sample_brier = 0.1813548 oos_brier = 0.1855661
## predictor added: statusUnmarried.Married.spouse.absent
## i = 9 in-sample_brier = 0.1813542 oos_brier = 0.1855927
## predictor added: worktypeSales.Self.emp.not.inc
## i = 10 in-sample_brier = 0.181353 oos_brier = 0.1856649
## predictor added: statusUnmarried.Widowed
## i = 11 in-sample_brier = 0.1813499 oos_brier = 0.1856563
## predictor added: worktypeCraft.repair.Private
## i = 12 in-sample_brier = 0.1813447 oos_brier = 0.1856134
## predictor added: native_countryIndia
## i = 13 in-sample_brier = 0.1813373 oos_brier = 0.1856355
## predictor added: native_countryPuerto.Rico
## i = 14 in-sample_brier = 0.1813246 oos_brier = 0.1859607
## predictor added: worktypeFarming.fishing.Private
## i = 15 in-sample_brier = 0.1813123 oos_brier = 0.1857883
## predictor added: worktypeFarming.fishing.Self.emp.not.inc
## i = 16 in-sample_brier = 0.1812982 oos_brier = 0.1856838
## predictor added: statusNot.in.family.Separated
## i = 17 in-sample_brier = 0.1812717 oos_brier = 0.1852927
## predictor added: worktypeProf.specialty.Federal.gov
## i = 18 in-sample_brier = 0.1812449 oos_brier = 0.1853558
## predictor added: native_countryGuatemala
## i = 19 in-sample_brier = 0.181218 oos_brier = 0.1857469
## predictor added: worktypeCraft.repair.Local.gov
## i = 20 in-sample_brier = 0.1811902 oos_brier = 0.1856173
## predictor added: raceOther
## i = 21 in-sample_brier = 0.1811586 oos_brier = 0.1855962
## predictor added: worktypeExec.managerial.State.gov
## i = 22 in-sample_brier = 0.1811215 oos_brier = 0.1859505
## predictor added: worktypeAdm.clerical.Local.gov
## i = 23 in-sample_brier = 0.1810644 oos_brier = 0.185881
## predictor added: native_countryDominican.Republic
## i = 24 in-sample_brier = 0.1810644 oos_brier = 0.185881
## predictor added: statusOwn.child.Married.spouse.absent
## i = 25 in-sample_brier = 0.1810073 oos_brier = 0.1858114
## predictor added: native_countryVietnam
## i = 26 in-sample_brier = 0.1809499 oos_brier = 0.1860419
## predictor added: statusOwn.child.Married
## i = 27 in-sample_brier = 0.1808553 oos_brier = 0.1860526
## predictor added: native_countryOther
## i = 28 in-sample_brier = 0.1807887 oos_brier = 0.1862179
## predictor added: native_countryUnited.States
## i = 29 in-sample_brier = 0.180699 oos_brier = 0.1868485
## predictor added: worktypeTech.support.Private
## i = 30 in-sample_brier = 0.1805934 oos_brier = 0.1864382
## predictor added: worktypeOther.service.Local.gov
## i = 31 in-sample_brier = 0.1804642 oos_brier = 0.1848996

```

```

## predictor added: worktypeExec.managerial.Self.emp.inc
## i = 32 in-sample_brier = 0.1803137 oos_brier = 0.1846994
## predictor added: native_countryJapan
## i = 33 in-sample_brier = 0.1801419 oos_brier = 0.1849772
## predictor added: worktypeProtective.serv.State.gov
## i = 34 in-sample_brier = 0.1799592 oos_brier = 0.1847671
## predictor added: statusOther.relative.Divorced
## i = 35 in-sample_brier = 0.179768 oos_brier = 0.1846089
## predictor added: worktypeProtective.serv.Private
## i = 36 in-sample_brier = 0.1795723 oos_brier = 0.1842935
## predictor added: worktypeProf.specialty.Local.gov
## i = 37 in-sample_brier = 0.179356 oos_brier = 0.1841564
## predictor added: native_countryChina
## i = 38 in-sample_brier = 0.1791469 oos_brier = 0.1840683
## predictor added: native_countryColumbia
## i = 39 in-sample_brier = 0.1789191 oos_brier = 0.1840311
## predictor added: worktypeOther.service.State.gov
## i = 40 in-sample_brier = 0.1786884 oos_brier = 0.1838212
## predictor added: statusOwn.child.Divorced
## i = 41 in-sample_brier = 0.1784501 oos_brier = 0.1838435
## predictor added: native_countryEl.Salvador
## i = 42 in-sample_brier = 0.1782627 oos_brier = 0.1844303
## predictor added: statusOther.relative.Married.spouse.absent
## i = 43 in-sample_brier = 0.1780273 oos_brier = 0.1841625
## predictor added: worktypeTransport.moving.Local.gov
## i = 44 in-sample_brier = 0.1777802 oos_brier = 0.1838986
## predictor added: worktypeCraft.repair.Self.emp.not.inc
## i = 45 in-sample_brier = 0.1775394 oos_brier = 0.1839145
## predictor added: worktypeSales.Self.emp.inc
## i = 46 in-sample_brier = 0.1772784 oos_brier = 0.184464
## predictor added: worktypeAdm.clerical.State.gov
## i = 47 in-sample_brier = 0.1770012 oos_brier = 0.1848479
## predictor added: native_countryEngland
## i = 48 in-sample_brier = 0.1766289 oos_brier = 0.1852858
## predictor added: native_countryItaly
## i = 49 in-sample_brier = 0.1762576 oos_brier = 0.1850986
## predictor added: worktypeTransport.moving.Private
## i = 50 in-sample_brier = 0.1759073 oos_brier = 0.185645
## predictor added: statusOther.relative.Married
## i = 51 in-sample_brier = 0.1755777 oos_brier = 0.1855656
## predictor added: worktypePriv.house.serv.Private
## i = 52 in-sample_brier = 0.1752024 oos_brier = 0.1858937
## predictor added: worktypeOther
## i = 53 in-sample_brier = 0.1748781 oos_brier = 0.1858285
## predictor added: native_countryGermany
## i = 54 in-sample_brier = 0.1744952 oos_brier = 0.1864225
## predictor added: native_countryCuba
## i = 55 in-sample_brier = 0.1741871 oos_brier = 0.186287
## predictor added: statusOwn.child.Separated
## i = 56 in-sample_brier = 0.1737656 oos_brier = 0.1862193
## predictor added: native_countrySouth
## i = 57 in-sample_brier = 0.1733164 oos_brier = 0.1853527
## predictor added: worktypeOther.service.Self.emp.not.inc
## i = 58 in-sample_brier = 0.1728051 oos_brier = 0.1853208

```

```

## predictor added: worktypeProf.specialty.Self.emp.inc
## i = 59 in-sample_brier = 0.1722497 oos_brier = 0.1846987
## predictor added: worktypeSales.Private
## i = 60 in-sample_brier = 0.1717164 oos_brier = 0.1863781
## predictor added: worktypeProtective.serv.Local.gov
## i = 61 in-sample_brier = 0.1711044 oos_brier = 0.1860013
## predictor added: statusNot.in.family.Widowed
## i = 62 in-sample_brier = 0.1705002 oos_brier = 0.1857051
## predictor added: worktypeExec.managerial.Self.emp.not.inc
## i = 63 in-sample_brier = 0.1698833 oos_brier = 0.1865027
## predictor added: native_countryJamaica
## i = 64 in-sample_brier = 0.1693691 oos_brier = 0.1866908
## predictor added: raceWhite
## i = 65 in-sample_brier = 0.1686613 oos_brier = 0.1859704
## predictor added: statusUnmarried.Separated
## i = 66 in-sample_brier = 0.1678313 oos_brier = 0.1864843
## predictor added: raceBlack
## i = 67 in-sample_brier = 0.1671104 oos_brier = 0.1841216
## predictor added: worktypeMachine.op.inspct.Private
## i = 68 in-sample_brier = 0.1664096 oos_brier = 0.1846154
## predictor added: raceAsian.Pac.Islander
## i = 69 in-sample_brier = 0.165671 oos_brier = 0.1834925
## predictor added: worktypeProf.specialty.Self.emp.not.inc
## i = 70 in-sample_brier = 0.164799 oos_brier = 0.1839977
## predictor added: native_countryPhilippines
## i = 71 in-sample_brier = 0.1639532 oos_brier = 0.1829634
## predictor added: statusOther.relative.Never.married
## i = 72 in-sample_brier = 0.1630177 oos_brier = 0.1798843
## predictor added: worktypeProf.specialty.Private
## i = 73 in-sample_brier = 0.161836 oos_brier = 0.178388
## predictor added: worktypeHandlers.cleaners.Private
## i = 74 in-sample_brier = 0.1604635 oos_brier = 0.1780931
## predictor added: worktypeExec.managerial.Local.gov
## i = 75 in-sample_brier = 0.1590754 oos_brier = 0.1803847
## predictor added: native_countryMexico
## i = 76 in-sample_brier = 0.1576239 oos_brier = 0.18131
## predictor added: statusNot.in.family.Married.spouse.absent
## i = 77 in-sample_brier = 0.1561724 oos_brier = 0.1814974
## predictor added: worktypeExec.managerial.Federal.gov
## i = 78 in-sample_brier = 0.154877 oos_brier = 0.1792748
## predictor added: worktypeAdm.clerical.Private
## i = 79 in-sample_brier = 0.1530984 oos_brier = 0.1792153
## predictor added: worktypeProf.specialty.State.gov
## i = 80 in-sample_brier = 0.1512046 oos_brier = 0.1803241
## predictor added: statusUnmarried.Divorced
## i = 81 in-sample_brier = 0.1486265 oos_brier = 0.1798221
## predictor added: statusUnmarried.Never.married
## i = 82 in-sample_brier = 0.1455114 oos_brier = 0.1793399
## predictor added: statusWife.Married
## i = 83 in-sample_brier = 0.141789 oos_brier = 0.179233
## predictor added: statusNot.in.family.Divorced
## i = 84 in-sample_brier = 0.1375809 oos_brier = 0.1772499
## predictor added: capital_loss
## i = 85 in-sample_brier = 0.1330105 oos_brier = 0.1663411

```

```
## predictor added: hours_per_week
## i = 86 in-sample_brier = 0.1290151 oos_brier = 0.1591097
## predictor added: worktypeExec.managerial.Private
## i = 87 in-sample_brier = 0.1283621 oos_brier = 0.1569123
## predictor added: worktypeOther.service.Private
## i = 88 in-sample_brier = 0.1242607 oos_brier = 0.1476126
## predictor added: education_num
## i = 89 in-sample_brier = 0.1209538 oos_brier = 0.1422338
## predictor added: statusOwn.child.Never.married
## i = 90 in-sample_brier = 0.1133092 oos_brier = 0.1362918
## predictor added: sexMale
## i = 91 in-sample_brier = 0.1027663 oos_brier = 0.1329848
## predictor added: statusNot.in.family.Never.married
## i = 92 in-sample_brier = 0.09516563 oos_brier = 0.1313902
## predictor added: age
## i = 93 in-sample_brier = 0.08715781 oos_brier = 0.1264595
## predictor added: capital_gain
```

Plot the in-sample and oos (select set) Brier score by p . Does this look like what's expected?

```
simulation_results = data.frame(
  iteration = 1 : length(in_sample_brier_by_iteration),
  in_sample_brier_by_iteration = in_sample_brier_by_iteration,
  oos_brier_by_iteration = oos_brier_by_iteration
)

pacman::p_load(latex2exp)
ggplot(simulation_results) +
  geom_line(aes(x = iteration, y = in_sample_brier_by_iteration), color = "red") +
  geom_line(aes(x = iteration, y = oos_brier_by_iteration), color = "blue") +
  #ylim(0, max(c(simulation_results$in_sample_brier_by_iteration, simulation_results$oos_brier_by_ite
  ylab(TeX("$brier score$"))
```

