```
############################
#
# Name: Rishikesh Yadav
# CWID: 20007668
# Description: Final Exam Submission for User-defined Function in R
# File: Rishikesh_Yadav_Final_Submission.r
#
############################
library(quantmod)
```

```
## Loading required package: xts
```

```
## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
## Loading required package: TTR
```

```
## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
```

```
library(roll)
```

```
## Warning: package 'roll' was built under R version 4.2.3
```

```
library(ggplot2)
library(data.table)
```

```
## Warning: package 'data.table' was built under R version 4.2.3
```

```
##
## Attaching package: 'data.table'
```

```
## The following objects are masked from 'package:xts':
##
##     first, last
```

```
stock_data <- function(stock.ticker, start.date, end.date, rolling.size) {

  # 2.1
  # Here we download the daily stock data and convert it to a dataframe for further
  # processing
  stock.data <- as.data.frame(getSymbols(stock.ticker, src = 'yahoo', from = start.date, to = end.date,
```

```r
  # 2.2
  # Here we get the adjusted close price
  adjusted.Close.Price <- stock.data[tail(names(stock.data), 1)]

  # 2.3
  # Here we calculate the the mean and standard deviation by performing a rolling
  # window estimation on stock price vector.
  mean <- rollapply(adjusted.Close.Price, rolling.size, by = 1, FUN = mean, by.column = FALSE)
  std.Dev <- rollapply(adjusted.Close.Price, rolling.size, FUN = sd, fill=0, align="r", by.column = FALS
  std.Dev <- tail(std.Dev, -(rolling.size - 1))


  # 2.4
  # Here we store the statistical result of Q 2.3 into a dataframe
  statistical <- do.call(rbind, Map(data.frame, A = mean, B = std.Dev))
  colnames(statistical) <- c('Mean','Standard Deviation')

  # Here we transform the dataframe for our plot
  statistical.Transpose <- transpose(statistical)
  colnames(statistical.Transpose) <- rownames(statistical)
  rownames(statistical.Transpose) <- colnames(statistical)

  # Here we pot statistical dataframe using scatter plot
  statistical.plot <- ggplot() + geom_point(data = stack(statistical.Transpose[1,]), aes(x = ind, y = va
    geom_point(data = stack(statistical.Transpose[2,]),aes(x = ind, y = values, color = "Standard Deviat
    labs(x = "Index", y = "Statistical Values", title = "Statistical Result") +
    theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1)) +
    scale_color_manual(name = "Statistical Values", values = c("Mean" = "yellow","Standard Deviation" =

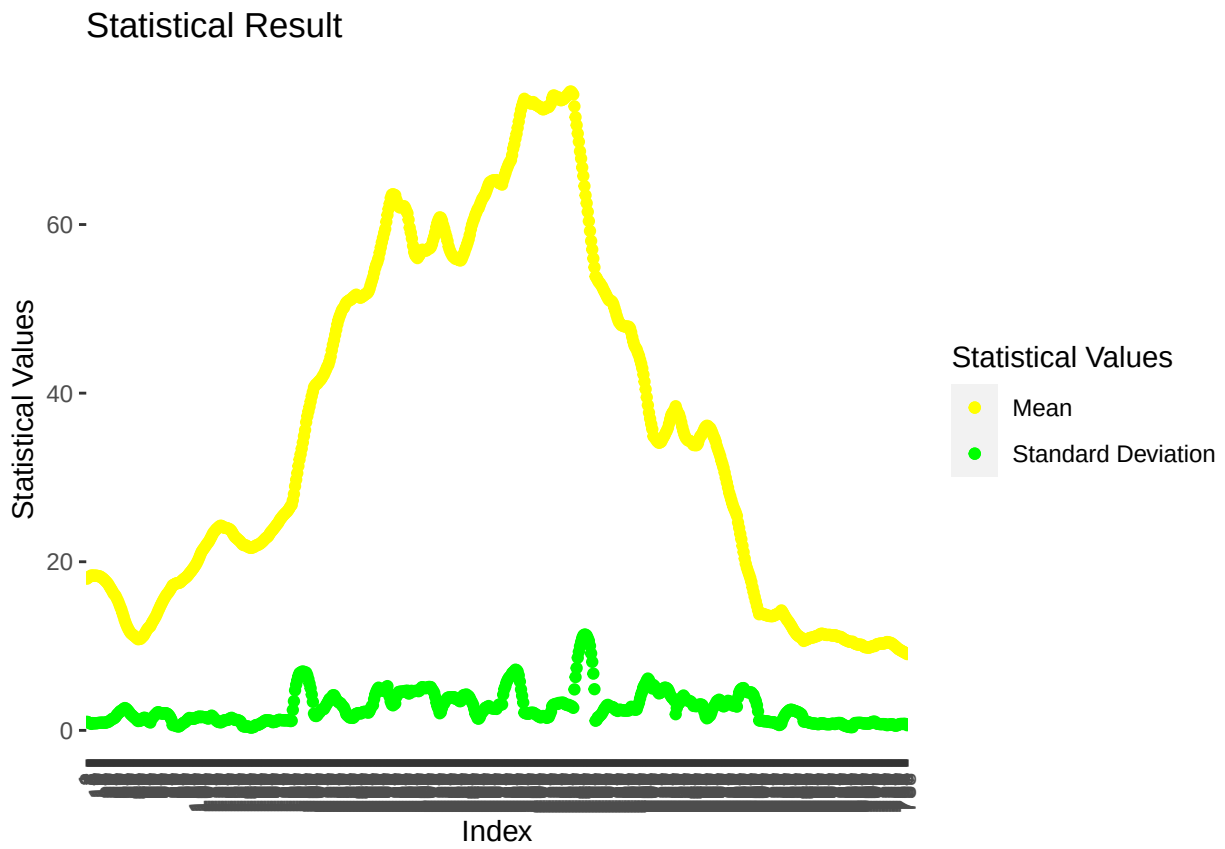
  print(statistical.plot)

  # 2.5
  # Here we return the statistical dataframe result
  return(statistical)
}


# 2.6
# Testing the above created function

stock.ticker <- 'SNAP'
start.date <- as.Date('2019-12-31')
end.date <- as.Date('2022-12-31')
rolling.size <- 20

statistical.stock.dataframe <- stock_data(stock.ticker, start.date, end.date, rolling.size)
```




```
print(statistical.stock.dataframe)
```

```
##        Mean Standard Deviation
## 1   17.9900          1.0173131
## 2   18.1175          0.9562802
## 3   18.1975          0.9039960
## 4   18.2715          0.8373908
## 5   18.3815          0.7731905
## 6   18.3395          0.8675278
## 7   18.3560          0.8366937
## 8   18.3445          0.8525346
## 9   18.3540          0.8425736
## 10  18.3345          0.8556096
## 11  18.3050          0.8779910
## 12  18.2750          0.8922619
## 13  18.2405          0.9065055
## 14  18.1435          0.9123437
## 15  18.0535          0.9121878
## 16  17.9445          0.9108032
## 17  17.8170          0.8968074
## 18  17.6720          0.9210723
## 19  17.5355          0.9739578
## 20  17.3695          0.9956929
## 21  17.1455          1.0770302
## 22  16.9100          1.1871194
```

```
## 23  16.7105          1.2601022
## 24  16.4765          1.3908357
## 25  16.2090          1.3984574
## 26  16.0920          1.4947051
## 27  15.8920          1.6284433
## 28  15.6080          1.8774328
## 29  15.3275          1.9804117
## 30  14.9875          2.1448172
## 31  14.6385          2.2942773
## 32  14.3265          2.2960660
## 33  13.9015          2.4477107
## 34  13.4885          2.5614045
## 35  13.0470          2.6475453
## 36  12.6745          2.5975708
## 37  12.3440          2.4761013
## 38  12.0690          2.3324031
## 39  11.8245          2.1607637
## 40  11.6025          1.9640047
## 41  11.4670          1.8309362
## 42  11.3675          1.7274620
## 43  11.2405          1.5806910
## 44  11.1575          1.4942587
## 45  11.0365          1.3768778
## 46  10.9075          1.2101756
## 47  10.8105          1.1069754
## 48  10.8460          1.1394708
## 49  10.8515          1.1455326
## 50  10.9720          1.2617932
## 51  11.1315          1.3840417
## 52  11.2410          1.4851755
## 53  11.4770          1.4953440
## 54  11.7105          1.4368770
## 55  11.9430          1.2290865
## 56  12.1185          1.1013402
## 57  12.2600          1.0045476
## 58  12.3495          0.9305713
## 59  12.6500          1.3484182
## 60  12.8915          1.5042335
## 61  13.0940          1.6375186
## 62  13.3305          1.8289440
## 63  13.5585          1.9167880
## 64  13.8555          2.0964267
## 65  14.1755          2.1588825
## 66  14.4515          2.1203880
## 67  14.7535          2.0405503
## 68  15.0210          2.0333274
## 69  15.2825          1.9733165
## 70  15.5290          2.0097000
## 71  15.7600          2.0427614
## 72  15.9875          2.0358624
## 73  16.1675          1.9890222
## 74  16.3270          1.8963541
## 75  16.5225          1.7318985
## 76  16.7285          1.5204822
```

```
## 77  16.9570          1.2345129
## 78  17.2090          0.6306464
## 79  17.2700          0.6682657
## 80  17.3445          0.6064692
## 81  17.4280          0.5204815
## 82  17.4530          0.5061006
## 83  17.4825          0.4569103
## 84  17.5035          0.4826492
## 85  17.5700          0.5799184
## 86  17.7080          0.7004104
## 87  17.8405          0.8198169
## 88  17.9515          0.9172171
## 89  18.0480          0.9493522
## 90  18.1570          1.0780983
## 91  18.2780          1.2139653
## 92  18.4280          1.3654096
## 93  18.6190          1.4739597
## 94  18.7660          1.4256648
## 95  18.9285          1.3901583
## 96  19.1110          1.3770026
## 97  19.2815          1.3768396
## 98  19.4985          1.4193190
## 99  19.6865          1.4897273
## 100 19.9420          1.5413241
## 101 20.2185          1.6069170
## 102 20.5315          1.6403989
## 103 20.8630          1.5569643
## 104 21.1745          1.6282521
## 105 21.3810          1.5914242
## 106 21.5580          1.5738241
## 107 21.7450          1.5698793
## 108 21.9445          1.5537780
## 109 22.1425          1.4419755
## 110 22.2970          1.4025544
## 111 22.5050          1.4530058
## 112 22.7710          1.6534649
## 113 23.0080          1.7531344
## 114 23.2990          1.6572994
## 115 23.5035          1.4967414
## 116 23.6530          1.3493005
## 117 23.8350          1.1950976
## 118 23.9390          1.0969956
## 119 24.0665          1.0026823
## 120 24.1970          0.9795710
## 121 24.2740          0.9573508
## 122 24.2505          0.9784925
## 123 24.1675          1.0971107
## 124 24.0510          1.1825617
## 125 24.0395          1.1936699
## 126 24.0145          1.2195579
## 127 23.9850          1.2398793
## 128 23.9195          1.2882732
## 129 23.8795          1.3230846
## 130 23.7695          1.4487801
```

```
## 131 23.6170          1.4933297
## 132 23.3815          1.3980338
## 133 23.1520          1.3310687
## 134 22.9545          1.2502485
## 135 22.8420          1.2266542
## 136 22.7350          1.2374871
## 137 22.6010          1.1752846
## 138 22.5010          1.1435997
## 139 22.3585          1.0498786
## 140 22.1845          0.8007725
## 141 22.0360          0.5323079
## 142 21.9720          0.4565500
## 143 21.9650          0.4576542
## 144 21.9375          0.4624520
## 145 21.8390          0.4698476
## 146 21.7655          0.4610796
## 147 21.6885          0.3837525
## 148 21.6550          0.3447118
## 149 21.6495          0.3325256
## 150 21.7180          0.3774649
## 151 21.7505          0.4080177
## 152 21.8420          0.5693818
## 153 21.9345          0.6320682
## 154 21.9775          0.6359235
## 155 22.0110          0.6556227
## 156 22.1135          0.7424800
## 157 22.1860          0.7859448
## 158 22.3005          0.9005406
## 159 22.4225          0.9756285
## 160 22.5565          1.0642083
## 161 22.7110          1.1636687
## 162 22.8300          1.1996576
## 163 22.9295          1.1948680
## 164 23.0435          1.1698502
## 165 23.2735          1.1722277
## 166 23.4860          1.1462266
## 167 23.6340          1.0437906
## 168 23.7815          0.9677226
## 169 23.9530          0.9967161
## 170 24.1230          1.0409766
## 171 24.3080          1.0492683
## 172 24.4705          1.1674466
## 173 24.6425          1.2225206
## 174 24.8975          1.2699064
## 175 25.0995          1.2206450
## 176 25.2505          1.2186902
## 177 25.4375          1.1919065
## 178 25.5780          1.2026841
## 179 25.7195          1.1897656
## 180 25.8460          1.1844093
## 181 25.9690          1.2041941
## 182 26.1570          1.2232704
## 183 26.3575          1.1462702
## 184 26.5965          1.0999007
```

```
## 185 26.7455          1.1403667
## 186 27.3020          2.4254432
## 187 28.0345          3.4663154
## 188 28.9585          4.7523602
## 189 29.7350          5.4205693
## 190 30.5125          5.9449747
## 191 31.3500          6.4504689
## 192 32.1220          6.7897553
## 193 32.7595          6.8462749
## 194 33.4220          6.9548384
## 195 34.1440          6.9730636
## 196 34.9100          6.9502467
## 197 35.6350          6.8426300
## 198 36.5540          6.8561180
## 199 37.2610          6.5363155
## 200 37.8380          6.0759843
## 201 38.3950          5.5487680
## 202 39.0070          4.9963861
## 203 39.6370          4.2517811
## 204 40.1580          3.3862112
## 205 40.6990          1.9963095
## 206 40.9055          1.7356949
## 207 41.0715          1.6992206
## 208 41.1275          1.7881481
## 209 41.3270          2.0132878
## 210 41.4645          2.1196959
## 211 41.5995          2.2922100
## 212 41.7900          2.4957733
## 213 42.0415          2.4946326
## 214 42.2270          2.5342954
## 215 42.5430          2.7778752
## 216 42.8410          3.0241919
## 217 43.1685          3.2250194
## 218 43.3720          3.4894768
## 219 43.8170          3.7427854
## 220 44.3475          3.7072191
## 221 45.0820          3.9280205
## 222 45.7335          4.1664733
## 223 46.2920          4.1667906
## 224 46.9055          3.9465075
## 225 47.5245          3.6452544
## 226 48.1555          3.4773986
## 227 48.6905          3.3481931
## 228 49.0940          3.2754441
## 229 49.4355          3.2100676
## 230 49.8080          3.0074082
## 231 50.0375          2.8364511
## 232 50.1490          2.7117138
## 233 50.4895          2.3591114
## 234 50.7320          1.9193057
## 235 50.8610          1.7709026
## 236 50.9430          1.6637445
## 237 51.0535          1.5332574
## 238 51.0720          1.5150153
```

```
## 239 51.1940          1.5223719
## 240 51.3730          1.4792469
## 241 51.4345          1.5792058
## 242 51.5905          1.8981921
## 243 51.6820          1.9422688
## 244 51.5660          2.0304202
## 245 51.4990          2.0495214
## 246 51.3560          2.0204888
## 247 51.3165          1.9944171
## 248 51.4185          2.0999662
## 249 51.4925          2.1503466
## 250 51.5880          2.2036689
## 251 51.7450          2.2076775
## 252 51.7795          2.1551155
## 253 51.8745          2.1714334
## 254 52.0540          2.0989359
## 255 52.3930          2.2995655
## 256 52.8570          2.6183644
## 257 53.3045          2.9088509
## 258 53.7290          2.9918851
## 259 54.2890          3.7018525
## 260 54.8415          4.2421071
## 261 55.2625          4.5968747
## 262 55.5700          4.8776153
## 263 56.0100          5.0676242
## 264 56.6570          4.9543415
## 265 57.2820          4.8996618
## 266 57.8985          4.7605714
## 267 58.4320          4.6856344
## 268 58.9880          4.8392486
## 269 59.4800          4.7589599
## 270 60.3200          5.1429373
## 271 61.1290          5.2503549
## 272 61.8445          4.4113052
## 273 62.4710          3.9768951
## 274 63.1575          3.3862273
## 275 63.5405          3.0519629
## 276 63.5980          2.9690446
## 277 63.5205          3.1053389
## 278 63.4765          3.1881824
## 279 62.9390          3.9695868
## 280 62.5650          4.2300075
## 281 62.1785          4.5485594
## 282 62.0295          4.5827060
## 283 62.0525          4.5849191
## 284 62.1410          4.6002997
## 285 62.1120          4.5976878
## 286 62.1735          4.6144445
## 287 61.9545          4.6830753
## 288 61.5965          4.6698195
## 289 61.3340          4.7098983
## 290 60.5745          4.3753796
## 291 59.6265          4.4005094
## 292 59.0340          4.6747508
```

```
## 293 58.3310          4.6830539
## 294 57.4760          4.6412601
## 295 56.7310          4.6486040
## 296 56.3445          4.6819821
## 297 56.1835          4.6879146
## 298 56.0175          4.7002174
## 299 56.2170          4.6448357
## 300 56.4135          4.7308645
## 301 56.8200          4.9534000
## 302 57.0025          5.1262156
## 303 56.9900          5.1119018
## 304 56.9250          5.0291504
## 305 56.9140          5.0171626
## 306 56.9110          5.0127498
## 307 57.0490          5.0958102
## 308 57.1530          5.1449627
## 309 57.1695          5.1488898
## 310 57.3215          5.1344042
## 311 57.6485          4.8797033
## 312 58.1430          4.7124837
## 313 58.5640          4.4668957
## 314 59.1110          3.9471554
## 315 59.7325          3.2975709
## 316 60.2320          2.8350667
## 317 60.5985          2.5087135
## 318 60.8515          2.0292473
## 319 60.7965          2.1536488
## 320 60.4885          2.6273206
## 321 59.9580          3.0827099
## 322 59.5295          3.1917975
## 323 59.0145          3.5123322
## 324 58.5570          3.6363861
## 325 58.0345          3.8581250
## 326 57.3880          3.9082900
## 327 56.9750          3.9151249
## 328 56.6485          3.8831065
## 329 56.3920          3.9242771
## 330 56.1725          3.9346993
## 331 56.1735          3.9349366
## 332 55.9390          3.7486877
## 333 55.9440          3.7544796
## 334 55.8760          3.6789863
## 335 55.8035          3.5635997
## 336 55.7430          3.4565224
## 337 55.7580          3.4848173
## 338 55.9840          3.8456294
## 339 56.3345          4.1346512
## 340 56.6610          4.2036697
## 341 57.0815          4.1956331
## 342 57.4150          4.2609527
## 343 57.8155          4.1129144
## 344 58.2395          4.0585689
## 345 58.7930          3.8491365
## 346 59.4495          3.5510088
```

```
## 347 59.9785          3.3185301
## 348 60.3970          3.0280057
## 349 60.7390          2.5380031
## 350 61.1580          1.9821158
## 351 61.4630          1.7788638
## 352 61.8125          1.4270863
## 353 61.9530          1.3895167
## 354 62.3130          1.5486697
## 355 62.6660          1.9000258
## 356 62.9960          2.1631684
## 357 63.2010          2.2675393
## 358 63.3950          2.4686378
## 359 63.6625          2.6804080
## 360 64.0155          2.7204498
## 361 64.3900          2.7979220
## 362 64.7745          2.8880030
## 363 65.0235          2.6751394
## 364 65.0330          2.6632886
## 365 65.1920          2.6065981
## 366 65.2270          2.5956990
## 367 65.2460          2.5842974
## 368 65.2555          2.5731455
## 369 65.2705          2.5428194
## 370 65.1215          2.8008724
## 371 64.9420          3.0375567
## 372 64.8785          3.0800648
## 373 64.9015          3.0664362
## 374 64.7325          3.0755309
## 375 65.2485          4.2371379
## 376 65.6810          4.8886912
## 377 66.0685          5.2289711
## 378 66.4980          5.6911527
## 379 66.8370          5.9882808
## 380 67.1750          6.2233443
## 381 67.4255          6.3779706
## 382 67.6415          6.5080638
## 383 68.2300          6.7948454
## 384 68.9980          6.9158371
## 385 69.5065          7.0418329
## 386 70.1745          7.2027081
## 387 70.7670          7.1509360
## 388 71.4700          6.9814401
## 389 72.2080          6.5260608
## 390 72.9735          5.7899162
## 391 73.6165          4.8643131
## 392 74.0905          4.1100274
## 393 74.5190          3.3032697
## 394 74.9135          2.1053379
## 395 74.6510          2.0301365
## 396 74.6100          2.0027514
## 397 74.6430          1.9970804
## 398 74.5695          1.9651053
## 399 74.4040          2.0705850
## 400 74.3390          2.0903666
```

```
## 401 74.3895          2.0812108
## 402 74.5260          2.1009485
## 403 74.3895          2.0259360
## 404 74.2195          1.9062021
## 405 74.1745          1.8727846
## 406 74.0915          1.7176829
## 407 74.0080          1.6701924
## 408 73.9125          1.5699979
## 409 73.8745          1.5446596
## 410 73.7065          1.6391403
## 411 73.6500          1.7033125
## 412 73.7405          1.6475769
## 413 73.7665          1.6219032
## 414 73.9615          1.4825234
## 415 73.9120          1.5415114
## 416 73.9415          1.5786972
## 417 74.1400          1.8889281
## 418 74.3740          2.2212874
## 419 74.9490          2.8636906
## 420 75.2970          3.0467724
## 421 75.2925          3.0480622
## 422 75.0750          3.1404583
## 423 75.0600          3.1457204
## 424 75.1265          3.1343901
## 425 74.9340          3.2533629
## 426 74.7800          3.2487257
## 427 74.7300          3.2669007
## 428 74.8130          3.2849960
## 429 74.8380          3.2843911
## 430 74.9515          3.1921650
## 431 75.1490          3.0750518
## 432 75.2155          3.0545587
## 433 75.4235          2.9996248
## 434 75.5525          3.0249587
## 435 75.7560          2.8880758
## 436 75.7730          2.8911444
## 437 75.6255          2.8135358
## 438 75.4125          2.6728730
## 439 74.0140          4.8576987
## 440 72.7350          6.3230177
## 441 71.7835          7.3967749
## 442 70.7965          8.6165243
## 443 69.8225          9.3228600
## 444 68.6890          9.9830071
## 445 67.8265         10.4844949
## 446 66.7660         10.9522571
## 447 65.7565         11.2609311
## 448 64.5555         11.3599628
## 449 63.4640         11.3523495
## 450 62.5325         11.2467652
## 451 61.5105         10.9542313
## 452 60.4070         10.6361342
## 453 59.2395         10.0244437
## 454 58.0575          9.1318286
```

```
## 455 57.0440          8.1287786
## 456 55.9780          6.7303712
## 457 54.9235          4.8852285
## 458 53.8415          1.1389527
## 459 53.6505          1.2266620
## 460 53.3885          1.5521000
## 461 53.1525          1.5901276
## 462 53.0345          1.7573624
## 463 52.8030          1.8707059
## 464 52.6165          2.0694789
## 465 52.2980          2.3232143
## 466 52.0510          2.5823372
## 467 51.7995          2.7318141
## 468 51.5260          2.9485084
## 469 51.2635          3.0270946
## 470 51.0385          2.9074470
## 471 50.9685          2.8273616
## 472 50.9425          2.8112033
## 473 50.8190          2.7563670
## 474 50.5410          2.7307683
## 475 50.1070          2.5818299
## 476 49.6720          2.4225297
## 477 49.1790          2.3783185
## 478 48.7700          2.3037450
## 479 48.4250          2.4157061
## 480 48.2670          2.4611317
## 481 48.0720          2.4147826
## 482 48.0230          2.3906861
## 483 47.9670          2.3607874
## 484 47.9100          2.3520921
## 485 47.8825          2.3589893
## 486 47.9210          2.3545743
## 487 47.8770          2.3629979
## 488 47.8670          2.3682575
## 489 47.6725          2.5186399
## 490 47.2190          2.8022749
## 491 46.6320          2.6610139
## 492 46.0820          2.5492298
## 493 45.6265          2.4707661
## 494 45.3850          2.4481041
## 495 45.1790          2.4913022
## 496 44.7775          2.8965690
## 497 44.4445          3.2653059
## 498 43.9650          3.7956708
## 499 43.4965          4.2834786
## 500 42.9410          4.6341200
## 501 42.2085          5.1284962
## 502 41.3645          5.3897459
## 503 40.4655          5.6074540
## 504 39.5115          5.9241756
## 505 38.5735          6.1470673
## 506 37.6930          5.9801904
## 507 36.9685          5.6585600
## 508 36.3220          5.2233302
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## 509 35.7240          4.9730567
## 510 34.8825          5.3816601
## 511 34.7440          5.2310517
## 512 34.5700          5.0542929
## 513 34.3625          4.8257590
## 514 34.2110          4.5709093
## 515 34.1055          4.3844842
## 516 34.1610          4.4480051
## 517 34.2400          4.5337299
## 518 34.5265          4.8038487
## 519 34.7745          4.9578588
## 520 34.9975          5.0671605
## 521 35.2920          5.0622791
## 522 35.5455          5.0048266
## 523 35.8615          4.8780392
## 524 36.3715          4.6079191
## 525 36.9140          4.2309030
## 526 37.3900          3.9905374
## 527 37.6550          3.8240162
## 528 37.8405          3.7082546
## 529 38.0200          3.4949843
## 530 38.4495          1.9181747
## 531 38.0150          2.6521621
## 532 37.6820          3.0571860
## 533 37.4880          3.1857391
## 534 37.0610          3.3594126
## 535 36.5325          3.5933331
## 536 35.9580          3.9919955
## 537 35.4560          4.1359343
## 538 35.0125          3.9321709
## 539 34.7105          3.7561537
## 540 34.5380          3.6031415
## 541 34.3960          3.5139669
## 542 34.3645          3.4933858
## 543 34.3095          3.4585252
## 544 34.2205          3.3575016
## 545 34.0330          3.1670310
## 546 33.8475          2.9002504
## 547 33.8490          2.9024308
## 548 33.8225          2.8708388
## 549 33.8390          2.8828787
## 550 34.0540          2.9826948
## 551 34.5100          3.0617883
## 552 34.8615          3.0677341
## 553 35.0010          3.0746072
## 554 35.2265          2.9869881
## 555 35.5075          2.7274546
## 556 35.8275          2.1045959
## 557 36.0270          1.6128790
## 558 36.1330          1.4326237
## 559 36.0940          1.5034710
## 560 35.9260          1.6906069
## 561 35.8490          1.7604780
## 562 35.5750          2.0917116
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## 563 35.2520          2.5008874
## 564 34.8875          2.7444334
## 565 34.6130          2.9568139
## 566 34.2360          3.2096636
## 567 33.6970          3.4624741
## 568 33.2955          3.5434603
## 569 32.9190          3.6407979
## 570 32.5255          3.5564567
## 571 32.0050          3.2556923
## 572 31.6005          2.9246926
## 573 31.1405          2.8407921
## 574 30.5740          2.8973770
## 575 29.9600          3.0573624
## 576 29.3845          3.2545443
## 577 28.7980          3.5076648
## 578 28.2025          3.4672679
## 579 27.7805          3.3395549
## 580 27.3195          3.2690633
## 581 26.8650          2.9631110
## 582 26.4635          2.9515710
## 583 26.1525          2.9513491
## 584 25.8275          2.8904450
## 585 25.4555          2.8151573
## 586 24.6605          3.8925670
## 587 24.0140          4.4949578
## 588 23.3140          4.7892438
## 589 22.6700          4.9249045
## 590 21.8995          5.0016665
## 591 21.1495          5.0165604
## 592 20.3865          4.7260502
## 593 19.7475          4.6088883
## 594 19.2590          4.5491745
## 595 18.8535          4.5229442
## 596 18.4675          4.4896277
## 597 18.0805          4.5171271
## 598 17.6060          4.4969855
## 599 16.9695          4.3304230
## 600 16.3940          4.1906180
## 601 15.8270          3.7772088
## 602 15.3015          3.4861746
## 603 14.7625          3.0001856
## 604 14.2420          2.2600990
## 605 13.7725          1.1764034
## 606 13.8300          1.1537399
## 607 13.8570          1.1680983
## 608 13.8445          1.1586629
## 609 13.7520          1.0842781
## 610 13.7445          1.0821882
## 611 13.7045          1.0897294
## 612 13.6180          1.0580399
## 613 13.6125          1.0535448
## 614 13.5690          1.0034934
## 615 13.5600          0.9880283
## 616 13.5495          0.9709869
```

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## 617 13.5475          0.9698338
## 618 13.5855          0.9736825
## 619 13.6760          0.9019943
## 620 13.7390          0.8116319
## 621 13.7615          0.8020846
## 622 13.8465          0.7155364
## 623 13.9330          0.6339276
## 624 14.0660          0.6726100
## 625 14.2295          0.8047718
## 626 14.0305          1.2493850
## 627 13.7930          1.5343852
## 628 13.5465          1.7808847
## 629 13.3375          1.9910877
## 630 13.1230          2.1455832
## 631 12.9605          2.2647864
## 632 12.7790          2.3891529
## 633 12.5535          2.4423355
## 634 12.3555          2.4554847
## 635 12.1130          2.4092303
## 636 11.8740          2.3482589
## 637 11.6915          2.3109653
## 638 11.4975          2.2658561
## 639 11.3345          2.2056900
## 640 11.2315          2.1631538
## 641 11.1300          2.0900919
## 642 11.0460          2.0040496
## 643 10.9690          1.9056810
## 644 10.7980          1.6067607
## 645 10.6085          1.0415994
## 646 10.6885          1.0505752
## 647 10.7415          1.0380208
## 648 10.7900          1.0055059
## 649 10.8555          0.9622150
## 650 10.9325          0.9231803
## 651 10.9720          0.8921565
## 652 11.0085          0.8441269
## 653 11.0155          0.8347169
## 654 11.0435          0.8194111
## 655 11.1130          0.8074267
## 656 11.1650          0.7770965
## 657 11.1830          0.7627243
## 658 11.2480          0.7254371
## 659 11.3460          0.7605635
## 660 11.4230          0.8116526
## 661 11.4745          0.8562616
## 662 11.4510          0.8404504
## 663 11.3965          0.7954759
## 664 11.3870          0.7878559
## 665 11.3240          0.7379160
## 666 11.3135          0.7358724
## 667 11.3190          0.7338930
## 668 11.3315          0.7230511
## 669 11.3115          0.7420617
## 670 11.2670          0.7744479
```

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## 671 11.2425          0.8016028
## 672 11.2515          0.7910504
## 673 11.2890          0.7455687
## 674 11.2545          0.7806305
## 675 11.1635          0.8373472
## 676 11.1015          0.8778699
## 677 11.1040          0.8769469
## 678 11.0910          0.8733113
## 679 11.0320          0.8084267
## 680 10.9325          0.7159820
## 681 10.8205          0.5987836
## 682 10.7475          0.5649767
## 683 10.6970          0.5367259
## 684 10.6310          0.4561152
## 685 10.5655          0.4489927
## 686 10.5275          0.4095296
## 687 10.5015          0.3857498
## 688 10.5020          0.3862315
## 689 10.5185          0.3913576
## 690 10.3905          0.7309797
## 691 10.2970          0.8663784
## 692 10.2545          0.8792310
## 693 10.1955          0.8831074
## 694 10.1640          0.8944766
## 695 10.1770          0.8910969
## 696 10.1735          0.8920484
## 697 10.1450          0.8793209
## 698 10.0620          0.8524306
## 699  9.9525          0.8182451
## 700  9.8765          0.8196615
## 701  9.8565          0.8107909
## 702  9.8550          0.8099350
## 703  9.8075          0.7972576
## 704  9.8150          0.8055694
## 705  9.8945          0.8970154
## 706  9.9295          0.9382878
## 707  9.9885          1.0165073
## 708  9.9990          1.0270136
## 709 10.0055          1.0326791
## 710 10.1435          0.8915880
## 711 10.2260          0.7826904
## 712 10.2415          0.7726460
## 713 10.2785          0.7568583
## 714 10.3095          0.7383515
## 715 10.2975          0.7442048
## 716 10.2930          0.7469383
## 717 10.2960          0.7468770
## 718 10.3625          0.7351396
## 719 10.4295          0.6786711
## 720 10.4775          0.6134877
## 721 10.4480          0.6502356
## 722 10.3990          0.6986822
## 723 10.3910          0.7096248
## 724 10.3270          0.7347187
```

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## 725 10.2210          0.6963582
## 726 10.1270          0.6708839
## 727 10.0150          0.5578577
## 728  9.8995          0.5669909
## 729  9.7770          0.5986836
## 730  9.6605          0.6690565
## 731  9.5730          0.7386410
## 732  9.5095          0.7623542
## 733  9.4275          0.7587793
## 734  9.3475          0.7596112
## 735  9.2835          0.7697865
## 736  9.2200          0.7755609
## 737  9.1450          0.7361314
## 738  9.0490          0.6144737
```