

SD - Aug 30

Srijan Kundu

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**Question: Draw 50 random sample of size 25 each from the following distributions:**

(i) Rectangular(0, 1)

(ii) Normal(0, 1)

(iii) Cauchy(0, 1)

**Compute the statistics below for each sample:**

(i)  $\bar{X}_n$ , (ii)  $X_{(1)}$ , (iii)  $X_{(n)}$ , (iv)  $Med(X)$

```
set.seed(30)
library(ggplot2)
```

**The Rectangular (0, 1) distribution:**

**Drawing 50 random samples:**

```
samp1 <- replicate(50, runif(25, 0, 1))
samp1
```

```
##           [,1]      [,2]      [,3]      [,4]      [,5]      [,6]
## [1,] 0.09878282 0.2973978 0.13645145 0.395779653 0.19794849 0.4357022
## [2,] 0.48823179 0.4763574 0.16730515 0.984985246 0.80378294 0.3857202
## [3,] 0.36403673 0.2563579 0.29659443 0.882247154 0.54903277 0.3594613
## [4,] 0.42061913 0.8106153 0.41316954 0.001670874 0.61189834 0.9425587
## [5,] 0.30096439 0.4693751 0.07762887 0.094879959 0.26773305 0.3251900
## [6,] 0.14763513 0.6058477 0.88565553 0.159730863 0.13038539 0.8013029
## [7,] 0.89857491 0.2333836 0.10698215 0.484631268 0.04328997 0.4495942
## [8,] 0.22355651 0.4921895 0.07899135 0.878909588 0.83419952 0.1789526
## [9,] 0.96596330 0.6071742 0.59170621 0.795814868 0.76295112 0.4197278
## [10,] 0.14106704 0.2998100 0.85000749 0.315599537 0.64596295 0.6556245
## [11,] 0.06535501 0.6686493 0.04224549 0.098180273 0.17995765 0.5759580
## [12,] 0.39725471 0.0793686 0.09535451 0.047571812 0.48125640 0.6384687
## [13,] 0.54399676 0.4103161 0.73067664 0.047516478 0.99531705 0.6138759
## [14,] 0.87963113 0.0333278 0.56602656 0.871602137 0.86108949 0.9513179
## [15,] 0.22338939 0.2747117 0.76634877 0.621060567 0.30446102 0.5853048
## [16,] 0.92094417 0.4371046 0.60961343 0.375395771 0.53469872 0.8675296
## [17,] 0.25146172 0.6206256 0.48317353 0.134578747 0.19314806 0.7498351
## [18,] 0.83046382 0.7747034 0.19993850 0.569797243 0.29127136 0.2294632
## [19,] 0.60815737 0.4851259 0.58550682 0.654165118 0.65070246 0.3818295
## [20,] 0.43135087 0.1808502 0.98846726 0.265818339 0.83008782 0.9778312
## [21,] 0.15308963 0.6901507 0.96161447 0.995261409 0.83498573 0.5440337
```

```

## [22,] 0.58556296 0.7881247 0.03811624 0.050551693 0.58363913 0.4897843
## [23,] 0.03442537 0.2748119 0.58720106 0.075601726 0.65512150 0.1465837
## [24,] 0.32988994 0.9319606 0.62571272 0.250955993 0.26920039 0.4660419
## [25,] 0.25213389 0.1649692 0.70245644 0.010477407 0.63617399 0.5842838
##      [,7]      [,8]      [,9]      [,10]     [,11]     [,12]
## [1,] 0.692021806 0.84496502 0.6955628 0.07277298 0.77010700 0.72370103
## [2,] 0.289385920 0.23255791 0.3091034 0.02951835 0.08064415 0.10842686
## [3,] 0.234163941 0.14725974 0.1232451 0.01136248 0.18508206 0.49358280
## [4,] 0.051134567 0.67383079 0.8774552 0.91084470 0.96645063 0.21281199
## [5,] 0.865500215 0.14374284 0.7491301 0.61299291 0.57374567 0.43444714
## [6,] 0.151273756 0.71376553 0.7261369 0.10962091 0.70326575 0.01971062
## [7,] 0.263506581 0.95611736 0.2918561 0.32805381 0.11934085 0.10817603
## [8,] 0.930298233 0.41224375 0.4913098 0.65776352 0.02140614 0.36677609
## [9,] 0.421836107 0.92724681 0.3679289 0.35030832 0.34383348 0.99949264
## [10,] 0.004004411 0.31942295 0.7907357 0.19155336 0.73368451 0.42280594
## [11,] 0.802764247 0.83955466 0.5458015 0.22329389 0.40620436 0.63797663
## [12,] 0.954157097 0.71657280 0.8297549 0.85201816 0.12287562 0.24056558
## [13,] 0.285644288 0.17463708 0.2139297 0.74431942 0.45159445 0.75656125
## [14,] 0.469624718 0.09796882 0.3717849 0.91153499 0.74424168 0.93345296
## [15,] 0.439502541 0.46960682 0.6879379 0.05955640 0.13985608 0.88441077
## [16,] 0.674009262 0.60308014 0.9173555 0.30808086 0.63671048 0.06786013
## [17,] 0.333993289 0.80900927 0.5959598 0.33668941 0.93603420 0.53997199
## [18,] 0.957794233 0.53989606 0.3071337 0.02486925 0.76923553 0.11263237
## [19,] 0.986746531 0.12306094 0.5473485 0.89081715 0.84278787 0.18192331
## [20,] 0.702242127 0.60624939 0.2788492 0.95537335 0.21856648 0.04165444
## [21,] 0.020996978 0.24412915 0.4526890 0.19972966 0.96089413 0.88588319
## [22,] 0.815329046 0.58391438 0.7055959 0.69792332 0.94799822 0.10294309
## [23,] 0.143222455 0.23347346 0.5713688 0.92172704 0.88258693 0.55297433
## [24,] 0.900612770 0.08322308 0.5329214 0.03141096 0.37373876 0.15940196
## [25,] 0.942039193 0.80947109 0.2543833 0.37381262 0.14121825 0.43712100
##      [,13]     [,14]     [,15]     [,16]     [,17]     [,18]
## [1,] 0.22195921 0.89030099 0.338600985 0.6003906 0.42129555 0.11452322
## [2,] 0.97325657 0.72381253 0.095665211 0.6636447 0.45788055 0.27914954
## [3,] 0.44972098 0.18551558 0.250598309 0.5275241 0.65635253 0.13794890
## [4,] 0.66591407 0.13518944 0.554320173 0.2462430 0.96121626 0.17156126
## [5,] 0.17032431 0.48510523 0.858856739 0.3540606 0.86768899 0.65297969
## [6,] 0.71050789 0.04642570 0.599453649 0.0089029 0.87150560 0.80949441
## [7,] 0.28366301 0.05119415 0.548733333 0.1986179 0.39775045 0.72911179
## [8,] 0.16717404 0.51860728 0.156667443 0.9445149 0.91226587 0.02552564
## [9,] 0.61915059 0.31575681 0.432355981 0.5139751 0.89539333 0.82580260
## [10,] 0.13782779 0.16599924 0.318859533 0.9031082 0.32043654 0.24367859
## [11,] 0.05340944 0.47176338 0.950332988 0.6193075 0.07277936 0.13310983
## [12,] 0.97126520 0.01004325 0.001377158 0.6089844 0.17562269 0.80563828
## [13,] 0.04657108 0.44922264 0.037994377 0.9953839 0.68999758 0.91149100
## [14,] 0.33409237 0.18140094 0.970445728 0.3002348 0.94983026 0.41402115
## [15,] 0.65585573 0.03216818 0.117516203 0.1968216 0.63117686 0.59905752
## [16,] 0.46988378 0.59196233 0.015774151 0.4382741 0.19976297 0.91048721
## [17,] 0.02002500 0.55678626 0.920887904 0.7544148 0.13331506 0.09205075
## [18,] 0.71082238 0.35426583 0.994959084 0.3924943 0.52927172 0.39939335
## [19,] 0.19646000 0.36367295 0.719795119 0.1198882 0.52597929 0.09722963
## [20,] 0.53028791 0.02836102 0.312087854 0.7391164 0.96324012 0.98444160
## [21,] 0.86917857 0.14234072 0.898161637 0.3599746 0.76389148 0.40298082
## [22,] 0.23633955 0.37938796 0.618978276 0.1011689 0.51267767 0.97093580
## [23,] 0.44016330 0.29270269 0.135893565 0.4632031 0.54496063 0.50766174

```

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## [24,] 0.56039413 0.05981305 0.293934692 0.4353388 0.81168334 0.91197132
## [25,] 0.77081281 0.99328463 0.072332910 0.2781692 0.82940078 0.19875491
##      [,19]      [,20]      [,21]      [,22]      [,23]      [,24]
## [1,] 0.29408054 0.311778182 0.23371977 0.140295117 0.002523081 0.442409225
## [2,] 0.24779042 0.144438945 0.41466086 0.357329789 0.703200192 0.448565430
## [3,] 0.78361957 0.950417558 0.89589626 0.601600691 0.168903483 0.555024537
## [4,] 0.92274413 0.780230260 0.42267745 0.992589954 0.036175763 0.335922234
## [5,] 0.29308329 0.731204654 0.22681910 0.688944571 0.932342545 0.769074283
## [6,] 0.18580017 0.040930673 0.70568604 0.213524386 0.529006831 0.478981720
## [7,] 0.39609163 0.056601550 0.75330500 0.977344373 0.716931635 0.561561592
## [8,] 0.19697373 0.148751318 0.13692213 0.951613500 0.290582908 0.477952700
## [9,] 0.94510859 0.442900970 0.60829967 0.024130482 0.853192323 0.535023910
## [10,] 0.05911431 0.768673621 0.41823938 0.085238743 0.491982570 0.814692287
## [11,] 0.22635133 0.792308825 0.39692283 0.585878141 0.317625932 0.091447619
## [12,] 0.55308646 0.109910481 0.64089145 0.880217842 0.512529559 0.815768319
## [13,] 0.57417748 0.727027005 0.18886555 0.005918184 0.700121480 0.774776843
## [14,] 0.10634544 0.849044108 0.76316497 0.390972439 0.398606442 0.301657159
## [15,] 0.29071622 0.964650379 0.19210122 0.702037414 0.141272729 0.483891945
## [16,] 0.74470414 0.180267791 0.83241123 0.237828817 0.115988636 0.252828720
## [17,] 0.31383967 0.565645968 0.11289691 0.527150075 0.587711293 0.919860395
## [18,] 0.96211532 0.686360021 0.01816265 0.382302124 0.317692986 0.425786042
## [19,] 0.21449216 0.544901679 0.34645791 0.571707363 0.042413462 0.842307801
## [20,] 0.56870566 0.239301624 0.76381245 0.240712078 0.441417954 0.780012067
## [21,] 0.51155953 0.529253500 0.04211637 0.114867788 0.349124721 0.800752893
## [22,] 0.33380417 0.007755061 0.01741369 0.464718077 0.251548364 0.948441539
## [23,] 0.98507899 0.243613814 0.07992041 0.483778921 0.609875458 0.169576000
## [24,] 0.81644494 0.390909684 0.36839629 0.688967616 0.891015803 0.034971510
## [25,] 0.34163974 0.100562136 0.62828754 0.827096262 0.996273146 0.001138356
##      [,25]      [,26]      [,27]      [,28]      [,29]      [,30]
## [1,] 0.22430510 0.70182615 0.6979170 0.638379752 0.54828852 0.988755857
## [2,] 0.44744544 0.86114730 0.3284509 0.833529117 0.81388016 0.011906762
## [3,] 0.57617682 0.80742664 0.2745280 0.845036386 0.12036259 0.186018289
## [4,] 0.78300349 0.03154611 0.7525333 0.981749326 0.98171036 0.003329883
## [5,] 0.92151400 0.54481680 0.6555585 0.684297744 0.57208251 0.374704920
## [6,] 0.02426103 0.48269100 0.5447201 0.801647214 0.73225618 0.182790284
## [7,] 0.48751974 0.20725718 0.5862766 0.731230332 0.31078984 0.270007835
## [8,] 0.47458255 0.71247625 0.2193005 0.110689448 0.96643583 0.743639232
## [9,] 0.95704982 0.53259469 0.2878961 0.894142610 0.16926626 0.651583354
## [10,] 0.58130966 0.07441521 0.7739067 0.277469387 0.09906288 0.679616107
## [11,] 0.27247687 0.91260408 0.8339184 0.267030181 0.43025874 0.836636999
## [12,] 0.14140404 0.55520098 0.5276322 0.861100549 0.10505288 0.375852058
## [13,] 0.72323325 0.02822487 0.4577087 0.544924249 0.08177472 0.689197883
## [14,] 0.86445043 0.81668628 0.8155624 0.387598166 0.55956367 0.969238055
## [15,] 0.55643007 0.12342621 0.3644800 0.231062325 0.59123819 0.815624179
## [16,] 0.26824204 0.73860036 0.1336865 0.271626313 0.34662501 0.961664900
## [17,] 0.19043913 0.84522428 0.1404868 0.316376099 0.73696628 0.938272316
## [18,] 0.74483573 0.55794817 0.3544226 0.974022008 0.84062658 0.444735781
## [19,] 0.54885578 0.36757361 0.6474187 0.941739990 0.06340573 0.463708312
## [20,] 0.65793842 0.13289883 0.8918689 0.005325485 0.43370922 0.109877445
## [21,] 0.14981974 0.17056128 0.9750785 0.866459585 0.04302924 0.401949235
## [22,] 0.78313099 0.76525246 0.1480687 0.431438042 0.79133036 0.613156848
## [23,] 0.64331024 0.86148586 0.8419956 0.470394799 0.56643381 0.195325563
## [24,] 0.21386901 0.13610607 0.6225040 0.153448379 0.71203103 0.504338674
## [25,] 0.93299062 0.47515572 0.4694915 0.536352560 0.13112496 0.642743037

```

##		[,31]	[,32]	[,33]	[,34]	[,35]	[,36]
##	[1,]	0.9516199	0.21441015	0.000650994	0.9159515155	0.89357406	0.418307451
##	[2,]	0.3137542	0.76512301	0.344416323	0.6830185989	0.09098538	0.681078823
##	[3,]	0.7532431	0.08654085	0.667466387	0.0528826369	0.08584761	0.049999142
##	[4,]	0.5786835	0.22193493	0.211487222	0.7311529121	0.27067759	0.004346256
##	[5,]	0.4977007	0.16800178	0.972796772	0.9305858128	0.04906291	0.848449549
##	[6,]	0.9787163	0.79842413	0.699442412	0.5731677625	0.85749543	0.010320184
##	[7,]	0.4002913	0.64605565	0.998254652	0.0903098816	0.46003577	0.261627201
##	[8,]	0.1933602	0.21780751	0.006467780	0.5877454171	0.39897562	0.687559162
##	[9,]	0.8294406	0.94811648	0.201937143	0.9194327882	0.78421562	0.537168685
##	[10,]	0.9930752	0.20606211	0.510632197	0.7227278876	0.01568811	0.089830031
##	[11,]	0.7200510	0.09044462	0.521428020	0.1945894591	0.06889243	0.091815122
##	[12,]	0.5552021	0.02807093	0.698261563	0.8521334073	0.55135509	0.811797715
##	[13,]	0.4460849	0.24630528	0.754551927	0.9686448707	0.76548353	0.233904565
##	[14,]	0.8791966	0.94880020	0.947019577	0.6875784164	0.71842509	0.154771921
##	[15,]	0.9496184	0.26150966	0.772988017	0.7568100218	0.59175775	0.841242276
##	[16,]	0.7731587	0.56890443	0.950224898	0.0001352641	0.74641201	0.854456792
##	[17,]	0.2240990	0.89575364	0.669055003	0.1087737761	0.96692832	0.533747477
##	[18,]	0.3820063	0.96716475	0.205376261	0.5330054769	0.34674714	0.407434175
##	[19,]	0.2042817	0.69115355	0.316888799	0.0238596904	0.19502703	0.422317875
##	[20,]	0.1632326	0.14340754	0.259843213	0.4513600988	0.76710708	0.905097357
##	[21,]	0.6279583	0.29597732	0.031769275	0.9043137820	0.03288380	0.731062069
##	[22,]	0.8919962	0.89410296	0.273115210	0.7024052353	0.95928931	0.366684634
##	[23,]	0.9276193	0.35409248	0.314627938	0.6427455551	0.33402801	0.443111462
##	[24,]	0.5756935	0.09009547	0.274502333	0.3925404469	0.12906298	0.880401264
##	[25,]	0.4968500	0.24315592	0.065947107	0.6504013503	0.99035152	0.868453018
##		[,37]	[,38]	[,39]	[,40]	[,41]	[,42]
##	[1,]	0.94456209	0.357606173	0.30381990	0.3190106	0.81343641	0.25290196
##	[2,]	0.26923494	0.294294079	0.47307796	0.1397403	0.57330458	0.69508540
##	[3,]	0.35221977	0.391752410	0.58198443	0.4799231	0.85680220	0.45345906
##	[4,]	0.51695056	0.633910292	0.54094185	0.2063539	0.37977533	0.17298793
##	[5,]	0.53033226	0.529288011	0.43666576	0.1004529	0.13425752	0.10880252
##	[6,]	0.62308381	0.319243054	0.68151551	0.3773391	0.31465596	0.13681436
##	[7,]	0.00952775	0.787027872	0.19743712	0.8305240	0.71633688	0.62316956
##	[8,]	0.03151089	0.722309563	0.02418926	0.6372843	0.04714883	0.14910642
##	[9,]	0.55208796	0.836486696	0.94702925	0.1477464	0.39016005	0.94402299
##	[10,]	0.71795120	0.911931055	0.85398087	0.1846938	0.81628961	0.31453155
##	[11,]	0.16092177	0.002249812	0.45753939	0.2403049	0.62492932	0.15342701
##	[12,]	0.81221268	0.879739488	0.11625999	0.6364739	0.16397134	0.25829341
##	[13,]	0.98903296	0.692129708	0.78236240	0.3219120	0.96407202	0.08059727
##	[14,]	0.86048363	0.567899579	0.96196811	0.4582701	0.38950933	0.71035187
##	[15,]	0.02897580	0.082477422	0.14547020	0.6614586	0.33545601	0.18480475
##	[16,]	0.70479089	0.667754014	0.51643788	0.5278304	0.45116759	0.49334658
##	[17,]	0.54617169	0.999843023	0.43393624	0.9304231	0.99127839	0.47359772
##	[18,]	0.96482702	0.493124211	0.28566912	0.7189614	0.23037063	0.85798235
##	[19,]	0.83813145	0.138362033	0.32217127	0.3707934	0.20523008	0.31036662
##	[20,]	0.13596448	0.836900318	0.48355956	0.5889265	0.16386444	0.94457944
##	[21,]	0.38287509	0.689958882	0.85589249	0.5432043	0.31629181	0.30586078
##	[22,]	0.37739719	0.483939623	0.73230579	0.4837839	0.82640682	0.01157267
##	[23,]	0.38621286	0.371952861	0.95499755	0.4865244	0.04108188	0.60116121
##	[24,]	0.01418721	0.416868865	0.23180395	0.8258671	0.32288796	0.95079146
##	[25,]	0.15373332	0.179966519	0.31804636	0.4255709	0.10153656	0.29202308
##		[,43]	[,44]	[,45]	[,46]	[,47]	[,48]
##	[1,]	0.84259881	0.77676651	0.80864264	0.14974247	0.99136840	0.6877329

```

## [2,] 0.11282887 0.82665878 0.17495515 0.67421270 0.23317506 0.1892408
## [3,] 0.67534040 0.56396821 0.84426747 0.96350861 0.92269940 0.7173697
## [4,] 0.19390484 0.68897016 0.13653873 0.75435498 0.30713896 0.7708146
## [5,] 0.78674603 0.81639548 0.72885648 0.53037414 0.75036572 0.6967160
## [6,] 0.97826477 0.06281172 0.26524376 0.37593875 0.21299405 0.6508152
## [7,] 0.75975398 0.31052858 0.98620106 0.48192488 0.64945459 0.5967672
## [8,] 0.40866943 0.42988873 0.14545790 0.20824573 0.30522818 0.9122680
## [9,] 0.02994009 0.84626286 0.70929675 0.42232568 0.04310857 0.2802713
## [10,] 0.42448971 0.65388395 0.61507502 0.85383652 0.36367181 0.2247707
## [11,] 0.73219554 0.84137500 0.28778724 0.86110210 0.34533710 0.6387120
## [12,] 0.31132588 0.23509840 0.22264660 0.20618495 0.19560035 0.4332023
## [13,] 0.08532719 0.96326992 0.67356443 0.19701098 0.58796162 0.2421155
## [14,] 0.19410138 0.45079829 0.64305452 0.98431348 0.95616945 0.1849660
## [15,] 0.64143895 0.16224306 0.53861996 0.90852686 0.34974103 0.1987029
## [16,] 0.18616073 0.75110790 0.09449500 0.47639161 0.92553835 0.3127301
## [17,] 0.58519453 0.85281524 0.48490277 0.92940966 0.78186062 0.6238281
## [18,] 0.41447300 0.80608902 0.70018179 0.48544934 0.36532833 0.9250960
## [19,] 0.76968759 0.12220329 0.08590316 0.17501270 0.87824003 0.4532865
## [20,] 0.26411429 0.92890716 0.95192979 0.68265351 0.47362448 0.2413260
## [21,] 0.25394757 0.71199183 0.49395141 0.12673660 0.60939709 0.4258400
## [22,] 0.96352172 0.55606255 0.02282222 0.10761578 0.28592079 0.6944911
## [23,] 0.99478139 0.30131675 0.29904184 0.76791182 0.85678857 0.2644468
## [24,] 0.10955078 0.20229025 0.43074029 0.80705671 0.09455955 0.5524170
## [25,] 0.70151346 0.77247716 0.27593128 0.02297501 0.49470240 0.8805130
##      [,49]      [,50]
## [1,] 0.82368279 0.4891343
## [2,] 0.11526344 0.3967687
## [3,] 0.34703619 0.3592841
## [4,] 0.94203395 0.6786118
## [5,] 0.10902410 0.1724208
## [6,] 0.52979553 0.2016020
## [7,] 0.86588062 0.7798039
## [8,] 0.52784045 0.0808286
## [9,] 0.97380013 0.9816547
## [10,] 0.53559211 0.5157456
## [11,] 0.28904488 0.9695043
## [12,] 0.33791675 0.9699722
## [13,] 0.43426482 0.9364704
## [14,] 0.64901260 0.2526310
## [15,] 0.08593573 0.1946434
## [16,] 0.93985540 0.5025675
## [17,] 0.59301489 0.9077823
## [18,] 0.39422985 0.9312351
## [19,] 0.27869431 0.7905641
## [20,] 0.11871959 0.1460613
## [21,] 0.94689232 0.1944843
## [22,] 0.70295368 0.9814702
## [23,] 0.91430335 0.4452738
## [24,] 0.86905086 0.9042947
## [25,] 0.11407775 0.6335137

```

Calculating mean for the above sample:

```
samp1_mean <- replicate(50, mean(runif(25, 0, 1)))
samp1_mean
```

```
## [1] 0.4242015 0.5200406 0.5017782 0.4902966 0.4670296 0.4265392 0.4972424
## [8] 0.4946778 0.4290083 0.4922050 0.5490255 0.4485942 0.5079615 0.4451926
## [15] 0.5362271 0.4315300 0.4957183 0.5023440 0.5014595 0.6067149 0.4994223
## [22] 0.5466601 0.4139500 0.5060135 0.3668918 0.5173425 0.3997405 0.4508578
## [29] 0.5770198 0.5876233 0.5483592 0.4182377 0.3710242 0.5436938 0.4641644
## [36] 0.3946543 0.4436471 0.5508089 0.4460531 0.4519154 0.4985648 0.5323046
## [43] 0.4250067 0.5620196 0.4952670 0.4649322 0.4512556 0.5805571 0.4962565
## [50] 0.5399272
```

Calculating minimum for each of the above samples:

```
samp1_min <- replicate(50, min(runif(25, 0, 1)))
samp1_min
```

```
## [1] 0.003689917 0.105844652 0.072148430 0.024065241 0.006919096 0.040734239
## [7] 0.055408920 0.014543394 0.036304511 0.011940632 0.070607972 0.073674982
## [13] 0.067236380 0.002631008 0.055728340 0.001808006 0.043558556 0.003462068
## [19] 0.037358899 0.133136444 0.168777044 0.003483265 0.044110296 0.039450905
## [25] 0.029509597 0.047041128 0.010190208 0.001805829 0.005312536 0.030717315
## [31] 0.014488494 0.022903054 0.014523079 0.038127724 0.025270938 0.003029816
## [37] 0.023421920 0.014239904 0.004028954 0.037418598 0.046825035 0.009141473
## [43] 0.040813657 0.012714515 0.023348854 0.038002664 0.003324724 0.077604079
## [49] 0.012343351 0.023700084
```

Calculating maximum for each of the above samples:

```
samp1_max <- replicate(50, max(runif(25, 0, 1)))
samp1_max
```

```
## [1] 0.9940864 0.9443692 0.8671208 0.9943593 0.9223705 0.9102514 0.9696273
## [8] 0.9991450 0.9655174 0.9117923 0.9848463 0.9993197 0.9829833 0.9431326
## [15] 0.9750815 0.8474711 0.9703309 0.9667354 0.9810141 0.9681867 0.9699511
## [22] 0.9575549 0.9668233 0.9266872 0.9774207 0.9165798 0.9658592 0.9925993
## [29] 0.9810713 0.9589875 0.9497282 0.9887019 0.9907580 0.9096894 0.9796691
## [36] 0.9894741 0.8920092 0.9732112 0.9358926 0.9943915 0.9808538 0.9848268
## [43] 0.9407670 0.9486007 0.9984547 0.9165140 0.9546213 0.9799196 0.9704686
## [50] 0.9357774
```

Calculating median for each of the above samples:

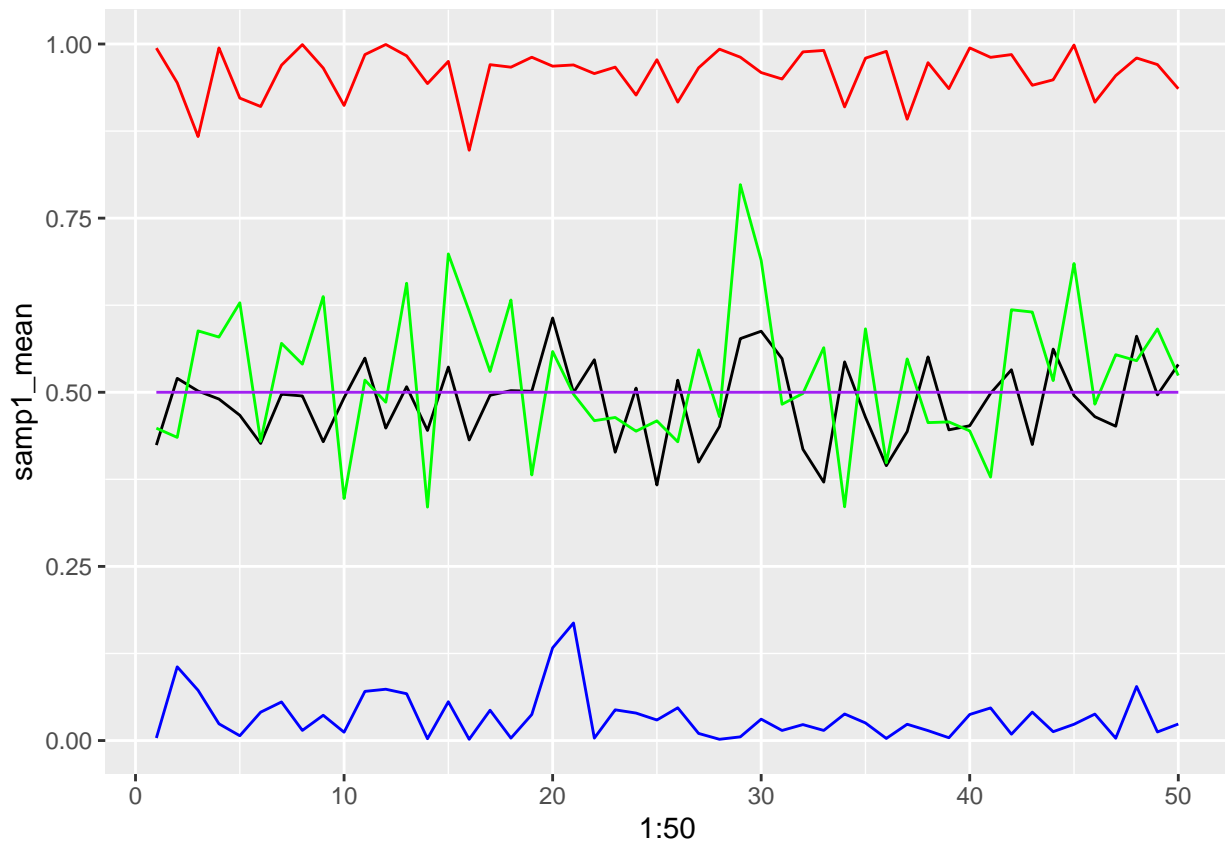
```
samp1_mid <- replicate(50, median(runif(25, 0, 1)))
samp1_mid
```

```
## [1] 0.4484540 0.4352211 0.5881784 0.5792439 0.6284931 0.4295968 0.5702661
## [8] 0.5403792 0.6374086 0.3474937 0.5174726 0.4857749 0.6564957 0.3351414
## [15] 0.6986765 0.6162572 0.5298832 0.6324712 0.3813259 0.5585472 0.4973086
## [22] 0.4592361 0.4638133 0.4441378 0.4589612 0.4288996 0.5608110 0.4651315
## [29] 0.7980895 0.6894594 0.4827991 0.4983421 0.5640077 0.3356282 0.5910946
## [36] 0.3987274 0.5478936 0.4564261 0.4574427 0.4445859 0.3781859 0.6184745
```

```
## [43] 0.6151763 0.5167851 0.6848569 0.4828917 0.5539644 0.5453286 0.5909060
## [50] 0.5240244
```

Plotting these 4 statistics:

```
ggplot(NULL,aes(1:50))+geom_line(aes(y =samp1_mean), color = "black") +
  geom_line(aes(y =samp1_max), color = "red") +
  geom_line(aes(y = samp1_mid), color = "green") +
  geom_line(aes(y = samp1_min), color = "blue") + geom_line(aes(y = 0.5), color = "purple")
```



The Normal (0, 1) distribution:

Drawing 50 random samples:

```
samp2 <- replicate(50, rnorm(25, 0, 1))
samp2
```

```
##           [,1]      [,2]      [,3]      [,4]      [,5]      [,6]
## [1,] -0.157165079 -1.05107125 -4.48321385  0.367008206  0.27378755  0.22717701
## [2,] -1.101688171 -0.42562741 -0.05270364 -0.009165949  1.02152550 -0.09413663
## [3,] -0.796675750  0.62006701  1.18202246 -0.430416421 -0.16747753  0.50769704
## [4,]  0.005729214  0.08649163 -0.49535475  0.009559083 -0.25965106 -1.02770936
## [5,]  1.376738235  1.85458597 -0.56988105  0.636848558 -1.57240490 -1.82485320
## [6,]  1.347774499  2.15215047  2.54242481  0.452841768  1.05451156 -1.05592298
## [7,] -0.537242032  0.98882483 -0.46645347  0.654150543 -1.62954796 -1.43104756
## [8,]  0.684765805 -0.11401333 -0.42314493  1.340323129  0.21935186  1.22877743
```

```

## [9,] -1.823733193 -0.40379221 0.91764748 0.643678049 -0.97800570 0.12540878
## [10,] 0.692806439 -0.55505717 0.94614267 -0.086571639 -0.38638812 0.94165077
## [11,] 0.561837377 -0.72774615 -0.35322599 1.070840308 -0.08564649 0.43402847
## [12,] -0.337906180 -0.07586157 0.84397878 0.112304365 -0.17847459 -1.54317676
## [13,] 1.004786214 -0.81827161 0.36627932 -0.235210287 -0.73232325 0.74788115
## [14,] 0.869192263 0.49660246 0.88050247 0.920772564 0.14829670 0.58646824
## [15,] -1.372505083 -0.02333126 0.51097999 0.564791988 1.15655161 0.02606438
## [16,] -0.557798005 -0.10197637 0.96689605 -0.847832931 0.77555784 -0.12732929
## [17,] -1.190051907 -0.35448765 -0.09666309 -0.725721476 0.18873835 1.29588972
## [18,] 0.976318261 -0.43218582 -0.91581804 0.753963708 -0.30721715 -0.39371165
## [19,] -0.363032637 1.22678027 -1.33275001 1.233740185 0.43893403 0.60396767
## [20,] 0.100241594 -0.71082659 0.43563352 -0.635893859 0.12690591 0.61002905
## [21,] 1.648602023 -0.37283663 -0.76684423 1.122940188 -0.52842147 0.95872691
## [22,] -0.462678536 1.07638912 0.28439241 -1.169775405 -1.47265066 0.89089756
## [23,] 0.491703335 0.08247336 0.43284267 -1.649549210 -0.94544107 -0.09984537
## [24,] 0.228507373 -1.00395144 -0.14968890 -0.710369327 -0.41484014 -1.81401793
## [25,] 0.686162988 -0.74020953 -0.79436979 0.262624189 0.78574580 -0.26646770
##      [,7]      [,8]      [,9]      [,10]      [,11]      [,12]
## [1,] -0.50091945 2.00047392 -1.0368885 0.76238548 0.88177552 0.31308940
## [2,] 1.89180053 1.20563890 0.9405297 -0.86570585 0.24777592 1.20548998
## [3,] -0.30507606 -0.79411707 0.5443181 1.09796231 -3.29524849 -1.39777916
## [4,] -0.48281825 1.14786560 -0.8424091 -0.08038888 0.30229541 -0.01900567
## [5,] 0.46807824 -0.48732190 1.9766817 -0.37878770 -0.42260567 0.26675584
## [6,] -0.29817682 0.57376256 0.7911632 -1.40287548 0.17644428 1.78324284
## [7,] -0.40414192 0.19337581 0.5030862 -0.11216004 -0.57712057 1.14767567
## [8,] 0.11179456 1.20959510 0.4863586 -0.24276021 1.89174439 -1.49928446
## [9,] 2.74436797 -0.14538024 -0.9258424 0.76421607 0.01184916 1.33129624
## [10,] -1.41769096 1.39146737 0.4117123 3.28504389 0.78809915 -0.82953651
## [11,] 1.98039137 0.56011679 0.6399530 0.16853412 1.38896292 -0.99045551
## [12,] 0.59942363 0.32594843 1.1865812 -0.44555047 0.88815424 0.21973436
## [13,] 0.91448859 0.57768626 1.3443289 0.10237772 -0.16606704 -0.16090884
## [14,] -0.19462063 -1.06767045 0.2145542 -0.10960851 0.64500650 -0.98614445
## [15,] -0.56002645 1.35079321 -0.1594200 0.81315305 0.26069874 -0.20657838
## [16,] -0.67576743 0.75817073 1.0507171 -0.15209490 0.09088487 0.22810448
## [17,] -0.85926540 -0.50844169 1.5467545 -0.78616659 -0.25523471 0.16170447
## [18,] 0.33197562 0.40995623 -0.8236284 -1.55889369 0.44529163 0.19216928
## [19,] 0.18279626 -1.40652044 1.2742950 0.76643305 -0.40433212 1.31184711
## [20,] -1.53811284 0.96494444 -0.5882519 -2.81591054 -0.66841103 -0.05370367
## [21,] 0.02689055 0.33477930 0.9314568 0.01528244 -1.30672407 -0.10164148
## [22,] -0.30624612 0.68397741 -1.7690223 -0.04732809 -0.09574621 -2.44616192
## [23,] -0.06539965 1.54485564 0.9873141 0.43704696 0.43567971 0.88397362
## [24,] -0.15311099 -0.03081351 1.1010061 1.93019165 -0.64200259 -0.12736770
## [25,] -0.59437693 -0.90108485 1.3436009 1.10193146 1.56082437 0.86876540
##      [,13]      [,14]      [,15]      [,16]      [,17]      [,18]
## [1,] -1.29499203 3.401045394 -0.8366054 0.91340057 0.04259349 -0.66892604
## [2,] 0.12726555 0.211068157 0.1175786 0.73957287 -0.18918845 0.33754348
## [3,] 0.88218278 2.448753519 -1.1959169 -1.37542714 -0.72767870 -2.01235375
## [4,] 0.07088568 -0.212925631 0.1237483 -1.52852731 0.93502185 0.24950686
## [5,] 1.53607022 1.620825087 1.7830813 -0.41620448 -0.09043330 -0.38002852
## [6,] -0.90554287 1.068058994 -0.2377112 -1.41330722 -0.62851290 -0.19477465
## [7,] -0.75522895 -0.918623271 -1.4541535 -0.43544352 0.05112854 -1.04745978
## [8,] 0.17199158 -0.068926758 -1.4566576 -0.69593187 0.82960249 -0.25738733
## [9,] -1.33723116 0.218269702 -1.8300269 0.54084011 -0.69503379 -0.43943926
## [10,] -0.82219320 0.009434709 0.8460547 1.37060827 -0.60384195 1.91913326

```



```

## [11,] -1.01635563 -0.237390979 -0.2510309 -1.08878410 -0.21996804 0.76231067
## [12,] 1.37279322 0.773281150 -0.6859658 0.85140335 0.67363297 0.15724058
## [13,] -0.29757979 0.815338784 2.7773200 -0.31494224 1.66956365 -0.85361506
## [14,] -1.15433824 -0.231360990 2.3376603 -0.14560675 -0.59875668 0.58966348
## [15,] 0.91118057 0.953583683 1.0991234 0.83991683 -0.37139332 -0.32143136
## [16,] 0.18613766 2.297839509 -0.2549753 -0.88655022 -0.69992097 0.50988201
## [17,] -0.98417690 0.633109945 0.2346176 0.80819016 1.27657965 -0.08604882
## [18,] 0.18451891 -0.741049976 -0.4942565 0.42029928 1.56145054 -0.03159373
## [19,] 0.20395627 -0.320962274 0.4246028 -1.41697455 0.47955237 0.69035746
## [20,] -0.45908954 0.372978568 -0.8001368 -2.30274675 0.02738079 -2.48375456
## [21,] -0.04102047 -0.540082331 -1.4395131 -0.05748058 -0.02951012 -0.69539674
## [22,] 1.18489332 0.429577219 -0.1783301 0.17054938 -0.50202491 -0.52476754
## [23,] -0.27290098 -0.848775163 -0.6537093 0.91716519 0.26931890 0.50743546
## [24,] 0.87890718 1.475605879 0.7887432 0.15745554 0.89560159 0.03620666
## [25,] -0.73354165 -1.418272045 0.4795460 -1.63933914 -1.22319487 0.57727225
##      [,19]      [,20]      [,21]      [,22]      [,23]      [,24]
## [1,] -0.89294580 -0.80698734 -1.27031363 1.19079530 0.65280507 0.27868660
## [2,] -1.48671386 0.60483840 1.64307086 0.12918181 -0.92579487 -0.29318819
## [3,] 2.71557128 -0.26796724 -0.31670063 0.01351031 -0.48121764 0.48187435
## [4,] -0.26521740 0.12557275 -0.89577142 -0.77045930 -2.68021791 0.16703469
## [5,] -0.55539049 -1.19401969 -0.93480955 -0.86886193 0.26326563 2.21045395
## [6,] 0.50725511 -0.80276100 -1.10005709 -0.11170818 0.24065102 -0.23305870
## [7,] 1.12040799 2.02475428 1.06550829 -1.26890246 0.59630533 -2.21352733
## [8,] 0.80074820 0.68550333 -0.84296931 0.09278781 -0.46256664 0.21392165
## [9,] -0.04512243 -1.32841586 0.14610929 -0.31903461 -0.28330741 -1.41482783
## [10,] -1.84002489 0.01010205 -0.93727126 -0.90099062 0.07460006 0.66833204
## [11,] -1.17768010 -1.12375069 0.12156692 -0.27660394 -0.12205934 0.09472429
## [12,] -0.79774393 0.43992775 1.21249624 0.01266146 -0.36902514 1.46836814
## [13,] -0.32474911 1.61587767 1.13887377 -0.72244300 -0.62148214 -0.82939864
## [14,] 1.31851902 -0.37286688 -1.00086120 0.85701087 0.57065687 -0.22474008
## [15,] -0.79064839 0.45466643 -0.41245541 -2.61294983 -0.42514208 0.19099082
## [16,] 0.71430818 -1.47496964 0.44521810 -1.49857876 -1.04836907 1.58773201
## [17,] 0.31168959 -0.78812103 0.37895709 -0.58385367 0.94372808 0.90101003
## [18,] 0.73671082 0.32382943 0.43587251 1.42590717 -1.04199451 -0.22591140
## [19,] -1.44913772 0.70559267 -0.42637992 -0.58929273 2.22396280 0.08486415
## [20,] -2.13717832 1.12138849 -1.47177867 -1.92822720 1.25856062 -1.00446749
## [21,] 1.31269051 -2.08538157 -0.19707160 -0.49284075 -0.25979938 0.47559472
## [22,] 0.17000283 1.29043416 0.94417782 -0.82526793 0.30117242 -0.78520987
## [23,] 0.14177822 -1.08968841 1.22869269 -1.63039881 0.58176396 -0.54801594
## [24,] 0.24354081 0.06613051 1.20963319 -1.81022362 -0.51979081 -0.93333610
## [25,] 1.68579559 -0.07246143 -0.05429993 1.18673736 -0.19262280 0.42693046
##      [,25]      [,26]      [,27]      [,28]      [,29]      [,30]
## [1,] -0.2083785 -0.1781990 0.066528073 -0.81325997 -2.057694145 0.5127033
## [2,] 1.1193905 -0.5423456 -1.002493862 1.46751133 -0.877201805 -0.4713157
## [3,] 1.0469607 -0.9862883 0.042015380 0.16482832 0.311772528 -0.7443993
## [4,] -1.1201164 -0.8527057 -0.421793491 -0.84870143 -0.537405212 -0.4889800
## [5,] -0.4867866 0.9409770 -1.150199950 0.69856321 -0.430077247 -0.2845931
## [6,] -0.3663055 -0.8483458 -0.259061348 0.22953469 0.816138506 -0.5204499
## [7,] 1.1714034 -1.2078539 -1.433673433 -3.21955847 -1.047160263 0.5184304
## [8,] 1.5629233 -0.2672346 0.007730724 0.05034718 0.272863540 0.9539263
## [9,] -0.5033041 -0.8947188 -0.215982135 -0.73170665 0.003160043 0.3563087
## [10,] 1.9204751 0.6355432 -1.695620721 -0.05294474 -0.240805941 -1.1601005
## [11,] 0.8097028 -1.3099218 0.934852347 -0.29655164 1.669347672 -0.2106277
## [12,] -0.9462463 -1.2100277 0.337907565 0.67860472 0.847441549 0.6403305

```

```

## [13,] -0.8186920  1.0339297 -0.517430803 -0.09825421 -0.505331059 -0.3462702
## [14,]  2.6627882  0.4782981  0.754552839 -0.23360443  1.444564731  0.6258638
## [15,] -1.0099017 -1.4090139 -0.795103655  0.50420188 -1.375829683 -1.4627315
## [16,] -0.4196535 -0.6085244 -0.254161079  1.24378381  0.410811811  2.1925332
## [17,]  0.1296194 -0.2067844 -0.513200876  0.80621545  0.416607339 -0.2216212
## [18,] -2.2051943 -0.6530495  0.638384603  0.60493716  0.569814184 -1.3665115
## [19,]  0.6875386 -1.5371696 -0.158006871  1.65438757  0.851680768 -0.9417173
## [20,]  1.0936103 -0.9815714 -0.153781761 -0.28923553  0.412281897  0.6657738
## [21,] -0.7949704 -1.1356096 -0.529258313  0.06662475  0.436717615  0.5392061
## [22,]  1.2989360  0.8540797  1.947677300 -0.20533001 -0.811939571 -1.1700903
## [23,]  0.6133207  0.6997419  0.494571918  0.45902253  0.296009022 -1.2714092
## [24,] -0.8846486  0.8131396 -0.534218604 -1.66390422 -0.573679448 -1.5948186
## [25,]  0.4024096  0.1766598 -2.589492470 -0.11859761 -1.417237114  0.5227795
##      [,31]      [,32]      [,33]      [,34]      [,35]      [,36]
## [1,]  0.28462823  1.435955538 -1.28576769  1.04495522 -1.8162750  1.207849892
## [2,]  0.30579710 -1.063894481 -2.05940779 -0.27896844  2.1910621  0.904622911
## [3,]  0.67194317 -0.741716853 -0.06052267 -1.28927385  1.2939766 -1.212112937
## [4,]  0.52834306 -0.179882749 -2.29180767 -0.08313792 -1.1013977 -0.322546760
## [5,]  0.44087491 -1.083106214  0.52788664  0.10357541  0.5997957 -0.949463152
## [6,] -0.38341087  0.583981378 -0.96884869 -1.45908676 -0.3340396 -0.719004954
## [7,]  0.07407137 -1.981997565  2.17406100  0.45241601 -1.3086230  0.578367685
## [8,]  0.37665919  0.455285161 -0.03097747  1.08135941  0.3214944  0.994826715
## [9,]  1.30094940  0.194050016 -0.53630346  2.79477709 -0.5847118 -1.286178021
## [10,] 0.23013162  0.907278392  0.72103267  0.18054752 -1.8696083  0.358016400
## [11,] 0.03575538  1.125250753 -0.18013589 -0.25272770 -1.1579139 -0.778819696
## [12,] 1.06136188  1.532900024 -1.34599568 -0.38030586  0.6138782  0.373555137
## [13,] 0.86095443  0.373065675  1.59713215 -1.24548369 -0.5610597  1.084411311
## [14,] 0.61575158 -0.007452553 -0.74933871  0.77265430 -0.4522569 -0.917529659
## [15,] 1.65748210 -0.197061159  1.43501988 -0.43274437 -0.6597148 -0.603445185
## [16,] -1.44557036 -0.140489448  1.08654598  1.06387133  1.0390014  0.689937602
## [17,] 1.63205693  1.399397055  1.37739227 -0.99462504 -0.9834481  0.004389165
## [18,] -0.58512505 -0.192847922 -0.48980599 -0.39546012  0.9503031  1.345420045
## [19,] -0.71922535 -0.544758434  0.08400927 -0.11226980 -1.4179447  1.925116650
## [20,] -1.56590097  0.494569141 -0.97074512 -0.61710478  0.3792782  1.215557496
## [21,] 0.34551735  0.264846538 -0.16640310  0.20602707 -1.5299815 -1.365558216
## [22,] -1.13839726  2.310844441  0.76622369  0.20083000 -0.2311466  0.019364101
## [23,] 1.47195055  1.611441628 -0.14443948 -1.53279046  0.2009428  0.100540479
## [24,] -1.33440343 -0.089180847  0.18503231  1.31319067 -0.1345385 -0.213192963
## [25,] -0.93364612 -0.183311103  0.32399336 -1.59326422 -1.5645663 -0.749991494
##      [,37]      [,38]      [,39]      [,40]      [,41]      [,42]
## [1,]  0.2195779  0.51049499  0.205422751  1.39254621  0.81622334 -0.65631872
## [2,]  0.2480374  0.44193604  0.925096645  0.16353777 -0.57103417  1.04748631
## [3,]  1.4953637  0.26347861  1.421693192  1.39031224  1.47796027  0.05319752
## [4,] -1.0427956  1.34379504 -0.577589146 -0.39098452  1.53417534 -1.74652612
## [5,] -0.5153262 -0.67550745  1.080017083 -0.25531940 -0.44127923  0.37631733
## [6,] -1.1481512  0.53308666  1.079989579 -0.38960173 -0.87122271 -1.96000951
## [7,]  0.6740339 -0.47161844 -1.764995625  0.93607833  0.81048486 -0.47941408
## [8,] -1.2128392  0.75656264  0.109248450 -0.52882551  0.71187071 -0.65877755
## [9,] -1.6052609  0.83244674 -0.362484038 -0.81343559  0.39726341 -2.12138002
## [10,] 0.3371754 -0.79296781 -0.124297905  0.36412907 -0.85641586 -0.68498503
## [11,] 0.4315097  0.89443045 -0.254579011  0.27171822 -0.49435269  1.54983426
## [12,] -0.7418913  1.52110402 -0.521932081  1.64977679 -0.34872776  0.60559764
## [13,] 1.2364650  0.17923547  0.647668211 -1.06230960  0.19691697 -0.74564406
## [14,] 1.0651155 -1.05149606  0.991606962 -0.09718064  0.96358345  0.97432206

```

```

## [15,] 0.3807213 1.78004873 -1.577717068 -2.13293855 -2.38286786 -1.21827666
## [16,] -0.2163689 -0.36941244 -0.005526195 -0.12050984 1.56576319 -0.78155167
## [17,] -0.4549696 1.04842627 -1.489500033 1.51852104 0.56583424 -2.18928848
## [18,] 0.7850767 1.58766928 0.675728105 0.67954701 0.95776486 0.14875257
## [19,] -0.3273333 1.29164985 -1.104514081 0.46993138 0.07904168 -1.05047338
## [20,] -1.9201315 -1.90985831 0.924590302 0.56342911 -0.34942111 0.75016575
## [21,] 0.1243218 -0.36180203 -0.844546234 1.06096018 0.76051007 0.92051070
## [22,] 1.3434945 -1.05536148 0.453114040 2.19822870 0.35896073 -0.40338218
## [23,] -1.9181619 -1.37954292 0.809493473 0.03559199 0.98226164 0.32291756
## [24,] 0.1057962 -0.06165629 -0.858666173 0.96232123 0.63139284 -1.12006118
## [25,] -0.6625431 0.32080461 -0.977063866 -0.50320378 -0.27559551 -0.07070709
##      [,43]      [,44]      [,45]      [,46]      [,47]      [,48]
## [1,] 0.52356247 -0.77146750 0.24130833 -0.460865476 -1.05470330 1.34464847
## [2,] -1.07496750 -0.16550267 -1.70680799 -1.686397797 -0.70465675 0.79315853
## [3,] 0.86495280 -0.54056082 -0.04426055 0.951267444 0.73933299 -2.15592947
## [4,] 0.40000393 1.31158742 0.46487715 0.977164071 -1.33083922 -0.82542968
## [5,] 1.02223148 -0.48246962 -0.41475583 0.225168777 0.44604941 0.03965802
## [6,] -1.76567986 -0.45685706 0.08320470 -0.564156311 -1.19037562 -0.64899000
## [7,] 0.79513032 -0.49882773 0.14615313 -0.960489479 -0.79549349 -0.59742274
## [8,] 0.78817728 -0.49104937 0.22704160 0.292439128 -0.60801437 -1.12960984
## [9,] 0.66106549 -0.04625656 -0.35167908 -0.771799943 0.33354844 -0.75401744
## [10,] -0.94955941 0.20193720 -0.82346213 2.383161485 0.06065837 -0.01043044
## [11,] 0.05263522 0.51681304 0.48692598 -2.034443836 -0.32134571 -0.96943371
## [12,] 0.08676866 -0.08364944 -0.73422198 -1.111517023 0.61667645 -0.80402602
## [13,] 0.83932398 0.22708583 0.12352309 0.864711519 -0.57828854 0.35284106
## [14,] -0.88173222 -0.99274562 0.77225387 1.032021681 0.89122290 -0.69372094
## [15,] 0.92648091 0.26978051 -0.24068413 0.829850424 -0.01583543 0.07213318
## [16,] 1.32252168 -1.53642727 0.22374330 -1.581255569 0.76739075 1.24060688
## [17,] 0.11621358 -0.97195527 0.14949326 0.145065912 1.51041438 -1.42428326
## [18,] 0.47725232 0.38706293 0.02449655 -1.423858054 -0.02992355 0.22378470
## [19,] -0.55007761 -0.25936654 -0.07838071 0.787869818 -0.51753652 0.11855724
## [20,] 0.75929533 0.04226360 -0.16396029 -2.719127808 1.28750879 1.15980747
## [21,] -1.25773325 0.37167963 -0.30004761 -1.099330203 -0.48780313 0.20995009
## [22,] -0.87940355 -0.46839461 1.30954508 1.033051326 -0.46077809 1.62040257
## [23,] 0.53192467 -1.98022712 0.62810472 -3.278798916 1.02854737 -0.48263756
## [24,] -1.22018765 -0.73843847 0.43470324 -0.100831167 1.77208848 0.70625346
## [25,] 0.34739667 0.21072159 -1.19534562 0.008836008 0.65580827 0.95207048
##      [,49]      [,50]
## [1,] -0.28624343 0.576588559
## [2,] 2.19381984 0.221767303
## [3,] -1.22577257 -0.009135614
## [4,] 0.34909993 1.011930381
## [5,] 1.10827090 2.454683522
## [6,] -0.47761208 0.848281770
## [7,] 0.83761056 0.672980487
## [8,] -0.94610383 1.775315654
## [9,] 1.70822669 0.788218099
## [10,] -0.86677004 -1.739010818
## [11,] -0.20737582 1.778082721
## [12,] -1.31393527 0.328437002
## [13,] -0.95998707 0.548371587
## [14,] 0.06882298 0.262119354
## [15,] 0.21489998 -0.675561478
## [16,] 1.29908423 0.352065641

```

```
## [17,] -0.37656275  0.419643576
## [18,]  0.37345634  0.266613832
## [19,]  0.62252143  1.044461269
## [20,] -0.72918440  0.509800124
## [21,]  1.72759612  1.389826575
## [22,]  0.29561129 -0.350170390
## [23,]  0.93560363  0.163302711
## [24,]  0.67469318  0.020300760
## [25,] -1.70142942 -2.003212586
```

Calculating mean for the above sample:

```
samp2_mean <- replicate(50, mean(rnorm(25, 0, 1)))
samp2_mean
```

```
## [1] -0.215361182  0.286070885 -0.137913158 -0.078460761  0.461717133
## [6] -0.030122600  0.008544982  0.211976856  0.586361301 -0.298348810
## [11] -0.022755942  0.510428849  0.206004331 -0.107430113 -0.001617816
## [16]  0.355162709 -0.046321362 -0.133155771  0.087762727 -0.173604281
## [21]  0.398638523  0.233167473  0.326149158 -0.008259064  0.038234746
## [26] -0.115392087  0.400855141  0.167021969  0.316761981 -0.087923039
## [31] -0.116510939  0.143417074  0.212592953 -0.028471158  0.205375248
## [36] -0.212884050 -0.103540125 -0.115424716  0.087910225 -0.017087571
## [41]  0.123906927 -0.081894760 -0.297265483  0.404775262 -0.438967023
## [46] -0.187673817  0.108004032 -0.351818326  0.036420864  0.001730972
```

Calculating minimum for each of the above samples:

```
samp2_min <- replicate(50, min(rnorm(25, 0, 1)))
samp2_min
```

```
## [1] -0.8799941 -1.9312839 -1.0877639 -1.1388401 -2.0192164 -2.8346501
## [7] -1.4832714 -2.1353210 -2.7374942 -1.4571395 -1.9133943 -1.2183526
## [13] -1.5173347 -1.6131079 -2.4188486 -1.1774608 -1.4782943 -1.8272874
## [19] -1.5909965 -2.2088316 -2.1615354 -1.1480573 -1.3366186 -1.7729477
## [25] -1.7575891 -2.0302766 -1.3592238 -1.9394025 -1.6613809 -2.1885141
## [31] -1.9748600 -2.1798477 -2.3549865 -2.4293668 -1.6013633 -1.7621738
## [37] -1.6634193 -1.2559628 -1.6401215 -2.0677227 -2.4340628 -1.2596262
## [43] -2.2802102 -2.6060920 -2.2845763 -1.3930710 -1.8398801 -1.8113108
## [49] -2.3052418 -1.0993483
```

Calculating maximum for each of the above samples:

```
samp2_max <- replicate(50, max(rnorm(25, 0, 1)))
samp2_max
```

```
## [1] 2.892517 2.158661 1.606470 1.994791 1.292425 2.254764 2.338164 1.214242
## [9] 2.266771 1.369280 1.918971 1.871587 2.042418 2.297186 1.781088 1.758692
## [17] 1.917733 1.432253 1.501084 1.362703 1.936739 2.614130 3.162368 2.220821
## [25] 2.037150 2.208530 2.074212 2.065867 2.434250 1.528484 1.388842 3.205089
## [33] 1.608914 1.051026 2.072090 2.478604 1.826188 2.598734 1.943017 3.486931
## [41] 2.009507 2.922449 2.427460 1.598070 1.821917 1.888597 1.103632 1.674961
## [49] 2.322979 1.645287
```

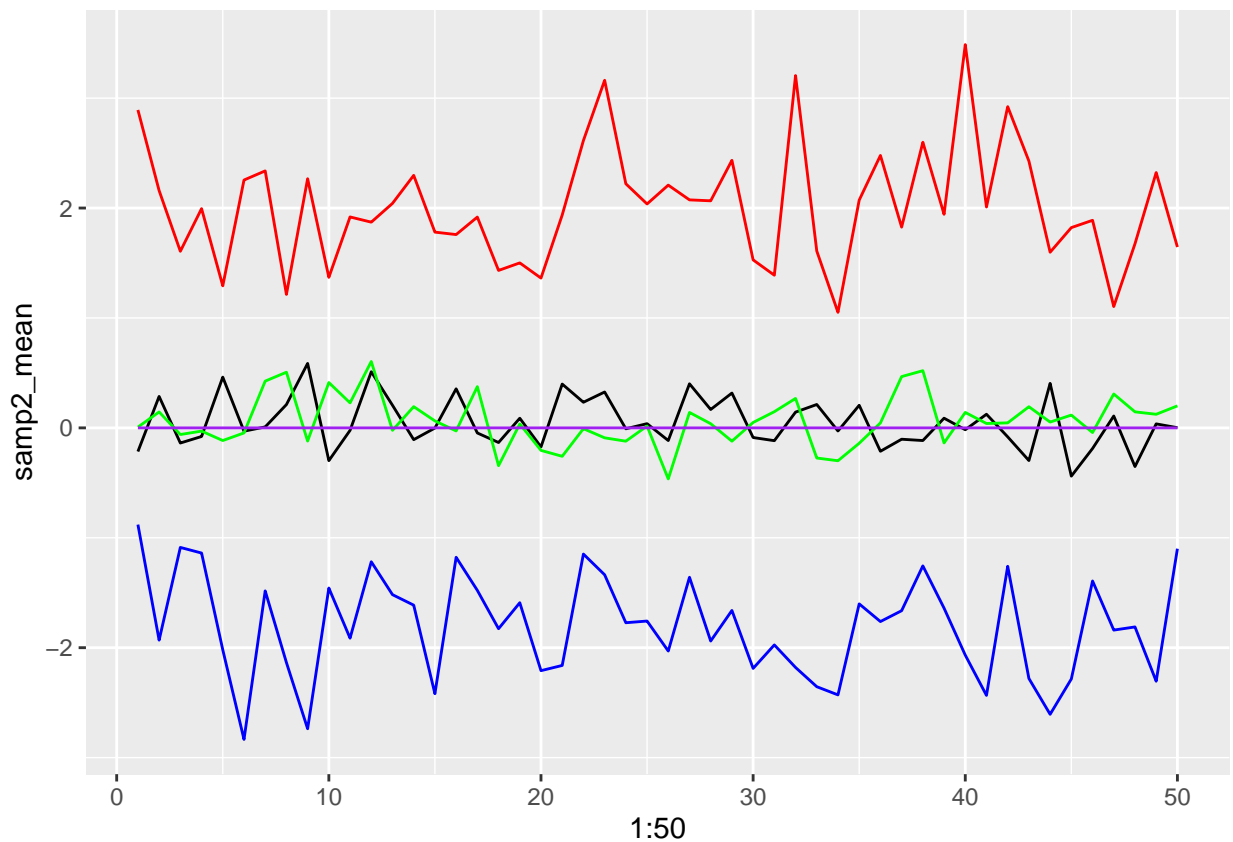
Calculating median for each of the above samples:

```
samp2_mid <- replicate(50, median(rnorm(25, 0, 1)))  
samp2_mid
```

```
## [1]  0.006915858  0.144810987 -0.060503576 -0.029511061 -0.115375527  
## [6] -0.046171703  0.425221608  0.506256002 -0.120126752  0.412475615  
## [11]  0.227496514  0.603824493 -0.022304803  0.193070990  0.063284553  
## [16] -0.028057850  0.375012940 -0.344062054  0.035239774 -0.204843466  
## [21] -0.258763724 -0.007440941 -0.090492415 -0.121156559  0.016684706  
## [26] -0.464372346  0.140424590  0.037673031 -0.121202266  0.049008796  
## [31]  0.147100797  0.267857895 -0.274300197 -0.299242222 -0.140089651  
## [36]  0.045160089  0.466536365  0.520014011 -0.136812423  0.140683983  
## [41]  0.039623202  0.045645150  0.192343548  0.052545199  0.116314653  
## [46] -0.042857603  0.308209900  0.145810083  0.123720124  0.200051673
```

Plotting these 4 statistics:

```
ggplot(NULL, aes(1:50)) + geom_line(aes(y = samp2_mean), color = "black") +  
  geom_line(aes(y = samp2_max), color = "red") +  
  geom_line(aes(y = samp2_mid), color = "green") +  
  geom_line(aes(y = samp2_min), color = "blue") + geom_line(aes(y = 0), color = "purple")
```



## The Cauchy (0, 1) distribution:

Drawing 50 random samples:

```
samp3 <- replicate(50, rcauchy(25, 0, 1))  
samp3
```

##		[,1]	[,2]	[,3]	[,4]	[,5]	[,6]
##	[1,]	0.278761326	-0.3847469	1.75576144	0.287490176	-0.38705626	-0.3277274
##	[2,]	-4.276741027	-0.1556373	0.45147699	1.403018521	-3.01962209	3.4059936
##	[3,]	1.041007403	0.2737653	0.20004815	0.093152976	-1.41161064	5.9830163
##	[4,]	-0.809799537	3.1919829	0.46780191	-1.066420918	0.14597361	0.2620174
##	[5,]	-0.474532070	-0.7339769	-0.38749506	-1.316490734	-4.96954818	-0.3774137
##	[6,]	6.059216931	7.7458984	-3.29537951	1.159306557	5.23632301	-1.3978367
##	[7,]	0.522545154	1.2339418	-5.48728871	-0.057161480	-0.97080454	3.4374525
##	[8,]	-0.099017488	0.4705693	5.40357582	0.193166036	5.32121584	2.0004521
##	[9,]	-0.004720126	-0.1820592	-3.81483258	1.104764154	0.11823453	-3.9512509
##	[10,]	-0.602123827	0.2413327	0.60524312	-0.081266294	-0.36349666	-1.4937217
##	[11,]	-0.939452626	2.5218418	5.46221838	-0.126499779	-2.53411565	-2.5120058
##	[12,]	-0.343035450	3.9157016	1.23041804	2.189036542	-0.83563364	-0.4051656
##	[13,]	-15.296345684	-0.2218550	1.04687151	2.570020476	1.13921767	1.3480029
##	[14,]	20.051485495	0.1152689	-4.58199607	1.658136370	-1.08543520	3.2379347
##	[15,]	0.125471028	-2.9943105	0.27812210	0.292183270	-5.37015113	-0.4723875
##	[16,]	0.331953112	-2.6683787	-0.14737307	-0.324013830	1.66116555	3.6842996
##	[17,]	3.602964032	-8.0054685	0.08019741	0.882632516	0.30728126	-1.0088965
##	[18,]	-1.794416442	-1.5058916	-7.90365462	1.634811531	-0.07118328	1.1015947
##	[19,]	1.704346736	2.3680521	9.98709822	-1.951195831	-0.10415668	0.5482349
##	[20,]	-1.938402472	-1.9491743	-0.27496470	0.792093497	0.14246347	-0.8848706
##	[21,]	0.097926441	-2.6456579	0.04684382	0.006109949	-7.01949192	0.8119719
##	[22,]	2.363750578	0.7042117	2.16560563	4.794960650	-0.71166002	-24.7694095
##	[23,]	-0.933242865	0.5179760	-0.31989025	-0.423693670	0.27795946	-1.0685263
##	[24,]	-7.392941435	0.5160146	2.14130154	-0.262928741	-0.31551247	0.3781279
##	[25,]	0.030938961	-0.7799148	-0.65885953	-0.083570756	1.31988947	3.9086698
##		[,7]	[,8]	[,9]	[,10]	[,11]	
##	[1,]	-1.20795669	0.16279647	0.13612166	-1.06552886	-1.18143712	
##	[2,]	-7.80153650	-2.40480810	-0.34840094	-5.83848499	10.50589869	
##	[3,]	0.42461275	0.96014649	-0.45894458	0.01109498	-1.79644172	
##	[4,]	-11.95091743	0.81976867	0.10632429	1.89764437	-0.31315046	
##	[5,]	-0.18827640	1.90545379	-0.64207466	-0.08702104	0.58751799	
##	[6,]	-27.05177258	0.27005840	-0.54665885	-0.42555773	-0.90721939	
##	[7,]	-1.54611701	-1.16293192	-0.35856791	0.55361665	-0.09324211	
##	[8,]	-2.62854200	-0.45393103	6.91768447	0.54567627	2.52450560	
##	[9,]	-0.60070484	1.85631136	-0.23895967	2.53444459	-1.02165209	
##	[10,]	0.15602528	4.28206727	1.16940801	-0.09324582	1.19714668	
##	[11,]	0.84751306	1.18251989	-4.04247807	0.27846756	0.86950239	
##	[12,]	-296.16818121	-0.88266618	5.10882140	-1.79949563	3.47379740	
##	[13,]	0.62575386	-0.21523271	-1.31497417	-7.69905192	0.97923248	
##	[14,]	-0.36168599	0.13124512	0.64782586	0.26168543	-0.20389774	
##	[15,]	1.09276490	-0.06132453	0.06102988	-0.22195334	1.07807744	
##	[16,]	-15.91385886	1.27849215	-0.38197653	-16.51889749	3.19262019	
##	[17,]	0.03760635	0.28002104	-0.70596627	0.73792507	-0.79053424	
##	[18,]	1.04515572	4.86504936	-1.31450566	5.49619629	-0.54042734	
##	[19,]	-0.77995904	0.52245526	-24.98297820	0.24609001	12.13206960	
##	[20,]	-0.19683914	-3.74255683	12.34852050	0.84611168	-0.58211678	
##	[21,]	0.23811821	10.65703097	-0.35229293	1.67808216	0.75734287	

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## [22,] -1.18485743 -0.36782719 -1.39062518 -0.43840197 1.79755143
## [23,] -0.62636114 -0.63847724 0.02290524 -0.74476021 0.02759001
## [24,] -0.91309030 -0.97690005 -0.21205869 1.42823836 -0.52721591
## [25,] -0.27419058 0.35616442 4.50787627 0.29190940 1.08308411
##      [,12]      [,13]      [,14]      [,15]      [,16]
## [1,] -0.05615688 -1.9897186 21.36381805 0.41573995 -0.08340240
## [2,] -0.79591791 -0.6840475 -1.00940974 -1.92743158 -3.24376529
## [3,] 0.35410312 0.2176623 0.06684169 0.05126856 -2.48570265
## [4,] -1.28817526 -46.6817620 0.31889187 1.97508207 0.06659890
## [5,] 0.28212524 1.0342245 -3.75070932 -0.91033997 4.84515781
## [6,] -0.49492615 0.1564969 -0.49812963 14.86997064 0.38275385
## [7,] -1.37642450 -1.0584684 -0.64235379 0.38119977 -0.10245294
## [8,] 0.53362744 -0.6381857 -0.64314487 -18.43728070 8.16287456
## [9,] 0.47902469 -1.8491877 0.09687797 1.60688387 0.01184437
## [10,] 28.51008208 1.6786184 0.83795853 1.87213777 17.14269840
## [11,] -22.25460389 -0.3406572 14.77658971 0.30210910 324.75821889
## [12,] -0.09615425 -0.6129357 -4.56242961 -1.19672105 -5.07923798
## [13,] 0.47061528 -1.9925589 0.11137096 -4.05542472 -0.09046474
## [14,] 1.13002577 -0.6325945 34.14013572 -0.73189837 -0.19632156
## [15,] 2.43744784 -0.2029828 -1.34308242 -1.60485290 -4.04384467
## [16,] 1.51515521 0.7642894 -0.61216336 37.84083079 -1.10893297
## [17,] -4.14230801 0.5863067 2.71620660 -0.86760540 -5.99940136
## [18,] 0.97594235 -0.7237004 -0.13862118 8.05021971 0.37121819
## [19,] 0.27863488 0.4468914 0.11882731 -1.04625673 0.37765956
## [20,] 1.00349608 0.4676772 -0.16965417 -0.70686430 -1.19962671
## [21,] 0.07101741 -0.3746888 8.60631229 -0.20562390 3.41022359
## [22,] 0.39844135 -0.2728303 0.79827585 0.36869068 1.16533401
## [23,] 4.63445803 -3.5455897 1.72804220 -0.10685433 2.05818783
## [24,] 2.12253722 -0.1054989 -0.74390991 4.17665826 -1.05867152
## [25,] 0.70375098 1.3316300 0.62557919 -0.68325846 1.16277516
##      [,17]      [,18]      [,19]      [,20]      [,21]
## [1,] 1.253340302 1.20172400 -0.44792393 -0.854751222 1.99519212
## [2,] -0.701925958 0.10649580 -0.26050373 1.043610275 8.20011857
## [3,] 17.224847782 -3.67247110 -0.91759426 0.461601266 1.99034149
## [4,] 7.369349983 -3.74670394 0.02727540 -0.203082631 0.92838444
## [5,] -1.044134190 1.37839086 0.24634011 -4.827428112 -0.15653855
## [6,] -3.811754736 0.21512127 0.19166486 1.356328413 -139.88899031
## [7,] 1.564095352 0.31091158 -0.08468807 -12.390411695 0.22893811
## [8,] -1.746617053 3.59390662 -0.20486039 -2.734258416 1.36471309
## [9,] 0.698510533 -7.11858644 -0.03412965 2.868792011 -4.54143919
## [10,] -0.093343956 -0.25891750 -0.69955100 -1.928900857 6.16693311
## [11,] -0.112267819 1.64053728 2.45728798 1.864458474 -0.56266974
## [12,] 0.213887757 1.80116742 -0.91377438 -0.317585265 0.03527263
## [13,] -7.951789658 -2.89270218 3.18944646 2.322101045 -1.10322471
## [14,] 6.587394429 3.93092218 -0.08545551 -0.009227332 1.26759473
## [15,] -0.003810426 -3.62623814 -14.79371339 -0.558178963 -0.36152023
## [16,] -0.481992110 -0.05085981 -0.16073740 -4.848007256 1.47758741
## [17,] -0.437331175 1.11388167 -0.33448165 0.720155057 -0.12473679
## [18,] 5.917676238 -1.24083911 -1.78212257 -0.598700653 0.52144730
## [19,] -1.986835647 -0.90975731 2.31457015 -0.391796113 21.83340537
## [20,] 0.012327282 -13.43994828 0.43345438 0.076866497 -3.15168977
## [21,] 0.173880282 -2.76967289 2.12819700 0.280155973 4.44709890
## [22,] -0.496188500 -1.12891297 46.75135212 -0.959294234 -7.05219895
## [23,] -0.508411828 -1.89421782 -0.06438179 -1.531552587 5.38645436

```

```

## [24,] -0.346224054  0.13399768 -1.62168965  0.203812476  0.53739713
## [25,]  0.298934260 -1.19122595  0.16026164  1.135598238 -3.18246741
##      [,22]      [,23]      [,24]      [,25]      [,26]
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## [2,]  0.80577359 -0.29990724  0.1090273  1.44606253  4.55329769
## [3,]  0.58015441  0.34202698  3.8452098 -3.76289663  1.11238470
## [4,] -1.56995204  0.83963065 -2.2475303 -0.50578513 -0.21828784
## [5,]  0.26097570 -1.26540650  0.5195736  0.53718589 -0.84483348
## [6,]  1.39418405 -0.88218613 -1.1156468 -0.48134452  3.36620430
## [7,] -7.55978208 -0.31363728 -11.4988333  0.59587780 -0.53874285
## [8,]  0.76430562 -0.05763678 -0.8897565  7.49600651 -30.43969010
## [9,] -0.31322530 -0.53256725 22.0940273 -1.22770544  0.94809732
## [10,] -0.20470414 -2.58831804  0.5698926  1.13279500 -0.14197777
## [11,]  0.46111238  0.24908509 -2.5863825 -2.88855369 -1.77057796
## [12,] -0.19137218  0.61539307  2.1389030 -0.73498428 -43.79902936
## [13,] -2.13734269  2.00875116  3.0688191 -6.24222619  0.86587634
## [14,]  1.76993175 -15.15086568  1.5623124 -1.07613940  1.71981548
## [15,]  1.31842856  0.11562677 -0.7527667 -0.26833278  0.62866528
## [16,] 10.47890267  2.13239707 -2.0283974 -0.38647089  0.86889473
## [17,] -2.13137468  4.10586871  1.2693115  0.37466143 -0.11566134
## [18,] -0.14325589 -1.26559514 -0.6977066 -6.52743371 -0.88908121
## [19,]  0.12864054 -0.46168037  1.8461679 -0.24259636  0.60062041
## [20,] -5.91906751  6.19172493  3.4217206  0.42475231  0.67958940
## [21,] -0.28979628  0.60541617  0.2323484 -0.96682077  0.42414238
## [22,] -0.08992801  1.39053215  1.6271152  4.57225396 -0.64570460
## [23,]  0.05739711 -1.21883669  0.5772202  0.94238181  0.49826913
## [24,]  1.07076906 -0.22842411 -3.4853333  1.65813257 -1.45170892
## [25,] -0.90221144  1.76884017 -5.3067239  0.34166462  0.14833056
##      [,27]      [,28]      [,29]      [,30]      [,31]      [,32]
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## [2,] 1735.3136275 -0.53804693  0.58954044  1.40320898  3.5359859  0.3937694
## [3,]  8.7348184  1.41458270 -4.82767777  5.29441211 -1.7888889  3.6470047
## [4,] -2.1719957  1.10600159 -0.56169405  0.65232727 -3.5569729  2.5032690
## [5,]  0.5196913  3.31468183 -0.30852146 -1.00459298 -0.1285699  1.6166110
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## [7,]  1.8852053 -2.58716567  1.16675700 -0.76900110 -3.0711153  3.4848689
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## [9,] -2.3710555  0.51525589  3.56054798 -0.05520933 -0.5613078 -0.6096194
## [10,] -6.7200246 -0.77668809 -0.35238927  0.59663118 -0.3204136 -0.2445123
## [11,]  2.9175333 -0.04217065  0.29056966 -5.90615565  1.8782202 -0.4921359
## [12,] -6.2185133 -14.99608870 -2.70380855  0.13143430 -1.0627909 -3.2252291
## [13,]  4.1252451 -0.54288975 -0.84519514 -2.13324044  0.1406002 -0.2241890
## [14,] -2.0341693 -3.60626371  7.81266328  0.54123367 -0.1137663  1.0892733
## [15,] -0.1632140  0.14685398  0.62018323  3.44432084  0.1603288  2.2458771
## [16,]  2.3849510  3.07156993 -1.18506218  0.40505683 -0.5479560  1.2197507
## [17,]  2.9233786 11.88509545 -1.91402676  1.38901042  3.7706302 -1.3574181
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## [19,]  3.0289828 -0.19194532  1.91632891 -0.14038360  0.8055744  1.4988337
## [20,]  0.7444108 -8.26991285 -0.60277720  1.94673345 22.7243102  0.2070922
## [21,]  0.1097764 -0.61878587 -0.12714505  0.47993057 -0.7713611 -4.7555365
## [22,]  5.5609277 -1.73250404  0.02741955  0.08966680 -0.6257540 -1.0666117
## [23,] -13.4587198  1.72168304 -1.45205914  2.16397935 -1.9140776 13.9172907
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##		[,33]	[,34]	[,35]	[,36]	[,37]
##	[1,]	-2.60601722	-0.4444881888	0.17755172	-4.3721237	-1.05742950
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##	[3,]	-38.62997312	0.7461557356	-1.06050589	-0.4349451	-0.76476044
##	[4,]	-0.14527342	1.0590210920	0.23338544	2.2073660	-1.93374729
##	[5,]	-0.45439188	0.8119267722	-1.26219122	-0.5025863	1.45403717
##	[6,]	0.52279089	-0.0009050726	0.82144890	0.8725312	-5.19440276
##	[7,]	-0.19533801	0.3073084698	0.56080431	12.0991456	0.76826018
##	[8,]	-0.11881014	0.1801739055	-0.59422492	4.2810517	0.26630611
##	[9,]	6.53868046	0.2904933542	-0.15612096	1.6182171	2.32587788
##	[10,]	-0.34133125	1.5937059044	1.07899769	0.2602880	0.48823316
##	[11,]	0.31563860	0.8182796607	-0.90803456	-0.5389251	28.66158829
##	[12,]	-0.54494452	-4.7998317000	2.18740938	9.1948361	-0.83372898
##	[13,]	0.84828422	-0.0435891209	7.59383395	0.4951213	2.06513105
##	[14,]	-1.33292594	0.1526715024	-41.91638763	-1.0774251	0.50574523
##	[15,]	0.08962170	0.2450558207	-0.05906051	4.3560030	-1.25729524
##	[16,]	0.28081544	-2.7784965323	8.61731511	1.8987685	-0.26266064
##	[17,]	-4.71624188	-2.9484705041	-13.64056585	0.1328520	-0.63107845
##	[18,]	-1.28401566	-1.1199203001	-9.18603703	-1.1326883	1.20209000
##	[19,]	-0.12595893	-0.2994988014	0.61748046	0.7820745	0.61533516
##	[20,]	-0.99331042	0.0167660831	0.23413045	-0.3927470	2.23470432
##	[21,]	-0.31669415	-0.6378121977	-1.11628028	1.2393223	-0.25542125
##	[22,]	-1.06000700	0.1801725265	-4.65969408	1.0599552	0.79723792
##	[23,]	0.29771015	-0.2730585885	1.81536445	1.3347198	-0.04549124
##	[24,]	0.05728559	0.3752619907	-2.36995827	11.8580352	1.57390988
##	[25,]	0.66963414	3.7482080428	-0.16570481	-30.0722614	17.76290641
##		[,38]	[,39]	[,40]	[,41]	[,42]
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##	[2,]	1.62041735	-0.74220460	-1.762793607	0.09309885	-0.2636115
##	[3,]	-1.90728870	-2.76344229	-0.014530442	-1.85372399	1.4220871
##	[4,]	40.81402115	9.26498120	-1.617082739	-1.44935883	-3.3840455
##	[5,]	4.34042296	-1.62950865	1.635459193	-0.89946280	-5.6512060
##	[6,]	-3.94329227	9.33922984	-1.034284429	-5.86204409	-0.6745434
##	[7,]	-57.11064726	-0.02774297	1.006458841	-0.02518466	-0.5435180
##	[8,]	18.06383754	-0.85639600	4.681476625	-3.16592511	0.7051544
##	[9,]	0.51286791	-1.76698321	2.483724149	-0.87849684	0.7929257
##	[10,]	0.01902882	2.18699221	1.692633837	1.05335489	0.3929764
##	[11,]	1.35607837	-0.24091964	-3.086977856	1.26506480	0.3363215
##	[12,]	-0.96730727	6.24014407	-31.644670189	0.41240747	-1.3609885
##	[13,]	6.08961732	-1.12481354	2.959274143	2.05740094	0.6892125
##	[14,]	0.04330767	-1.41609203	4.733831276	-1.08765870	-2.1847107
##	[15,]	1.60804662	-0.50978446	18.909937451	-1.97945389	0.1564603
##	[16,]	-0.57124565	-2.41085482	0.111490348	1.95322139	1.0471332
##	[17,]	1.78177589	0.75555279	0.169676145	-0.55019288	-3.9623409
##	[18,]	0.35104827	0.99401172	-0.007884146	-3.76976172	-1.2132013
##	[19,]	0.32043831	-2.39673950	1.155479325	-0.87588028	0.6985199
##	[20,]	0.47975125	-0.47871641	-1.020321815	-1.09726440	0.5594373
##	[21,]	-0.30214923	-0.91193011	0.362128437	2.56773496	-21.6101535
##	[22,]	-0.09336694	0.99322530	-0.179020314	9.15461496	1.4471445
##	[23,]	-0.86415797	-0.72265189	-4.565001482	0.73245332	0.8468590
##	[24,]	-0.08711669	0.40613364	2.993700633	-62.23579810	-1.6686420
##	[25,]	-0.68153814	20.11448175	-4.873588132	0.35210363	0.5824236
##		[,43]	[,44]	[,45]	[,46]	[,47]
##	[1,]	4.89064533	-1.3464780	0.2703612	-12.90204989	-0.21624638

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## [2,] 0.88802520 0.6097487 1.6085148 0.82884470 -1.90434335
## [3,] 2.30637603 -0.2615437 4.9784923 0.36146119 -0.11005508
## [4,] -0.17216984 -0.2030485 1.4879787 -0.62554638 -0.83489907
## [5,] -0.28886633 -0.1233564 2.1623576 -0.35282268 0.47152057
## [6,] 1.29283680 -3.6713532 33.2084987 2.72306663 -3.50972342
## [7,] 1.06410073 -1.3800848 1.0878948 0.23935010 2.16800914
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## [10,] -0.79553577 0.8719903 -0.4776656 -0.47957535 -0.71486335
## [11,] -1.18904018 -0.2378484 -1.1216568 1.09582342 2.46333144
## [12,] -21.63753853 0.3842553 0.3819082 3.94907998 0.21202540
## [13,] -12.99713379 0.4153756 -0.7556294 -0.23613903 -8.71656303
## [14,] 1.11165489 1.4985960 0.1153394 -0.16402725 -0.50441451
## [15,] 5.34038772 0.3405517 -0.5538997 8.68575316 -0.28440396
## [16,] 0.38043863 0.4613996 -2.7647630 1.27306916 7.13848861
## [17,] 3.64404445 -0.5188132 0.5059657 -2.10332511 -1.19030604
## [18,] -0.83018979 -1.0247575 -10.4431722 2.52568902 0.04975206
## [19,] -0.37536622 3.5100832 -1.0058101 -0.29151599 -1.49809577
## [20,] -1.76610986 0.6351492 0.1300558 -0.60260083 -7.27211111
## [21,] 0.29625309 0.9568594 0.1639851 4.90580473 0.43415645
## [22,] 1.11329562 13.9226252 3.2003010 -0.02096475 0.26926946
## [23,] 0.78931159 0.5213105 1.1396507 0.02090706 1.84163992
## [24,] -0.54458484 -0.4312384 15.9918871 11.84627496 -0.88417335
## [25,] -0.07362209 -0.4755580 -0.2973035 -0.05264331 -1.13896972
##      [,48]      [,49]      [,50]
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## [2,] -0.002637138 132.0469016 1.43552368
## [3,] -2.410661616 0.5869404 -3.15597602
## [4,] 2.324330159 0.3224476 2.70904958
## [5,] -1.466381386 -6.0767862 0.48579315
## [6,] -0.085043162 0.4141890 -3.06083018
## [7,] -0.229645779 0.6480610 -2.90649706
## [8,] -2.457168734 1.2016668 1.10298931
## [9,] 0.945771605 0.2752185 0.08010101
## [10,] 7.334595812 7.3020329 3.40797060
## [11,] 1.532952769 1.1145167 0.42101816
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## [13,] -0.592237140 4.6226423 -0.45890778
## [14,] 2.940847220 0.6489980 0.13098320
## [15,] -0.095474114 -1.1202903 -0.36766142
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## [18,] 0.878522601 1.0029844 0.10969917
## [19,] -1.102226977 -20.1549967 -0.15726647
## [20,] 0.671338544 -0.5279281 1.32290734
## [21,] 4.493129174 -1.3163921 -3.21158253
## [22,] -6.790805424 -0.6964072 0.18499751
## [23,] 0.738427989 -0.2578525 -0.11079481
## [24,] -1.901202626 0.1459617 -0.07707384
## [25,] -0.804429413 0.8135950 -0.01748014

```

Calculating mean for the above sample:

```
samp3_mean <- replicate(50, mean(rcauchy(25, 0, 1)))
samp3_mean
```

```
## [1] 10.60540111 0.17580826 45.08518278 0.30970705 0.11871822
## [6] 0.31109963 0.81890460 -12.98426015 -13.73533581 -1.59564998
## [11] 0.04048490 0.74043617 -0.02504744 -0.43948835 -1.63800729
## [16] -0.14480717 3.93396266 -0.75220236 0.58832701 1.66100518
## [21] -0.35303556 2.70703831 -1.28620514 -1.79988243 0.21496578
## [26] 0.30781538 -2.28844608 2.31675213 -1.62631271 0.57537983
## [31] 1.34317360 2.82182540 -0.88997205 -2.26039442 0.13875088
## [36] 26.61599258 5.45532443 -0.05782822 0.15416727 0.51599983
## [41] 0.71134724 -11.52216813 1.38221668 1.01610078 -1.89567282
## [46] 1.25935158 -1.91795764 -0.24734063 13.31732796 0.42127376
```

Calculating minimum for each of the above samples:

```
samp3_min <- replicate(50, min(rcauchy(25, 0, 1)))
samp3_min
```

```
## [1] -10.892500 -9.874914 -22.760627 -7.567045 -58.599954 -3.984514
## [7] -14.060826 -28.381999 -7.646513 -20.594932 -42.169496 -21.185816
## [13] -24.178804 -38.951214 -7.735813 -14.665276 -297.075108 -29.528985
## [19] -23.579924 -5.920546 -12.902788 -4.632523 -17.380445 -21.845295
## [25] -12.338575 -6.846647 -25.183095 -5.964571 -13.403662 -6.300439
## [31] -5.294006 -5.237055 -159.125313 -62.770444 -4.181435 -4.855082
## [37] -11.754150 -180.377968 -11.420862 -7.421176 -9.637843 -6.416297
## [43] -17.114307 -3.462034 -19.348138 -6.618833 -3.139000 -4.261080
## [49] -8.457381 -31.071273
```

Calculating maximum for each of the above samples:

```
samp3_max <- replicate(50, max(rcauchy(25, 0, 1)))
samp3_max
```

```
## [1] 10.410015 191.786222 10.289752 15.355463 35.431619 6.151836
## [7] 9.835686 5.046289 2.740874 7.509404 6.091772 518.744907
## [13] 8.788717 3.438673 35.262464 137.270370 18.007531 5.172403
## [19] 117.154595 17.787057 3.580094 15.893513 7.126428 8.874548
## [25] 1.644631 2.861025 16.264516 42.255806 174.259291 11.323687
## [31] 11.085073 17.228088 22.898692 18.208739 19.917855 4.005289
## [37] 25.658333 7.424817 11.137992 15.390476 4.276890 9.299606
## [43] 12.381957 26.334448 12.097685 11.070314 17.459538 189.267719
## [49] 58.689126 4.918791
```

Calculating median for each of the above samples:

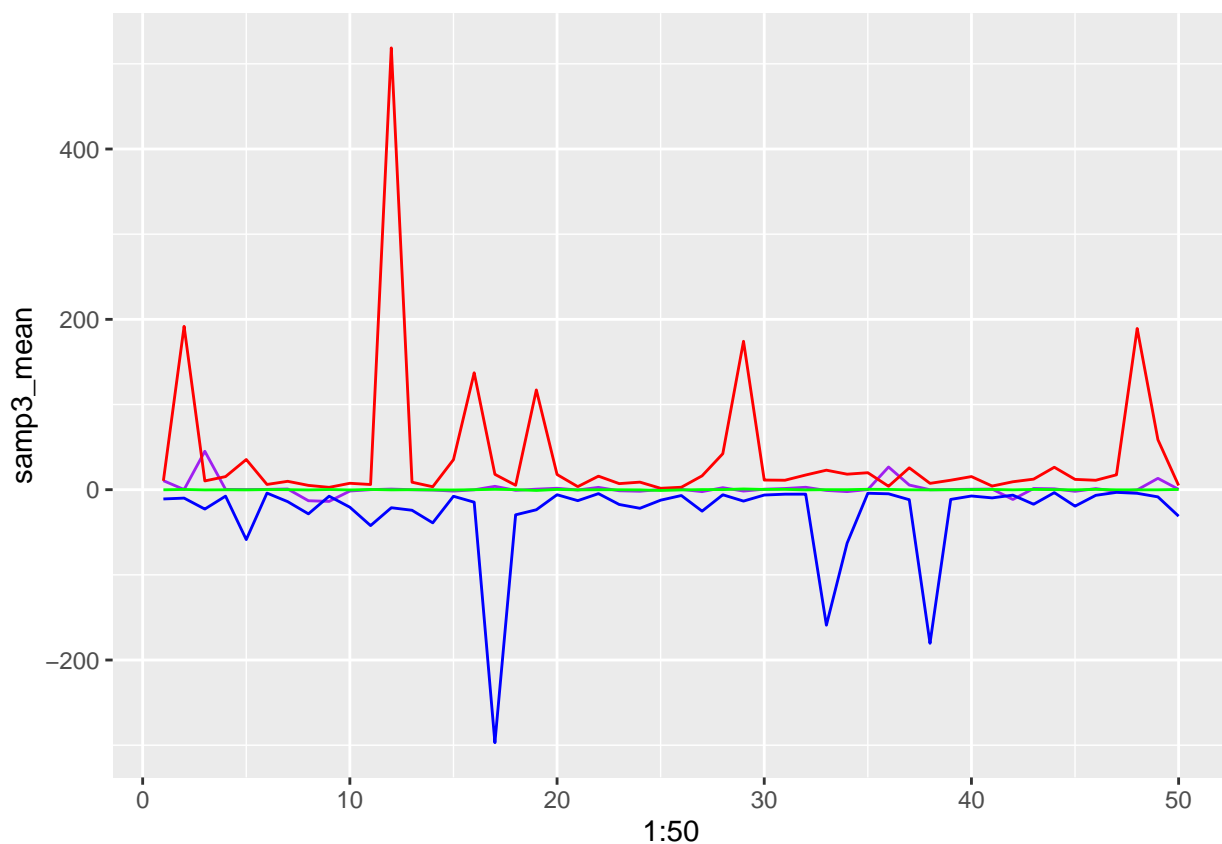
```
samp3_mid <- replicate(50, median(rcauchy(25, 0, 1)))
samp3_mid
```

```
## [1] -0.132687642 0.260170128 -0.257878289 -0.075394656 -0.235539447
## [6] 0.127764825 0.036887459 -0.243005163 0.189176401 -0.280433247
## [11] 0.263661813 -0.226708396 -0.024084979 -0.224875980 -0.306193953
```

```
## [16] -0.021383089  0.416401327  0.085566961 -0.890576817  0.284821084
## [21] -0.211184686 -0.069623938 -0.045620180 -0.192170102 -0.919912408
## [26] -0.274004936  0.145486022  0.072963961  0.858196527  0.254191115
## [31]  0.367953294 -0.242204626  0.044118556 -0.006749242  0.458313267
## [36]  0.296201173 -0.114415257 -0.240919015 -0.082558725  0.095924371
## [41]  0.268962610 -0.134328438  0.277272018  0.081571043 -0.136502375
## [46]  0.337707486 -0.145503850 -0.195537173 -0.131645385  0.264998458
```

Plotting these 4 statistics:

```
ggplot(NULL,aes(1:50))+geom_line(aes(y =somp3_mean), color = "purple") +
  geom_line(aes(y =somp3_max), color = "red") +
  geom_line(aes(y = somp3_mid), color = "green") +
  geom_line(aes(y = somp3_min), color = "blue")
```



The variation of the statistics from sample to sample is called **Sample fluctuation**.

**The Normal (0, 1) distribution:**

**Drawing 50 random samples:**

```
samp4 <- replicate(50, rnorm(100, 0, 1))
samp4
```

```
##           [,1]      [,2]      [,3]      [,4]      [,5]      [,6]
## [1,]  0.141419247 -2.31431262 -0.45400094 -0.56055917 -0.01449871 -0.54004721
## [2,]  0.103256788 -0.09945604 -0.74086387 -1.63703955 -2.98251749  0.90368281
```

```

## [3,] -1.000097667 0.15092529 -2.09396318 0.26413645 -1.23690613 -1.61019599
## [4,] -0.317392145 -0.10273553 0.10543610 -1.25681520 -0.13384377 0.06197023
## [5,] 2.448065849 0.62964822 -1.85776232 1.30882052 1.62309505 0.83178067
## [6,] -0.028685143 0.07293723 0.87235337 -0.81150116 0.19600067 1.10278166
## [7,] -1.419413573 -0.89877196 -0.06693343 -0.48204926 0.96476701 0.87349945
## [8,] -0.422203260 -0.62394253 0.78005088 -0.70152154 -1.03198297 0.76587671
## [9,] -1.485889073 0.70680393 -1.83454561 0.23821719 -0.53238876 0.25879043
## [10,] -0.050745431 1.99023790 -1.15373551 -1.56396743 0.85685487 -1.12996359
## [11,] -1.019163116 -1.11863431 -0.14599762 0.86486856 -1.30026070 0.64716333
## [12,] -0.512228831 0.33873729 0.88013774 -0.26161372 0.05678732 0.54239696
## [13,] -1.214305562 0.21146789 0.40540550 2.10379512 0.05627827 0.55205825
## [14,] -0.075370683 -1.77439291 -1.33682754 -0.17507657 -0.53618476 0.45186671
## [15,] 0.273135184 -0.88052265 1.17983023 0.84140240 0.00979549 1.69011421
## [16,] 0.589210957 0.47270075 -0.98497431 -0.21009882 0.32437540 0.41827786
## [17,] -0.787648243 1.29144443 0.50713394 0.34208656 0.36445364 -0.16643222
## [18,] 0.225260662 -2.13612533 -0.78713624 1.90163665 -0.52325608 -0.43828376
## [19,] 1.026499825 0.77836098 -0.41258578 1.78445153 2.26938859 -0.21554136
## [20,] 0.674698058 -0.19156224 1.37873037 -0.08427111 1.18855443 0.02901020
## [21,] 0.770684222 0.81009240 -0.23404758 0.66380881 0.83668413 0.36169441
## [22,] 1.901796209 -1.87146411 1.38189937 -1.19883753 1.03975988 0.72573213
## [23,] -0.314262004 -1.52678526 -0.74282738 -0.89923865 -0.24140283 2.22319978
## [24,] 0.925064634 0.73601128 -0.90740022 -1.10156812 -1.10741381 -1.06451483
## [25,] 1.040375244 1.55747277 -0.65957982 -0.09166101 0.49947907 -0.33098807
## [26,] 0.284809439 -0.59919078 -2.32748921 1.76830047 -2.21363111 -1.02019667
## [27,] 0.150730731 0.10458576 -0.28936285 0.08417452 0.77663780 1.14646365
## [28,] -1.740216581 -0.45432487 -0.29071037 0.51101566 -0.39835426 0.91466241
## [29,] 0.002333756 0.53362171 2.39297785 1.59062758 0.89146547 0.59593115
## [30,] -0.625072547 0.80203507 2.09826137 -0.32188396 1.21401921 -0.58414676
## [31,] 0.149043429 -0.43452991 1.56492803 -1.84526605 0.58209369 -0.93137712
## [32,] -0.984421383 1.37384823 1.56126513 -1.52020482 -1.77019648 1.04405331
## [33,] 1.169114958 -0.94538277 0.41846401 1.10129235 -0.99656394 -0.35048366
## [34,] -0.827127226 -0.65391089 0.78613402 0.66640150 -0.29436834 -0.10351272
## [35,] 0.899822871 -1.21887688 1.78456610 -1.69271243 -0.76788670 0.53176623
## [36,] -2.228039036 -0.06440493 -1.36206826 -0.84449413 0.96711619 -1.45610367
## [37,] 1.000028914 0.33001815 -0.42961327 -0.86276522 -1.59544362 0.22580218
## [38,] -1.716312863 -0.35711347 -2.48333240 -2.29429038 2.26987664 0.49939407
## [39,] -0.286100526 -1.26082440 1.05818052 0.08641858 0.04538381 0.20582233
## [40,] -0.027978157 -0.48019254 0.38500697 -1.07684891 1.25860322 1.13944646
## [41,] -1.419397316 2.35764817 1.61004647 0.14064134 -0.75152302 0.65372815
## [42,] 0.446041072 -0.21167441 0.36819029 -0.43443029 -1.06385555 -0.83907281
## [43,] 0.624205863 -0.62285415 -0.34911413 -1.07557427 -1.41003277 -1.36213782
## [44,] 0.510480537 0.01343157 -0.73413385 1.76291654 -1.24190369 0.97413048
## [45,] 0.348431712 1.04266130 -0.91647536 -1.80342654 -0.98601414 0.09352623
## [46,] 0.993634400 -0.00138955 0.43784937 -0.88609837 0.37096337 -0.62782030
## [47,] 0.684933670 1.37608405 1.29817379 0.29962676 1.60445942 -0.28703134
## [48,] 0.328113589 -0.30227142 1.13071569 -0.42718484 0.68730248 1.64666429
## [49,] 1.657794101 1.56541044 -2.34103827 0.21311749 0.03060507 0.74710014
## [50,] -0.809019567 0.62101641 0.11612255 0.26464242 -0.46029335 -0.49514866
## [51,] -0.399606333 -2.15905348 -0.71403829 0.16975066 0.38794658 -1.00396131
## [52,] 0.517525244 -0.53439907 0.87837628 -1.96770414 -0.08381018 0.97463188
## [53,] -0.028304310 -0.45075418 0.97807249 0.30259807 0.08672982 -0.20450259
## [54,] 1.898173582 -1.30018810 1.14476495 -1.24757430 -0.32946592 -0.89076600
## [55,] 0.014615067 -0.77775420 -0.32115305 -0.18757272 -0.99832269 -0.65165652
## [56,] 0.237510871 -2.29517289 0.03314617 -0.95189605 -0.21734951 1.15872499

```

```

## [57,] -0.789780628 -0.39434082 0.91150637 1.70911880 0.32556824 0.55221151
## [58,] -0.622817030 -1.04309445 -0.46962147 -1.00559178 -1.77507821 0.35883266
## [59,] -0.856317932 -1.07658792 -0.88891952 -0.15708525 -0.18584431 -1.14245657
## [60,] 0.300699642 -0.44885281 -1.37774468 0.55643627 -1.48444488 0.92831082
## [61,] -1.747051516 1.99568904 2.16043947 -0.43880517 -1.20250420 0.41817918
## [62,] 0.248866936 -1.28892606 0.08382095 -1.04806018 -0.56279852 -0.80152216
## [63,] 1.298629621 1.42202456 0.35619843 0.66799878 -0.71928326 -1.10988600
## [64,] 1.308408339 2.27080170 0.31407353 -1.80371234 -0.15543830 1.57063841
## [65,] -0.126412832 -1.10252213 -0.41521557 -0.26562836 2.29605188 -1.32172706
## [66,] 0.192766754 -1.68691193 -0.75799768 0.26704681 0.77292254 0.32991575
## [67,] -0.436132924 1.57512045 -0.58194084 1.59421021 -0.20497534 0.48943371
## [68,] 0.179566017 -0.43343640 -0.54294094 -0.44606289 -1.20305873 1.35620663
## [69,] -0.862125417 -1.17656267 0.37553377 -1.06644451 -0.58659996 0.05932361
## [70,] 1.902969702 -2.30293496 0.39551618 -0.22182045 -0.74103127 1.95996429
## [71,] -1.395738305 1.03581298 0.09463981 -0.25734559 0.12065115 -0.44314783
## [72,] 0.287432529 -1.01028980 -0.80201544 0.76485904 -1.03358168 -0.30995871
## [73,] 0.055372016 -0.78856975 -0.41149221 0.93682620 0.26831855 0.36613295
## [74,] -0.135368109 1.56589597 0.89257988 -1.73823876 0.33701078 -1.09540638
## [75,] -0.761800499 -1.26448548 0.23759157 -0.69055962 0.48466834 0.61886002
## [76,] -0.164433981 1.10729590 2.00441016 -0.62258285 0.23103851 -0.23959576
## [77,] -0.521961346 0.74048117 0.64524747 0.70829563 0.82212337 0.51262225
## [78,] -1.131559521 0.71588803 0.21656963 -0.08713693 1.78321480 -1.37123175
## [79,] -1.359929713 0.08849710 -0.36586607 1.16029716 -0.65452333 -0.01120609
## [80,] -0.970668917 1.14157519 -0.13704683 -1.70169196 -0.54822039 -0.23606444
## [81,] -0.014505739 1.18437700 -0.78597633 -0.37667868 2.50387331 -0.02890731
## [82,] -2.358012021 -1.42666332 0.73814988 0.85308678 -1.90832844 -1.04717681
## [83,] -0.330243447 -0.56764097 -0.48185143 0.15592633 1.24953888 0.45390170
## [84,] 0.956596443 -0.74622838 -0.61671611 0.03284204 1.85597387 0.59389609
## [85,] -0.351617655 0.06333329 1.17625624 -0.89615113 -0.85842187 -0.73545337
## [86,] 1.210713907 0.87911353 0.30243461 0.21776319 0.28708141 1.27214821
## [87,] 1.940983136 -0.77097027 1.42249708 -0.61761337 0.12202413 1.17502207
## [88,] -1.667201658 -0.10185054 -1.57814295 1.08968086 -1.91874336 0.40268112
## [89,] -1.440346631 -0.08854207 -0.19494155 0.08764401 -0.23442246 -0.89786543
## [90,] 1.773618727 0.34164288 0.66740569 -0.32143816 -1.20487198 0.35090712
## [91,] -0.808195631 0.65988536 -0.22098594 -0.01781514 2.37417281 0.55062446
## [92,] -0.665518212 1.29324444 0.14958370 -0.68733588 1.23553855 -1.66577756
## [93,] -0.682718966 -0.60548232 2.39023807 0.52752188 0.09506710 0.16080617
## [94,] -0.869150996 0.19239644 -1.37804539 -1.50309257 0.21746097 0.15242153
## [95,] -0.328442019 -0.42222350 -1.16830743 0.70614722 0.01315112 -0.95955333
## [96,] -0.893020912 0.20988845 1.30723061 -0.30706782 -0.09060003 0.29212648
## [97,] 0.949671862 -1.29830479 -0.81452083 0.97077355 -0.35925810 -1.33775085
## [98,] -1.586149802 0.34115827 0.38254426 1.86052448 -1.02232562 0.09426426
## [99,] 1.212537456 -0.51890595 -0.34533235 -0.32523648 0.68116747 0.68389740
## [100,] -1.495473075 -0.08735372 0.85390258 0.38411763 -0.29730163 0.22448523
##      [,7]      [,8]      [,9]     [,10]     [,11]
## [1,] -0.82558829 -0.17943134 -1.269336281 -0.231876927 -1.64706990
## [2,] 1.38273729 0.17917766 0.020757865 -0.711268615 -0.08811514
## [3,] -0.38211264 -0.57422239 -0.372544267 -0.892659824 0.88267339
## [4,] -0.13019624 -1.76811673 -2.374965407 3.416361089 -0.44546665
## [5,] -0.77087045 0.28297534 -0.621277652 0.240671637 -1.64999640
## [6,] 0.34845165 -0.05657637 -0.856291440 0.533175113 0.58737509
## [7,] 0.25896981 1.59812778 -0.462051612 -0.774361092 0.34917791
## [8,] -1.75238424 -1.56076143 1.503970132 -0.813548132 0.29174002
## [9,] -1.56060515 -0.16261820 1.433136020 -0.903331207 1.06004914

```

```

## [10,] 0.86967842 0.50789211 1.077598784 -0.485295716 2.19297365
## [11,] -1.48207697 1.13118297 0.057804070 2.293564846 -1.25782849
## [12,] 1.54504168 -1.47643667 -0.570830486 -0.580860785 0.43406326
## [13,] 0.30431548 1.11255035 0.056378605 -1.932614081 0.03264161
## [14,] 0.95869768 -0.71190255 -0.110635571 -0.925150346 -0.42845856
## [15,] -0.15632080 -0.81938408 -0.208520973 -1.493525217 0.44327919
## [16,] -0.33213542 1.01792766 -0.304620625 0.881045277 1.79393226
## [17,] -1.55146853 0.50670528 0.032925091 -0.062058765 1.33615088
## [18,] 1.86892967 0.84610242 1.387481375 0.942054216 -0.31959706
## [19,] 1.01517633 0.88824276 -1.245431848 -1.286872784 -1.15548268
## [20,] 0.31608870 0.41808381 -0.005595284 1.089368493 -0.23712912
## [21,] 0.50756925 0.44889245 -0.447189958 0.376756657 -0.24108285
## [22,] -1.59582154 -1.50125208 0.052370137 -0.560035931 -0.07993207
## [23,] 0.14104334 -1.05766518 -0.388228852 0.392622878 -0.06919942
## [24,] -0.93355243 0.51515448 -2.354278497 0.155043539 1.21736813
## [25,] 0.59679007 1.76200113 0.365293251 -2.060077486 -1.39420443
## [26,] 0.50395268 -1.37428196 0.010319519 -0.595866187 1.35404918
## [27,] -0.59584681 0.09994798 -0.509211138 0.570665867 -0.51159576
## [28,] -1.96938946 0.55637264 -0.004767257 1.851011719 -0.47167510
## [29,] 1.23301047 -1.49391457 -0.019463531 -0.582915994 0.21408694
## [30,] 0.80688159 1.36772484 -0.447714371 -0.565628352 -0.12212057
## [31,] 0.63277215 0.43344875 -1.500292458 0.822241815 -0.21269491
## [32,] 0.51484470 1.16298159 -0.275519956 -0.375789875 -0.99844463
## [33,] -1.25795440 0.70288929 1.273767953 -0.536932794 0.23603114
## [34,] -1.13887595 2.05181865 -2.745143865 0.892660399 1.83961856
## [35,] -0.12497226 1.36284248 -0.758974585 0.757066089 -0.77288461
## [36,] -0.47351729 0.85902183 -0.412253736 1.341749329 0.06626982
## [37,] 0.78770434 0.71456730 0.136431783 -1.667396368 -1.47496217
## [38,] 1.23176157 -1.20282808 -0.071599566 0.344572564 0.33982373
## [39,] 0.02892893 1.14616443 2.373554874 0.818566421 -0.49132140
## [40,] -3.07570582 -0.47698061 -0.950350858 -0.786774925 -0.82948710
## [41,] 0.28573814 0.35345470 1.493644271 -0.376725833 0.52149192
## [42,] 0.88529310 0.51046425 -0.511934329 -0.156375730 0.17215176
## [43,] 0.82523036 0.81424449 1.300647106 1.508551183 -1.09923688
## [44,] -1.68713880 0.30689388 2.195260550 -0.710897738 0.27304814
## [45,] -0.57387796 -0.41010924 -0.692465217 -2.386439346 -0.39484001
## [46,] 0.42032371 0.19154754 -1.893803311 -1.440247715 1.52480006
## [47,] -1.23953739 -0.71597588 -1.197777808 -0.533353938 -0.05653724
## [48,] -0.41934170 -0.69731484 -0.174428540 -0.205232623 -1.63690675
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## [86,]  0.033701190 -0.384300627 -0.57212358 -0.71988474 -0.784985478
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## [88,] -0.458007979  0.476831242  0.89715024  1.04124115 -0.692308284
## [89,]  0.686760336 -0.268713584  0.40173675  0.79792296 -0.305408351
## [90,]  0.978622851 -1.896603619  0.51788651 -1.05905760 -0.364435331
## [91,]  2.428349186  0.244251878  0.56669139  0.14820404  0.178223400

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## [94,] -0.642019862 -0.162950254 0.17561497 0.29415790 -0.006205335
## [95,] -0.033231500 1.836375744 -0.29018548 -0.65547836 1.746400528
## [96,] 1.869020219 0.885589340 -0.50355386 -1.17040523 -0.162990400
## [97,] 1.663742511 0.199772075 -0.37308697 1.31934633 -0.560757281
## [98,] 0.544311950 -0.540911212 -0.49541019 0.75544278 -1.280880725
## [99,] 1.228697887 -0.967183903 3.20458495 -1.83824727 -0.760080686
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## [2,] 0.51670182 -0.62796483 0.74328296 1.66116349 0.9852598051
## [3,] 0.32072174 1.19803332 -0.02872602 -0.91882421 -0.0516310421
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## [8,] 0.34011941 -1.52380663 -0.89466058 -1.26781356 -1.7497676535
## [9,] 0.09182727 -1.09163427 0.43481544 -0.92875152 -1.9702076682
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## [11,] 0.04051020 0.33696096 0.13616289 -0.14839639 0.0811996587
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## [99,] 1.03910021 0.98228463 -0.80249881 0.58465441 0.1237647623
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##      [,37]      [,38]      [,39]      [,40]      [,41]
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## [2,] -0.48401965 -1.52736806 1.024229e+00 -0.22567698 -0.26936659
## [3,] -1.76398441 0.31382796 9.038989e-02 0.90474892 -0.62822903
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## [25,] -1.75558512 -2.15370995 8.285167e-05 2.20462637 1.71776910
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## [52,] -1.20934151 -1.71394526 -3.455261e-01 1.06861517 -0.29232602
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## [74,] 0.36996006 -1.61478000 3.805981e-01 -1.35552658 -0.49547974
## [75,] -0.43354131 -0.22078269 7.867662e-02 0.69418037 1.03065050
## [76,] -0.12330601 -0.52062770 1.523790e+00 -0.17547900 -1.42321395
## [77,] -0.27174577 0.20485354 -1.257240e-01 1.77830348 -0.74178369
## [78,] 1.32421802 -1.02952364 1.411367e+00 2.44603127 0.09438200
## [79,] -0.46429805 1.62424679 -1.565831e+00 -0.06223104 -2.00862240
## [80,] -1.81507501 -0.68901261 -8.030050e-01 2.46368826 2.06280680
## [81,] 0.21217414 0.58388711 -1.401787e+00 -0.14733401 0.08307945
## [82,] 0.38561266 -0.59567124 8.238383e-01 -1.19965235 0.03904980
## [83,] 0.89106870 1.92809022 -4.910757e-01 -1.55945749 -0.77819672
## [84,] 1.68429964 -0.64519899 -1.468274e-01 0.22673307 2.08291869
## [85,] -0.38079366 0.36134260 -5.918565e-01 -1.49189860 0.83485334
## [86,] -0.63800668 -1.32810607 4.728283e-01 0.94657340 -1.66411461
## [87,] -0.93507033 0.02639553 1.484409e+00 1.10713767 0.39109095
## [88,] -0.20642888 1.56612624 8.772496e-01 0.03967203 -0.23681068
## [89,] 0.12905936 0.13405806 -1.112132e+00 -0.71467481 -0.99190843
## [90,] 0.51107495 -1.33562327 8.166219e-01 0.95796194 0.05126245
## [91,] 1.57090675 0.13918125 -5.116490e-01 1.23638810 -0.09388030
## [92,] -1.01940127 -0.56994408 -7.591721e-01 -0.13746108 1.04316681
## [93,] 0.86146252 -0.65255563 -7.796689e-02 -0.40713391 -0.61993964
## [94,] -0.20643735 0.56924479 -4.590165e-01 1.28781720 -0.36082761
## [95,] -0.45833486 -0.05910992 4.190073e-01 0.14247367 -0.27429701
## [96,] -0.97199563 -0.39608624 -6.026831e-01 0.85529578 0.35084864
## [97,] -1.78190755 -0.03171709 -2.421698e-01 0.40100642 0.85733279
## [98,] 1.89684362 0.71136707 -4.332530e-01 -0.52015962 1.36991942
## [99,] 1.20298498 -0.81769250 9.076686e-01 -0.16940323 1.81068217
## [100,] 1.28582876 1.29007440 -2.751422e-01 -0.86709054 -1.54459232
##      [,42]      [,43]      [,44]      [,45]      [,46]
## [1,] 1.232757896 -1.419994643 -0.054185062 -1.3639081122 -0.087014611
## [2,] 0.292305753 -1.186562091 0.105593432 0.5308596827 0.104241652
## [3,] -0.315560666 0.741978340 -0.390758147 -0.2739899481 1.161161083
## [4,] 0.009385257 2.404385403 0.135523110 0.2195069721 -0.220065569

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```

## [5,] 0.388879153 -1.629099399 0.538994056 0.7776742036 -1.344326184
## [6,] 0.337709724 -0.512066634 1.500449209 0.2794571471 1.614436073
## [7,] 1.215129139 -0.576434600 -0.570257917 0.6830170163 -0.248264992
## [8,] 1.148793017 1.261716063 -0.533825082 0.5744281181 -0.303916803
## [9,] 1.793718449 -0.364802551 1.701103272 -0.3447390279 -0.403395188
## [10,] 1.191129672 1.162948753 0.998666898 1.9600519387 1.066748622
## [11,] -0.211902324 1.619496726 -0.559729622 -0.5461241597 -0.162558389
## [12,] 0.128447187 0.382548653 -1.410487620 0.2887619974 -0.745887795
## [13,] 1.037213275 0.702338994 0.121187928 0.6401145421 -1.446940890
## [14,] 1.164169873 -0.967914388 -0.762286567 0.1681592327 0.555009609
## [15,] 0.475760519 0.258615881 -0.685450334 0.5769912313 0.005806543
## [16,] 1.571457880 -1.022595616 3.673767733 -0.2004242949 0.180417582
## [17,] 1.522714550 0.969820183 -0.870744254 -0.1733766025 0.380921343
## [18,] 2.224453956 -0.622999312 -0.576461807 1.3174381280 -0.709218919
## [19,] 1.730484912 0.141271352 1.265475700 1.0703462085 -0.567194164
## [20,] -0.049062721 -0.687849634 2.689657702 1.0526594546 -0.324720423
## [21,] -0.391323868 -0.521735592 -0.691870543 0.7964267187 -0.578656744
## [22,] 1.409205364 -0.540183212 1.238372565 2.0628294099 1.558548977
## [23,] 0.404690624 0.690581186 -0.458650252 1.2869623990 0.051812954
## [24,] -0.014030461 -0.324421404 -0.529185269 -0.6265415044 1.803491820
## [25,] -1.970340182 -1.609889012 -1.750054036 -0.0880112740 0.636650425
## [26,] -2.325045441 -1.016249185 -0.524066706 0.4958306343 1.492512123
## [27,] -0.494121204 0.416628411 -1.946690713 -1.0619792443 0.151283816
## [28,] 1.269067830 0.369724471 0.093568653 -0.7477901824 0.238804829
## [29,] 0.479841673 0.243761594 -0.280600717 2.2495332820 -0.520226241
## [30,] 0.756058077 1.436157660 -0.209066328 0.5726408636 -1.587850407
## [31,] 0.640907352 0.397372462 1.880503508 0.3577362826 0.653855263
## [32,] 1.209800650 -1.622818086 1.010835097 0.9378977072 0.990007124
## [33,] -2.707362489 0.866770153 -0.706294669 0.9906535728 -0.680847808
## [34,] -0.170313025 -0.571199531 0.439984586 0.0421069339 0.475619515
## [35,] 1.150316227 -1.602898051 -1.280915660 -0.1173346401 2.239183793
## [36,] 0.682162452 0.540173280 -0.775139259 0.4406936483 2.864002343
## [37,] 0.672119338 1.178858099 0.069271917 1.7958585553 1.119062880
## [38,] 1.080721284 -0.164047442 -1.909731150 1.2332147154 0.223016553
## [39,] -1.340911741 -0.148479051 0.740605644 0.4912797019 -0.640345041
## [40,] 0.772912434 -1.351238314 0.095343479 0.2306501783 0.177557059
## [41,] 1.189187495 1.732445887 -0.374692059 -0.6110448979 -1.409905417
## [42,] 0.365847984 0.223184372 2.911657287 -0.1427040369 -0.835785638
## [43,] -0.440785472 -0.603064193 1.099951101 0.2672889715 -0.161899653
## [44,] 0.240416003 -1.252636259 0.076130692 -1.7186736827 -1.959335194
## [45,] 0.840419589 -0.013798924 -0.657390724 -0.4874623293 -1.274246513
## [46,] 0.081416855 -1.828891767 0.436730556 0.1537327658 -1.282218266
## [47,] -0.621568361 0.450387747 0.367163436 -0.3218077528 0.129534458
## [48,] 0.284770223 1.137031734 0.194407188 -0.2751963044 1.590586188
## [49,] -0.049119894 1.243668571 1.886482751 -0.3944913518 -0.389322105
## [50,] -1.279177112 -0.906245432 0.551108252 0.1862073399 1.910060478
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## [52,] -0.008057546 0.323156637 -0.307146836 0.8106484062 -0.781933683
## [53,] -1.384748383 1.763750623 1.457355021 -0.1246765321 -0.152703333
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## [55,] 0.994023152 0.004176536 0.381107907 -0.7145503820 -1.016125138
## [56,] 0.574399428 0.288246260 0.043228245 -0.0217684731 -1.262344531
## [57,] -1.891556519 -1.638559846 0.956131419 -0.4241642407 0.401851984
## [58,] 0.424883112 -1.741801991 0.832618810 -0.4072225592 0.543389556

```

```

## [59,] -1.704026356 2.231852641 0.088814836 0.9293303590 -1.324532380
## [60,] 0.870356967 -1.365419597 0.768318822 0.3591250593 0.446882864
## [61,] -0.233065871 0.114510117 1.128083658 0.2369946323 0.498726308
## [62,] -0.504721340 1.879173128 -0.057782398 0.3311526233 1.153400996
## [63,] -1.134335690 0.576848472 0.934335785 -0.6597116801 -0.260408819
## [64,] 0.288666766 0.781838188 -1.031405238 -0.7535124619 -0.570491493
## [65,] 1.567559047 0.335460627 0.662731066 -0.4639946433 -0.370988102
## [66,] 0.309196620 -0.067068569 0.830729089 -0.8958527377 0.619371741
## [67,] -0.832035041 1.765902187 0.625542523 -2.6040699235 -1.965618319
## [68,] -0.975398815 -0.322986322 -0.807150847 -0.6058811631 0.368273451
## [69,] 0.437107524 1.898718726 0.023963735 2.0066113976 0.125222461
## [70,] 0.789181444 1.167020002 0.383571583 0.3678389982 -0.930651792
## [71,] -0.899817144 -2.246965076 0.541663081 -0.1389014004 0.522279466
## [72,] 0.530095993 0.069484755 0.116068478 0.4096913258 0.857947863
## [73,] -2.864633840 -0.830260840 0.351655750 0.4388425924 1.093859358
## [74,] 0.252021854 -0.464912061 -0.126926007 0.0435629368 -0.330681784
## [75,] -0.331455016 -1.312073543 -0.249713260 0.6326662695 -1.802561076
## [76,] -0.295356355 0.886678257 0.713945853 1.0581238894 1.192173457
## [77,] -0.179722912 -0.413773140 -0.149293087 -0.6747889597 -1.139420747
## [78,] -2.228999668 0.114021915 -0.016075586 0.6072223406 0.006226295
## [79,] -0.062655202 -2.116281974 -0.523452682 0.0148679532 0.690893606
## [80,] 0.827498680 -1.060295363 -1.399550182 1.3518134227 1.899946307
## [81,] 1.128817889 2.258675570 0.486433714 -1.3230108193 -0.699506163
## [82,] 1.458826502 -0.100815782 0.360626651 -0.0288624285 1.808891131
## [83,] 0.029871821 -1.204442191 -0.447217057 0.9013124897 -0.103860386
## [84,] -0.704028504 2.214510842 -0.628965861 -1.3980885777 0.929709905
## [85,] -0.508484816 -0.427597690 -2.011849524 1.3962243726 -0.597672241
## [86,] -1.058882385 1.542663450 -0.905312180 -0.1611703525 -0.020606593
## [87,] -0.070988669 1.539059078 0.268309470 -0.9712724551 1.790374543
## [88,] -0.083844703 -0.878078151 -0.086350008 0.7925695809 -0.031079442
## [89,] 0.270102428 0.431073587 -1.108036444 -0.2054136039 -0.510922868
## [90,] -0.532425185 -0.004726488 -0.182852361 0.2698971079 0.072985795
## [91,] 0.095045337 1.056286754 0.149327205 0.3551361129 0.023941361
## [92,] 0.216471477 0.650307604 0.697907145 1.2735274031 -0.701973772
## [93,] 0.976221607 0.325719857 -0.093598647 0.3210951214 0.343282793
## [94,] 0.266091092 0.487609799 -0.045957556 -0.1050157503 1.480568815
## [95,] 0.759953765 -0.133453354 -0.627280596 -0.1388410926 1.241681593
## [96,] -0.195270020 -1.056570625 1.076781237 0.7756573971 0.768289411
## [97,] 0.762167768 0.748188356 0.230042737 0.2239553773 -1.291367592
## [98,] -0.757033327 -2.351528741 -0.302658920 -1.9700180303 1.511296962
## [99,] -0.681057606 -0.635070486 -0.231647163 -0.0063295247 1.037734763
## [100,] 0.035190169 -0.431365235 -1.178037063 0.3819448780 0.828486368
##      [,47]      [,48]      [,49]      [,50]
## [1,] -0.657514708 0.16092896 0.34622134 -1.903645222
## [2,] 1.558170471 -0.29722277 1.40781851 -1.983084773
## [3,] 0.335027963 -0.79972744 1.21511803 0.102835700
## [4,] 0.548727409 1.85130973 -0.20577560 -1.018819904
## [5,] -0.824607991 0.51170818 -0.46746522 -1.311386943
## [6,] 0.706726204 2.39764069 0.49942032 -0.856971351
## [7,] -0.336152948 0.36571928 0.98272380 -1.366829422
## [8,] 1.316996837 0.35813716 -1.32662253 -1.094953107
## [9,] -0.707366908 -0.24257395 -0.52510199 0.483363122
## [10,] 0.512585990 1.30133939 -1.12758947 -0.289470935
## [11,] 1.509845025 -0.47498274 -0.07193977 0.941805105

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```

## [12,] -0.769449285 -0.10403840 0.82489740 -0.274014331
## [13,] -1.041179000 -0.30138677 1.80844457 -0.078447648
## [14,] -1.348530763 2.43225022 -0.40800475 -0.300140511
## [15,] 0.508748628 -1.22213558 1.59229700 -1.272581906
## [16,] 1.290721057 -1.24785521 -0.58081677 0.228163819
## [17,] 0.154783654 -1.52184463 -2.66897864 -0.894065531
## [18,] -0.004903355 -0.06695840 -0.20554874 1.184912504
## [19,] -2.233319935 -0.88065626 -0.20009845 -1.844044744
## [20,] -0.481564163 0.08753780 -0.93226356 -1.127116431
## [21,] -0.312620068 1.64932841 -0.06566096 0.787955582
## [22,] -0.032627893 1.06173678 -0.54678342 -1.409793720
## [23,] 0.954318758 0.83096918 -0.78785349 -0.631332000
## [24,] 0.417281653 1.54954837 -0.31363513 -0.849388080
## [25,] -0.534645871 -0.56217876 0.75340994 -1.102254043
## [26,] 1.971342101 1.10001883 1.68048882 1.000813839
## [27,] 0.164192670 1.23134250 0.18284483 -0.208884015
## [28,] -0.651898269 -2.24805365 0.76501146 -0.753970586
## [29,] -0.158612169 0.45159830 -0.06345480 -0.305479775
## [30,] -0.153719157 1.39657425 0.70711047 0.606803527
## [31,] -0.050147542 -0.21128249 -1.05331137 0.549525608
## [32,] 1.499735040 0.88227283 -0.08201966 -0.378815348
## [33,] -1.494425928 -0.45915880 -0.12606607 0.233015501
## [34,] -2.040642881 -0.28940600 2.15238181 0.538323281
## [35,] -0.908216747 1.88036609 0.09378855 0.076465307
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## [37,] 1.272992501 -2.03244554 2.13158501 0.596772034
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## [39,] -0.113353041 -0.13066281 0.60056325 -0.072935605
## [40,] -2.034761693 0.54578549 1.22599914 -1.184024473
## [41,] -1.091159592 -0.31767942 -0.75620351 -2.032843736
## [42,] -0.803567238 0.57255294 -0.13456348 0.207051932
## [43,] -2.469319645 0.17742214 -1.29196723 0.109071707
## [44,] 0.132754779 -0.98569039 0.47166204 -0.184217730
## [45,] -0.752258041 -0.21031388 0.77758839 -1.287603107
## [46,] -0.411981175 -0.50847653 -0.74411344 -0.484780205
## [47,] -0.480425625 -0.01104984 0.83865283 0.384489302
## [48,] 2.706520798 -1.10701426 -0.44560498 -1.101933809
## [49,] 0.724490333 0.19893715 0.27606967 0.649732895
## [50,] 1.407498903 0.06249034 0.02622370 0.819176417
## [51,] 0.020663244 1.09946931 1.75792032 0.875056091
## [52,] -1.066191589 0.78284242 1.64945353 1.407938220
## [53,] 0.128061938 0.06603856 -0.10116371 0.443723312
## [54,] 0.709567025 0.74214166 0.32952477 0.682387002
## [55,] -1.700131977 1.46595004 1.28565483 1.377979563
## [56,] -0.339900590 0.13883493 0.03598448 -0.629092286
## [57,] -1.064113494 -0.42298139 -1.12928186 0.009702396
## [58,] 0.219236341 -0.14552583 0.37842328 -0.688411274
## [59,] -1.770141108 0.13863499 1.48796443 0.283912397
## [60,] -1.735550474 0.30331831 0.78994376 0.355889431
## [61,] -0.657962216 -1.31700494 0.44941804 -0.156463256
## [62,] 0.479990611 -0.07663514 -0.89130588 1.044938636
## [63,] -0.751899545 0.27092744 -0.45373759 0.191087710
## [64,] 0.261241996 -0.86941981 0.09977416 0.116286609
## [65,] 0.560347647 -0.45420237 0.41955292 0.631759408

```

```
## [66,] -0.669955331 -1.58385987 -0.51515195 -1.193089124
## [67,] -0.639324904 -1.54665858 0.55122292 -1.308613195
## [68,] 1.060127323 0.12223724 0.73151618 0.097137794
## [69,] 0.108823308 0.41560587 1.56074487 1.916094445
## [70,] -1.131905535 0.78657361 0.74596466 1.245484834
## [71,] 0.712632363 0.33835347 -1.44987334 -0.484695023
## [72,] 0.417865287 0.57677943 0.30584013 -1.639626976
## [73,] 0.336811528 1.07224615 0.29040558 1.232415524
## [74,] -0.113950396 0.81212926 0.56729895 -1.305247367
## [75,] -0.143193549 0.13321829 -0.84192937 0.597476326
## [76,] -1.520032379 -1.03625154 0.01483922 -2.143896459
## [77,] 0.246817709 1.07412768 1.32294913 0.613594853
## [78,] 0.391694033 -0.88053578 0.47695668 1.027371365
## [79,] -2.397712797 0.73640078 0.03923706 -0.450189238
## [80,] -0.377190683 0.20949855 -0.22670776 -1.084945826
## [81,] 0.889237443 1.00184000 1.41903110 -0.154761322
## [82,] 0.244474006 0.02276553 -0.13704867 0.409811883
## [83,] 0.002664284 0.13474122 -0.86343402 -0.211709984
## [84,] -1.688711865 0.40733229 -0.46375583 1.068293205
## [85,] -0.178930699 0.30269439 -0.35234422 0.109884182
## [86,] 0.431368837 0.39307053 1.06063411 -0.555108121
## [87,] 1.126117053 1.46705900 1.07068950 -0.198678843
## [88,] 0.731503180 1.08428719 -0.33594558 -1.829906704
## [89,] -0.347715577 -1.08778735 -1.00308961 0.058368414
## [90,] -2.260653391 -0.36199987 0.55690492 -2.638264758
## [91,] 1.307894469 0.53288581 0.21332985 -0.074084595
## [92,] -1.089206330 0.91998494 -0.80485676 0.018634295
## [93,] -1.097791835 -0.17190358 -0.05931174 1.144180908
## [94,] -0.832195147 0.22232255 -0.97451305 0.856958195
## [95,] 0.972103660 0.14413632 0.21225878 -0.904300787
## [96,] -0.550699902 -0.42823819 -0.73066580 1.756503835
## [97,] 0.334050097 -0.74848361 -0.19933223 0.382867931
## [98,] 0.981485769 0.42476154 -0.48669226 1.402858731
## [99,] 1.676237212 0.74035123 -0.74274745 1.780039506
## [100,] 2.117876233 -0.64550550 -0.08331206 1.213619456
```

Calculating mean for the above sample:

```
samp4_mean <- replicate(50, mean(rnorm(100, 0, 1)))
samp4_mean
```

```
## [1] -0.0904041245 -0.0403605870 0.0387812995 0.0038953808 -0.0294288609
## [6] 0.0409396106 -0.0286474697 0.1483332464 0.0291205216 0.0270339052
## [11] 0.0182507816 0.1396282304 -0.0815798996 0.0702355899 -0.0013690930
## [16] 0.1205675824 0.0004605434 -0.1232830333 0.1161148052 0.0029442493
## [21] 0.0467289602 0.0776759715 0.0555096518 -0.0357142921 -0.1641595865
## [26] 0.0330155636 0.0334679892 0.0682334929 0.0441080541 0.0093816060
## [31] 0.1028929013 0.0602725512 0.1035843998 0.0661890371 -0.0551975746
## [36] -0.0135201896 -0.0053259448 0.1098868009 0.0925346766 -0.0513696075
## [41] -0.0945261434 0.0242763002 0.0962003951 0.0796891558 -0.1282945606
## [46] -0.0292233410 -0.0126364949 0.1739684093 0.0456410354 -0.0383610566
```

Calculating minimum for each of the above samples:

```
samp4_min <- replicate(50, min(rnorm(100, 0, 1)))
samp4_min
```

```
## [1] -2.898662 -3.057976 -2.790985 -2.453476 -2.610236 -2.071948 -2.243770
## [8] -2.347929 -3.011875 -2.130961 -2.122479 -2.067779 -2.855140 -3.639545
## [15] -1.965107 -2.751596 -2.305655 -1.979063 -2.915399 -2.706303 -3.049803
## [22] -2.345268 -2.715491 -2.630739 -2.162807 -2.595714 -2.559087 -2.613663
## [29] -2.724179 -2.596888 -3.261395 -2.513850 -2.460672 -3.094389 -2.505296
## [36] -2.111085 -2.307509 -2.372733 -2.548086 -2.076877 -1.901302 -2.124360
## [43] -2.055908 -2.989688 -2.141572 -2.202465 -2.440111 -2.748503 -1.864616
## [50] -2.571724
```

Calculating maximum for each of the above samples:

```
samp4_max <- replicate(50, max(rnorm(100, 0, 1)))
samp4_max
```

```
## [1] 2.561547 2.593928 2.810119 2.497486 2.483076 2.643880 1.724720 2.815052
## [9] 2.079194 2.588781 2.353064 2.637794 2.567466 2.872233 2.337202 2.464567
## [17] 1.986863 3.963245 2.714146 2.406451 2.438262 2.805878 2.506230 2.208197
## [25] 3.161585 2.969707 1.811789 1.975064 2.719264 3.311790 2.391620 2.608002
## [33] 1.617079 2.530323 2.697820 3.196358 2.225545 2.505780 2.644222 2.656754
## [41] 1.800581 2.335508 2.437677 2.443197 2.764375 2.005103 2.575180 2.470937
## [49] 2.601282 2.201480
```

Calculating median for each of the above samples:

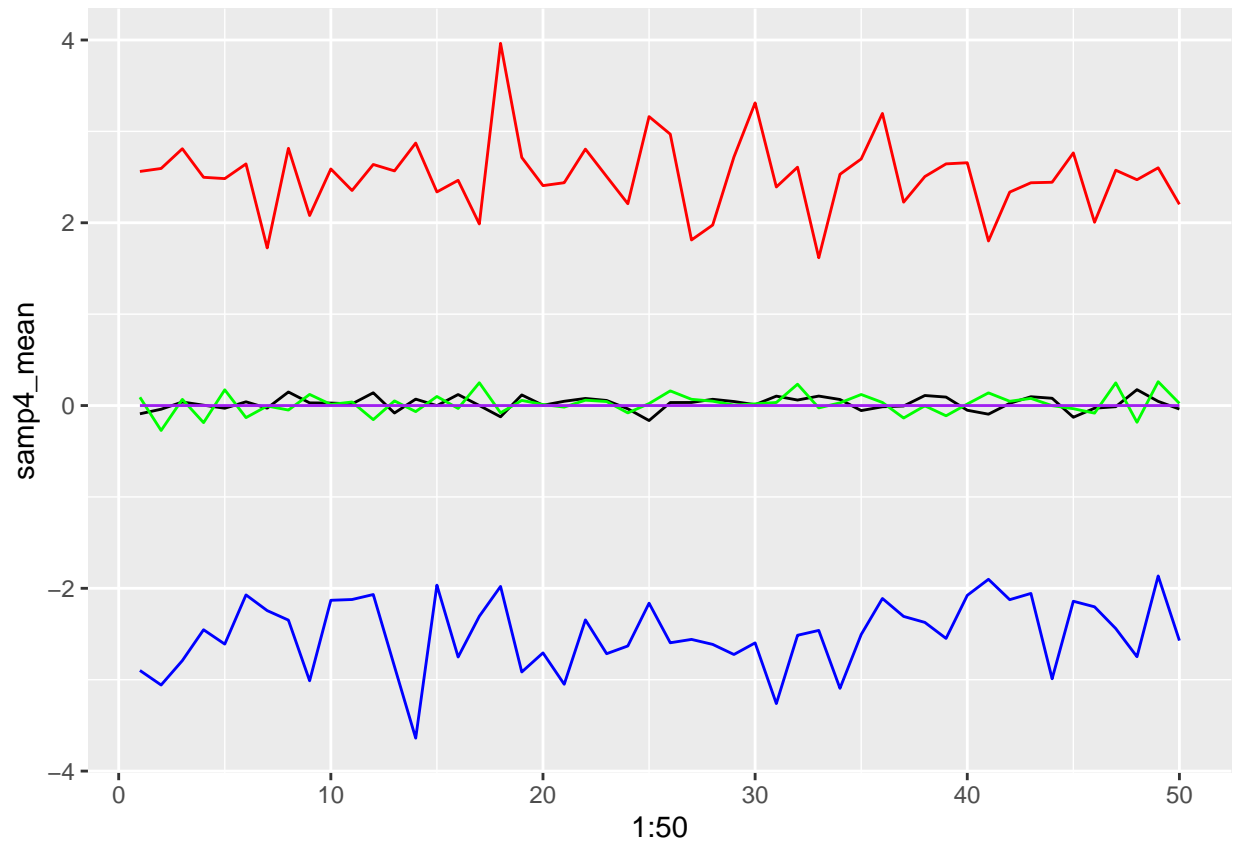
```
samp4_mid <- replicate(50, median(rnorm(100, 0, 1)))
samp4_mid
```

```
## [1] 0.090476454 -0.272752508 0.067754701 -0.187080734 0.172125215
## [6] -0.132022463 -0.004972229 -0.049278556 0.121813251 0.011957141
## [11] 0.038747849 -0.154286481 0.050870979 -0.066599892 0.099226767
## [16] -0.031863665 0.249619273 -0.079568490 0.056265993 0.011202803
## [21] -0.016979679 0.058602792 0.043875840 -0.080646758 0.021639673
## [26] 0.160480310 0.068290814 0.047527458 0.005392215 0.018314659
## [31] 0.033346553 0.233375243 -0.025500016 0.029545198 0.120837165
## [36] 0.033557092 -0.136568354 -0.002792577 -0.112304952 0.016673334
## [41] 0.138562018 0.046712561 0.078138879 -0.001181906 -0.034651498
## [46] -0.083252130 0.248220456 -0.182866919 0.260950601 0.023244598
```

Plotting these 4 statistics:

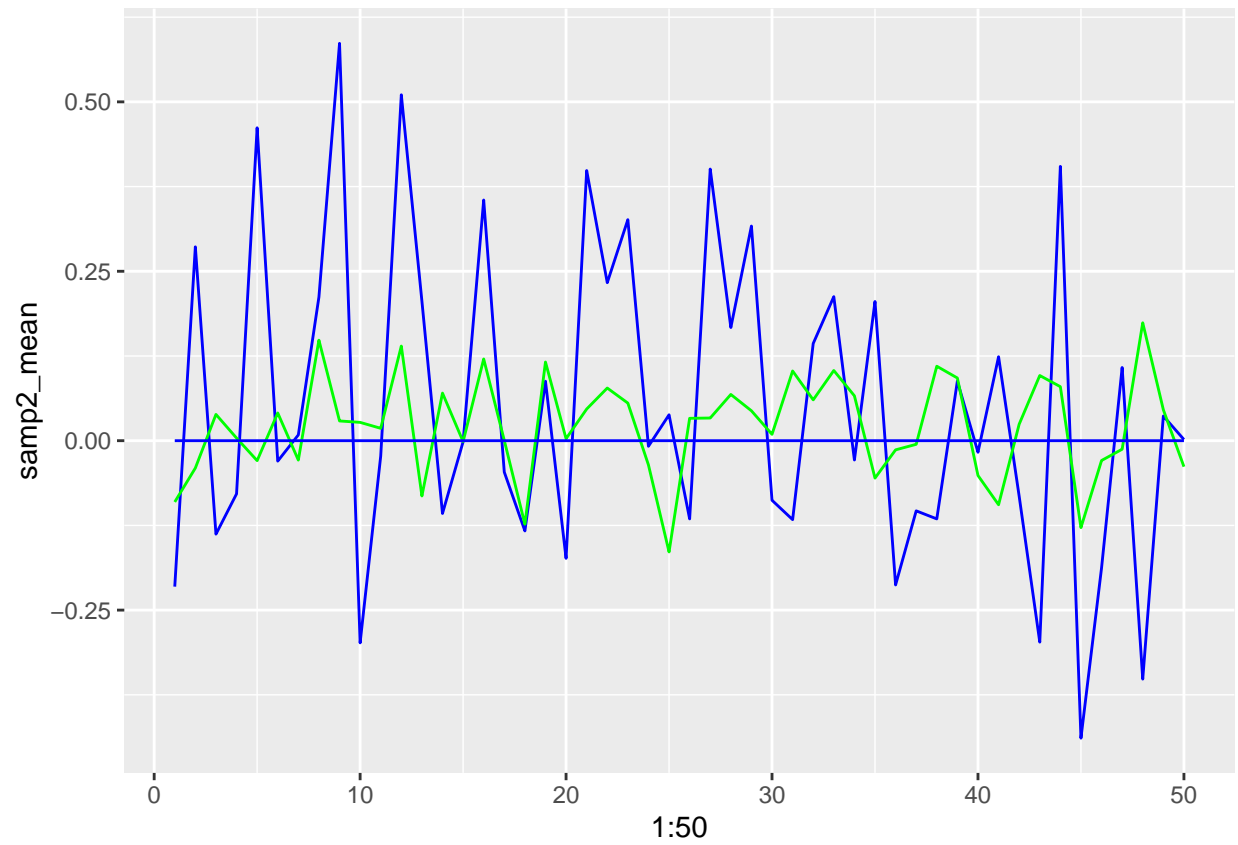
```
ggplot(NULL, aes(1:50)) + geom_line(aes(y = samp4_mean), color = "black") +
  geom_line(aes(y = samp4_max), color = "red") +
  geom_line(aes(y = samp4_mid), color = "green") +
  geom_line(aes(y = samp4_min), color = "blue") + geom_line(aes(y = 0), color = "purple")
```





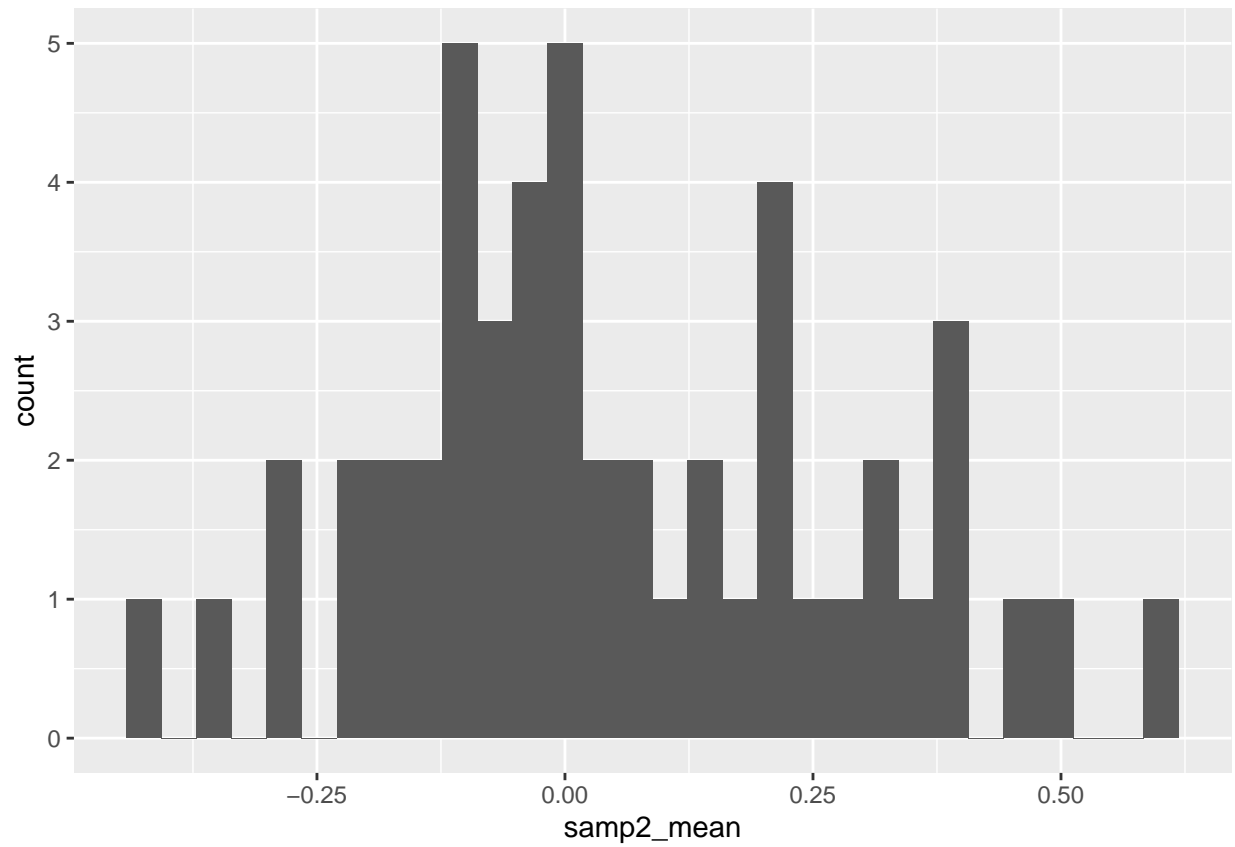
Sample fluctuation decrease with increase in sample size.

```
ggplot(NULL, aes(x = 1:50)) + geom_line(aes(y = samp2_mean), color = "blue") + geom_line(aes(y = samp4_mean), color = "red") + geom_line(aes(y = samp6_mean), color = "green")
```



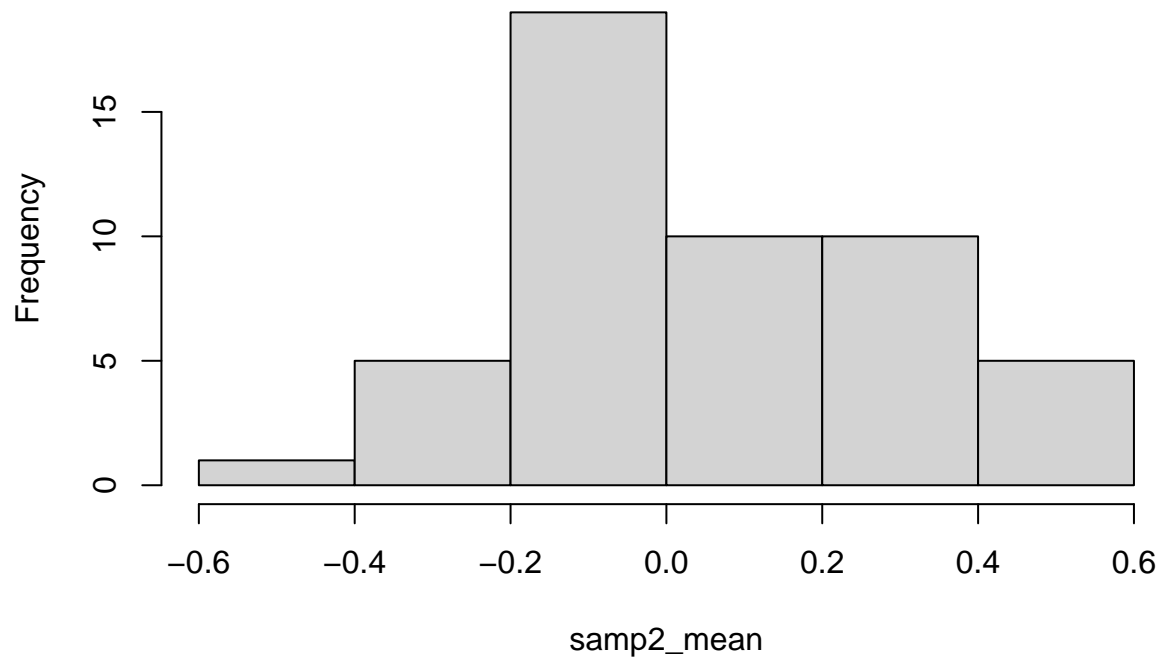
```
ggplot(NULL, aes(x = samp2_mean)) + geom_histogram()
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



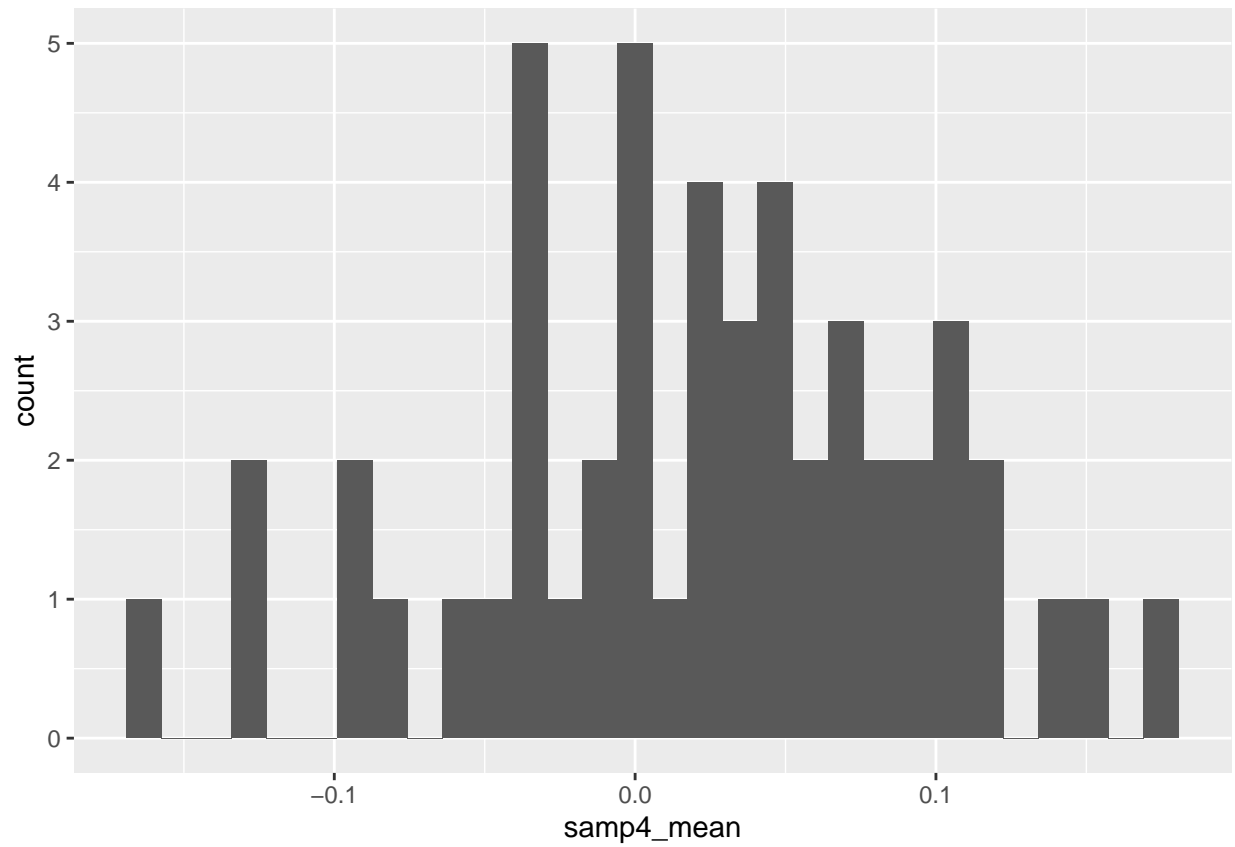
```
hist(samp2_mean)
```

**Histogram of samp2\_mean**



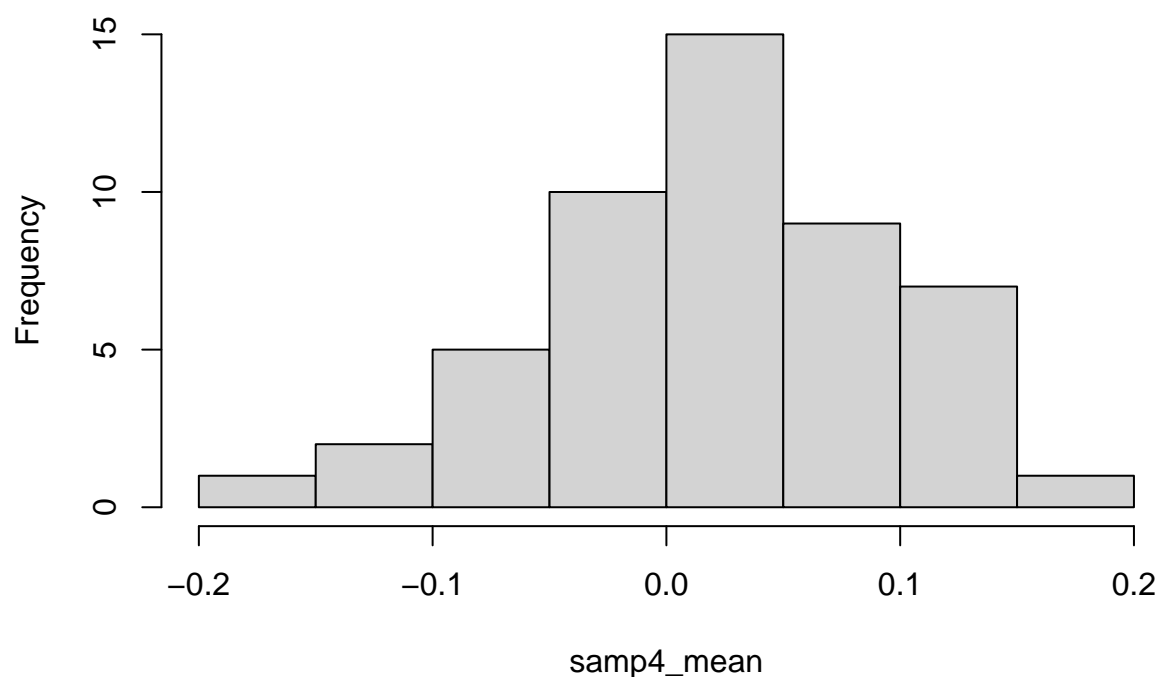
```
ggplot(NULL, aes(x = samp4_mean)) + geom_histogram()
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



```
hist(samp4_mean)
```

## Histogram of samp4\_mean



```
#A = matrix(replicate(50, rnorm(25, 0, 1)))
#A1 = apply(A, 2, mean)
#A2 = apply(A, 2, median)
#A3 = apply(A, 2, min)
#A4 = apply(A, 2, max)
#matplot(1:50, cbind(A1, A2, A3, A4), type = "l", col = 1:4, x = "sample number", y = "Statistics")
#alt+ctrl+i for a R block
```

Question: Taking 50 random samples from  $N(0, 1)$  of sizes: (a) 25, (b) 200, (c) 500, (d) 1000, (e) 10000, obtain the histogram of the frequency distribution of the sample mean. Comment on your findings.

Submit to: [sdg.stat@sxccal.edu](mailto:sdg.stat@sxccal.edu)