hw1.R

glib

Mon Jan 22 15:20:07 2018

```
x <- c(10.4, 5.6, 3.1, 6.4, 21.7)
x
```

```
## [1] 10.4  5.6  3.1  6.4 21.7
```

```
1/x
```

```
## [1] 0.09615385 0.17857143 0.32258065 0.15625000 0.04608295
```

```
y <- c(x, 0, x)
y
```

```
##  [1] 10.4  5.6  3.1  6.4 21.7  0.0 10.4  5.6  3.1  6.4 21.7
```

```
a <- c(1,2,3)
b <- c(10,20,30,40,50,60,70)
a+b
```

```
## Warning in a + b: longer object length is not a multiple of shorter object
## length
```

```
## [1] 11 22 33 41 52 63 71
```

```
a * b
```

```
## Warning in a * b: longer object length is not a multiple of shorter object
## length
```

```
## [1]  10  40  90  40 100 180  70
```

```
2*a + b
```

```
## Warning in 2 * a + b: longer object length is not a multiple of shorter
## object length
```

```
## [1] 12 24 36 42 54 66 72
```

```
c <- c(100,200)
c
```

```
## [1] 100 200
```

```
a
```

```
## [1] 1 2 3
```

```
b
```

```
## [1] 10 20 30 40 50 60 70
```

```
a+b+c
```

```
## Warning in a + b: longer object length is not a multiple of shorter object
## length
```

```
## Warning in a + b + c: longer object length is not a multiple of shorter
## object length
```

```
## [1] 111 222 133 241 152 263 171
```

```
mean(x)
```

```
## [1] 9.44
```

```
median(x)
```

```
## [1] 6.4
```

```
mean(a+b+c)
```

```
## Warning in a + b: longer object length is not a multiple of shorter object
## length
```

```
## Warning in a + b: longer object length is not a multiple of shorter object
## length
```

```
## [1] 184.7143
```

```
var(a+b+c)
```

```
## Warning in a + b: longer object length is not a multiple of shorter object
## length
```

```
## Warning in a + b: longer object length is not a multiple of shorter object
## length
```

```
## [1] 3342.238
```

```
sort(a+b+c)
```

```
## Warning in a + b: longer object length is not a multiple of shorter object
## length
```

```
## Warning in a + b: longer object length is not a multiple of shorter object
## length
```

```
## [1] 111 133 152 171 222 241 263
```

```
median(a+b+c)
```

```
## Warning in a + b: longer object length is not a multiple of shorter object
## length
```

```
## Warning in a + b: longer object length is not a multiple of shorter object
## length
```

```
## [1] 171
```

```
max(a+b+c)
```

```
## Warning in a + b: longer object length is not a multiple of shorter object
## length
```

```
## Warning in a + b: longer object length is not a multiple of shorter object
## length
```

```
## [1] 263
```

```
min(a+b+c)
```

```
## Warning in a + b: longer object length is not a multiple of shorter object
```

```
## length
```

```
## Warning in a + b: longer object length is not a multiple of shorter object
## length
```

```
## [1] 111
```

```
sqrt(-17+0i)
```

```
## [1] 0+4.123106i
```

```
sqrt(-17+1i)
```

```
## [1] 0.121215+4.124887i
```

```
1:30
```

```
##  [1]  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
## [24] 24 25 26 27 28 29 30
```

```
c(1:30)
```

```
##  [1]  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
## [24] 24 25 26 27 28 29 30
```

```
n <- 10
1:n-1
```

```
##  [1] 0 1 2 3 4 5 6 7 8 9
```

```
1:(n-1)
```

```
## [1] 1 2 3 4 5 6 7 8 9
```

```
seq(3,10,by=.1)
```

```
##  [1]  3.0  3.1  3.2  3.3  3.4  3.5  3.6  3.7  3.8  3.9  4.0  4.1  4.2  4.3
## [15]  4.4  4.5  4.6  4.7  4.8  4.9  5.0  5.1  5.2  5.3  5.4  5.5  5.6  5.7
## [29]  5.8  5.9  6.0  6.1  6.2  6.3  6.4  6.5  6.6  6.7  6.8  6.9  7.0  7.1
## [43]  7.2  7.3  7.4  7.5  7.6  7.7  7.8  7.9  8.0  8.1  8.2  8.3  8.4  8.5
## [57]  8.6  8.7  8.8  8.9  9.0  9.1  9.2  9.3  9.4  9.5  9.6  9.7  9.8  9.9
## [71] 10.0
```

```
seq(from=-1,length=10,by=2)
```

```
##  [1] -1  1  3  5  7  9 11 13 15 17
```

```
x
```

```
## [1] 10.4  5.6  3.1  6.4 21.7
```

```
x = c(1,2,3)
x
```

```
## [1] 1 2 3
```

```
rep(x,times=2)
```

```
## [1] 1 2 3 1 2 3
```

```
rep(x,each=3)
```

```
## [1] 1 1 1 2 2 2 3 3 3
```

```r
temp <- x > 2
temp
```

```
## [1] FALSE FALSE  TRUE
```

```r
x = c(4,5,6)
x
```

```
## [1] 4 5 6
```

```r
temp
```

```
## [1] FALSE FALSE  TRUE
```

```r
z <- c(1:3,NA)
z
```

```
## [1]  1  2  3 NA
```

```r
is.na(z)
```

```
## [1] FALSE FALSE FALSE  TRUE
```

```r
z[1]
```

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

```r
z[2]
```

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

```r
z[4] == NA
```

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

```r
z[4]
```

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

```r
z == NA
```

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

```r
1-2
```

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

```r
0/0
```

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

```r
1/0
```

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

```r
3/0
```

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

```r
labs <- paste(c("X","Y"), 1:10, sep="_")
labs
```

```
##  [1] "X_1"  "Y_2"  "X_3"  "Y_4"  "X_5"  "Y_6"  "X_7"  "Y_8"  "X_9"  "Y_10"
```

```r
x = c(1:3,NA)
x
```

```
## [1]  1  2  3 NA
```

```
x[!is.na(x)]
```

```
## [1] 1 2 3
```

```
x
```

```
## [1]  1  2  3 NA
```

```
x[is.na(x)] <- 0
x
```

```
## [1] 1 2 3 0
```

```
as.character(c(1:3))
```

```
## [1] "1" "2" "3"
```

```
e <- numeric()
e
```

```
## numeric(0)
```

```
e[3] <- 17
e
```

```
## [1] NA NA 17
```

```
e <- numeric()
e
```

```
## numeric(0)
```

```
length(e) <- 3
e
```

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

```
e <- c(1:5)
e
```

```
## [1] 1 2 3 4 5
```

```
length(e) <- 3
e
```

```
## [1] 1 2 3
```

```
factor(c(1,2,1,3,0,1,2,1,0,1))
```

```
##  [1] 1 2 1 3 0 1 2 1 0 1
## Levels: 0 1 2 3
```

```
x <- scan()
length(x)
```

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

```
sum(x)
```

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

```
mean(x)
```

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

```r
hw1 <- c(1:20)
hw2 <- c(20:1)
hw3 <- c(hw1,hw2)
hw3
```

```
##  [1]  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 20 19 18
## [24] 17 16 15 14 13 12 11 10  9  8  7  6  5  4  3  2  1
```

```r
hw3 <- c(hw1[1:19], hw2)
hw3
```

```
##  [1]  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 19 18 17
## [24] 16 15 14 13 12 11 10  9  8  7  6  5  4  3  2  1
```

```r
tmp <- c(4,6,3)
hw4 <- rep(tmp, times=10)
hw4
```

```
##  [1] 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3
```

```r
hw5 <- rep(tmp, c(10,20,30))
hw5
```

```
##  [1] 4 4 4 4 4 4 4 4 4 4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 3 3 3 3 3
## [36] 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
```

```r
x <- seq(from=3, to=6, by=.1)
x
```

```
##  [1] 3.0 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 4.0 4.1 4.2 4.3 4.4 4.5 4.6
## [18] 4.7 4.8 4.9 5.0 5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9 6.0
```

```r
e
```

```
## [1] 1 2 3
```

```r
exp(1)
```

```
## [1] 2.718282
```

```r
exp(x)
```

```
##  [1]  20.08554  22.19795  24.53253  27.11264  29.96410  33.11545  36.59823
##  [8]  40.44730  44.70118  49.40245  54.59815  60.34029  66.68633  73.69979
## [15]  81.45087  90.01713  99.48432 109.94717 121.51042 134.28978 148.41316
## [22] 164.02191 181.27224 200.33681 221.40642 244.69193 270.42641 298.86740
## [29] 330.29956 365.03747 403.42879
```

```r
hw6 <- exp(x)*cos(x)
hw6
```

```
##  [1] -19.884531 -22.178753 -24.490697 -26.773182 -28.969238 -31.011186
##  [7] -32.819775 -34.303360 -35.357194 -35.862834 -35.687732 -34.685042
## [13] -32.693695 -29.538816 -25.032529 -18.975233 -11.157417  -1.362099
## [19]  10.632038  25.046705  42.099201  61.996630  84.929067 111.061586
## [25] 140.525075 173.405776 209.733494 249.468441 292.486707 338.564378
## [31] 387.360340
```

```r
i = c(0.1,0.2)
j = c(3,1)
k = c(1:34)
```

```
hw7 = i^j^k
hw7
```

```
##  [1]  1e-03  2e-01  1e-27  2e-01 1e-243  2e-01  0e+00  2e-01  0e+00  2e-01
## [11]  0e+00  2e-01  0e+00  2e-01  0e+00  2e-01  0e+00  2e-01  0e+00  2e-01
## [21]  0e+00  2e-01  0e+00  2e-01  0e+00  2e-01  0e+00  2e-01  0e+00  2e-01
## [31]  0e+00  2e-01  0e+00  2e-01
```

```
hw7 = (i^j)^k
hw7
```

```
##  [1] 1.000000e-03 4.000000e-02 1.000000e-09 1.600000e-03 1.000000e-15
##  [6] 6.400000e-05 1.000000e-21 2.560000e-06 1.000000e-27 1.024000e-07
## [11] 1.000000e-33 4.096000e-09 1.000000e-39 1.638400e-10 1.000000e-45
## [16] 6.553600e-12 1.000000e-51 2.621440e-13 1.000000e-57 1.048576e-14
## [21] 1.000000e-63 4.194304e-16 1.000000e-69 1.677722e-17 1.000000e-75
## [26] 6.710886e-19 1.000000e-81 2.684355e-20 1.000000e-87 1.073742e-21
## [31] 1.000000e-93 4.294967e-23 1.000000e-99 1.717987e-24
```

```
i <- c(2)
j <- c(1:25)
hw8 = (i^j/j)
hw8
```

```
##  [1] 2.000000e+00 2.000000e+00 2.666667e+00 4.000000e+00 6.400000e+00
##  [6] 1.066667e+01 1.828571e+01 3.200000e+01 5.688889e+01 1.024000e+02
## [11] 1.861818e+02 3.413333e+02 6.301538e+02 1.170286e+03 2.184533e+03
## [16] 4.096000e+03 7.710118e+03 1.456356e+04 2.759411e+04 5.242880e+04
## [21] 9.986438e+04 1.906502e+05 3.647221e+05 6.990507e+05 1.342177e+06
```

```
hw9 <- c(rep(tmp, times=10),4)
hw9
```

```
##  [1] 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4 6 3 4
```

```
i <- c(10:100)
hw10 <- sum(i^3+4*i^2)
hw10
```

```
## [1] 26852735
```

```
i <- c(1:25)
hw11 = sum(2^i/i+3^i/i^2)
hw11
```

```
## [1] 2129170437
```

```
hw12 = paste(c("label"),c(1:30),sep=" ")
hw12
```

```
##  [1] "label 1"  "label 2"  "label 3"  "label 4"  "label 5"  "label 6"
##  [7] "label 7"  "label 8"  "label 9"  "label 10" "label 11" "label 12"
## [13] "label 13" "label 14" "label 15" "label 16" "label 17" "label 18"
## [19] "label 19" "label 20" "label 21" "label 22" "label 23" "label 24"
## [25] "label 25" "label 26" "label 27" "label 28" "label 29" "label 30"
```

```
hw12 = paste(c("fn"),c(1:30),sep="")
hw12 = paste(c("label"),c(1:30),sep=" ")
hw13 = paste(c("fn"),c(1:30),sep="")
xVec <- sample(0:999,250,replace=T)
```

```
yVec <- sample(0:999,250,replace=T)
xVec
```

```
##   [1] 697 244 459 470 723 517 371  82 211   7 704 224  80 920 440 786 426
##  [18] 948 179 190 256 511 475  33 341 671 214 672 764 845 375 293 930 938
##  [35] 449 876 516 786 861 451 211 991 521  82 520 983 457 825 304 782 165
##  [52] 208 833 591 131 966 733 569  52 961 396 113 429 670 777 484 177 901
##  [69] 974 872 356 440  52 404 505 474 732 790 629 140 598 600 885 331 868
##  [86] 662 789 807 303 391 736 811 504 901 563 333 989 463 900 876 691 881
## [103] 837 554 503 215 665 206 446 916 891 105 840 371 710 965 836 506 962
## [120] 477  45 909 392  87 374  80 862 994  88 945 139 908 954 211 565 616
## [137] 784 945  12 204 340 410 743 240 946 254  49  61 172 405 468 664 680
## [154] 692 147 961 708 576 781 405  87 427 154 117 418 884 733   3 526 221
## [171] 886 636 746 911 550 432 552 230 815  14 869 490 827 188 503 694 462
## [188] 207 494 893  61 715 325 609 219 975 965  69 490 955 574 980 519 984
## [205] 339 691 396 328 662 580 977 941 268 694 338 919 324 163 875 560 886
## [222] 492 220 403 701 738 561 570 233  74 345 116 607 582 787 739  70 124
## [239] 808 450 544 490 469 875 732 640 733 593 588 696
```

```
yVec
```

```
##   [1] 450 284 945 891 193 109 920 504 718 828 808 160  19 804 136 821 672
##  [18] 127 657 561 709 321 437 305 389 617  28 950 525 169  99 756  30 725
##  [35] 152 930 464 635 289 702  37 541 663 642 971 390 853 464  39 287 601
##  [52] 462 318 662 888 901 215 944 186 213 964 739 886  21 945 451  36 537
##  [69] 796 652 978   8 987  31 439 735 907 920 559 620 612 422 320 920 849
##  [86] 645   9 102 234 299 492 356 526  51 150 589   5 549  66 552  26 606
## [103] 206 130 276 881 865 755  63 240 382 708 745 485  21 220 520 568 825
## [120] 706  95 896 473  50 422 492 135 756  96 656 906 144 537 586 363 268
## [137] 968 893 855 476  36 910 417 194 134 190 870 717 152 879 532 244 560
## [154] 489 468 539 557 859 720 759 538 688 474 379 438 804 215 243 592 468
## [171] 642 210 314  79 955  82  44 710 817 920 417 429 725 417 348 315 131
## [188] 538 522 543 947 805 829 465  76 452 454 897 424 862 258 598 942 657
## [205] 771 668 933 109 667 336 607 829 505 132 267 118 146 882 865 444 487
## [222]  43 230 590 572 773 129 845 171  23 321 308 799 548 593 404 798 894
## [239] 686 399 901 541 996 407 931 823 976  16 882 640
```

```
hw14 <- y[-1]-x[-length(x)]
hw14
```

```
##  [1]  2.6  0.0  3.2 18.4 -3.4  6.9  2.0 -0.6  2.6 17.8  1.6 -1.0  2.2 17.4
## [15] -4.4  5.9  1.0 -1.6  1.6 16.8  0.6 -2.0  1.2 16.4 -5.4  4.9  0.0 -2.6
## [29]  0.6 15.8
```

```
x[-length(x)]
```

```
##  [1] 3.0 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 4.0 4.1 4.2 4.3 4.4 4.5 4.6
## [18] 4.7 4.8 4.9 5.0 5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9
```

```
hw14 <- yVec[-1]-xVec[-length(x)]
hw14
```

```
##   [1] -413  701  432 -277 -614  403  133  636  617  801 -544 -205  724 -784
##  [15]  381 -114 -299 -291  382  519   65  -74 -170  356  276 -643  736 -147
##  [29] -595 -746  463 -900 -213 -297   54  -52 -151 -572  251 -174 -450  142
##  [43]  560  451 -593  396 -361 -265 -495  436  254 -515   71  757  -65 -518
##  [57]  375  134 -748  568  626  457 -649  168  -33 -141 -364 -178 -220  622
```

```
##  [71] -432  935 -373  -66  261  175  130  -70  480   14 -178 -565  589  -19
##  [85]  -17 -780 -705  -69  -92 -244 -455   22 -850 -413  256 -984   86 -834
##  [99] -324 -665 -275 -631 -424 -227  666  200  549 -383 -676 -509  603  -95
## [113]  114 -689 -745 -316   62 -137  229   50  -13   81  -37   48  412 -727
## [127] -238    8 -289  767 -764 -417  375 -202 -348  184  -52  843  272 -304
## [141]  500 -326  -46 -812  -64  821  656  -20  474   64 -420 -120 -203  321
## [155] -422 -151  283  -61  354  451  261  320  262   20  -80 -518  240   66
## [169]  247 -244 -426 -432 -832  405 -350 -508  480    2  906 -452  -61 -102
## [183]  229 -155 -379 -331  331   28 -350  886   90  504 -144 -143 -523 -511
## [197]  828  -66  -93 -316 -382  423 -327  432  -23  537 -219    5 -244 -370
## [211] -112  237 -562  -71 -801 -178  719  -10 -116 -399 -449   10  187 -129
## [225]   35 -432  275  -62  -51  -24  192  192  -34 -194 -335  728  770 -122
## [239]  -51  357   51  527 -468  199  183  243 -577  294  -56
```

```
hw15 <- sin(yVec[-length(yVec)])/cos(xVec[-1])
hw14 <- yVec[-1]-xVec[-length(xVec)]
hw14
```

```
##   [1] -413  701  432 -277 -614  403  133  636  617  801 -544 -205  724 -784
##  [15]  381 -114 -299 -291  382  519   65  -74 -170  356  276 -643  736 -147
##  [29] -595 -746  381 -263 -205 -786  481 -412  119 -497 -159 -414  330 -328
##  [43]  121  889 -130 -130    7 -786  -17 -181  297  110 -171  297  770 -751
##  [57]  211 -383  161    3  343  773 -408  275 -326 -448  360 -105 -322  106
##  [71] -348  547  -21   35  230  433  188 -231   -9  472 -176 -280   35  518
##  [85] -223 -653 -687 -573   -4  101 -380 -285 -453 -751   26 -328 -440 -397
##  [99] -348 -850  -85 -675 -707 -278  378  650   90 -143 -206 -534 -183  640
## [113] -355 -350 -490 -445 -268  319 -256 -382  851 -436 -342  335  118   55
## [127] -106 -898  568  -39    5 -371 -368  152 -297  352  109  -90  464 -168
## [141]  570    7 -549 -106 -756  616  668   91  707  127 -224 -104 -191 -224
## [155]  392 -404  151  144  -22  133  601   47  225  321  386 -669 -490  589
## [169]  -58  421 -676 -322 -667   44 -468 -388  158  587  105  403 -440  235
## [183] -410  160 -188 -563   76  315   49   54  744  114  140 -533  233 -521
## [197]  -68  355  372 -697   24  -38  138 -213  329  242 -287  339 -326   27
## [211] -148 -436 -136 -427 -220 -773  558  702 -431  -73 -843 -262  370  169
## [225]   72 -609  284 -399 -210  247  -37  683  -59   11 -383   59  824  562
## [239] -409  451   -3  506  -62   56   91  336 -717  289   52
```

```
hw15
```

```
##   [1] -1.359578e+00  1.004442e+00  1.781674e+00 -1.031968e+00  4.738019e+00
##   [6]  8.528606e-01  4.924463e-01 -1.118837e+00  1.312305e+00 -1.022692e+00
##  [11]  9.815930e-01 -1.987777e+00 -1.695624e-01 -2.490864e-01 -9.589177e-01
##  [16] -2.797534e+00 -4.091792e-01 -9.750716e-01 -5.971939e+00 -2.449401e+01
##  [21]  1.783922e+00 -6.498796e-01  2.359444e+01  1.918619e+00 -1.983708e+00
##  [26]  1.017806e+00  2.836438e-01 -1.140109e+00  3.480375e-01  1.475293e+00
##  [31]  1.483637e+00  9.053113e-01  4.250566e+00 -6.707213e-01 -1.066057e+00
##  [36]  1.242829e-01 -9.908140e-01  3.960180e-01 -1.469633e-01  1.135725e+00
##  [41]  3.749605e+00  6.876823e-01 -1.301841e-01  1.353013e+01  2.583322e-01
##  [46] -4.216502e+00  3.063650e+00  1.100449e+00 -9.964120e-01  1.353606e+01
##  [51] -1.029831e+00  2.081347e-01 -6.931574e-01  1.314968e+00 -2.208746e+01
##  [56] -1.116517e+00 -1.052104e+00 -6.128074e+00 -6.357860e-01 -5.953105e-01
##  [61]  4.540945e-01  3.864282e+00 -1.061825e-01 -1.616044e+00  5.917213e-01
##  [66] -2.051642e+00  1.233818e+00  2.119474e-01 -4.471173e+00  1.837697e+00
##  [71] -8.349180e-01 -6.070026e+00 -1.709979e+00  5.777973e-01  7.896431e-01
##  [76]  1.322972e-01 -7.212804e+00  6.021585e-01  1.021623e+00 -1.960942e+00
##  [81] -5.738929e-01  1.429389e+00  1.009439e+00  7.723877e-01 -1.087369e+00
```

```
##  [86]  9.228952e-01 -4.454514e-01  6.104691e+00  7.807294e+00 -8.063042e-01
##  [91]  1.056646e+00 -3.761483e+00  1.214931e+00 -8.450756e-01 -7.149042e-01
##  [96]  1.211596e+00  2.553851e+00  1.060226e+01  3.032724e-02 -8.048716e-01
## [101]  3.546018e+00  1.384265e+00 -2.066675e+00 -9.884060e-01 -2.245306e+00
## [106]  1.858876e+00 -3.902847e+00  8.557525e-01  7.476941e-01  2.694698e+00
## [111]  3.969003e+00  2.476131e+00 -4.471746e-01  9.301170e-01 -9.702908e-01
## [116]  9.364625e-02  1.018836e+00  7.514259e-01  1.090719e+00  1.440570e+00
## [121] -1.448901e+00  7.865766e-01  1.723468e+00  2.653735e-01 -7.750312e+00
## [126]  2.625448e+00  2.860414e-01  9.023278e-01 -1.207992e+00  7.782270e-01
## [131] -9.425444e-01 -9.769192e-01 -2.419283e-01  1.126475e+00 -1.020537e+00
## [136] -4.784321e+00 -4.663176e-01  8.398645e-01 -4.776570e-01 -1.314802e+00
## [141]  4.476164e+01  6.547694e+01  2.268885e+00  7.565250e-01 -9.931687e-01
## [146]  3.319441e+00 -8.499227e-01 -9.312325e-01 -9.671976e-01  6.048128e-01
## [151]  2.030910e+00 -5.606886e+00  1.082765e+00  1.116972e+00  1.026003e-01
## [156]  2.347024e+00  1.738851e+00  3.153429e+00  5.638201e-01 -1.673952e+00
## [161] -7.326913e-01 -8.807925e-03 -5.128816e-01 -9.185245e-01  2.761155e+00
## [166]  4.602136e-01 -9.901546e-01  4.138119e+00  2.117204e+00  9.739640e-02
## [171]  5.231067e+00 -3.656796e+00 -1.588969e-01  4.552125e-01 -1.424032e+00
## [176]  5.172412e-01 -2.247304e-02 -2.502639e-04  1.351797e+00 -1.365241e+00
## [181]  7.420615e-01 -1.360588e+00  7.391609e-01  7.854918e-01 -6.859975e-01
## [186] -7.581939e-01 -8.624569e-01  9.871279e-01  6.741113e-01 -1.842286e+00
## [191] -3.461051e+00 -4.430673e+00 -4.162946e-01  7.227361e-02  1.263654e+00
## [196]  4.402084e-01  1.005854e+00 -1.001080e+00  1.148669e-01 -1.523585e+00
## [201]  3.856547e-01 -1.107328e+00  5.920757e-01 -4.134841e-01 -9.771619e-01
## [206]  9.282542e-01  1.814155e-01 -1.275780e+00 -2.264364e+00 -1.499409e-01
## [211] -6.708958e+00  6.518018e-01 -7.464474e-01  1.928963e-01 -4.208015e-01
## [216]  1.073488e+00  1.065856e+00 -1.067240e+01 -1.249044e+00 -8.622493e-01
## [221]  1.589308e-01 -8.350438e-01 -9.624181e-01  6.372063e-01 -2.369683e-01
## [226] -7.480579e-01  9.783515e-01  1.018845e-01  5.687200e+00 -1.008500e+00
## [231] -5.445785e-01 -1.580211e-01 -1.241390e+00 -3.152742e+01 -9.219761e-01
## [236]  1.505945e+00 -3.821945e-01 -1.192026e+00 -1.240293e+00  2.025526e-02
## [241]  5.971948e-01 -9.718337e-01  1.730116e+00  9.866619e-01  1.398823e+00
## [246]  1.822920e-01 -1.187650e+00  3.321692e-01  5.180062e+00
```

```
length(xVec)
```

```
## [1] 250
```

```
length(xVec)-2
```

```
## [1] 248
```

```
c(1:length(xVec)-2)
```

```
##   [1]  -1   0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15
##  [18]  16  17  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32
##  [35]  33  34  35  36  37  38  39  40  41  42  43  44  45  46  47  48  49
##  [52]  50  51  52  53  54  55  56  57  58  59  60  61  62  63  64  65  66
##  [69]  67  68  69  70  71  72  73  74  75  76  77  78  79  80  81  82  83
##  [86]  84  85  86  87  88  89  90  91  92  93  94  95  96  97  98  99 100
## [103] 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117
## [120] 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134
## [137] 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151
## [154] 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168
## [171] 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185
## [188] 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202
```

```
## [205] 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219
## [222] 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236
## [239] 237 238 239 240 241 242 243 244 245 246 247 248
```

```
hw16 <- xVec[c(1:(length(xVec)-2))]+2*xVec[c(2:(length(xVec)-1))]-xVec[c(3:length(xVec))]
hw16
```

```
##   [1]  726  692  676 1399 1386 1177  324  497 -479 1191 1072 -536 1480 1014
##  [15] 1586  690 2143 1116  303  191  803 1428  200   44 1469  427  794 1355
##  [29] 2079 1302   31 1215 2357  960 1685 1122 1227 2057 1552 -118 1672 1951
##  [43]  165  139 2029 1072 1803  651 1703  904 -252 1283 1884 -113 1330 1863
##  [57] 1819 -288 1578 1640  193  301  992 1740 1568  -63 1005 1977 2362 1144
##  [71] 1184  140  355  940  721 1148 1683 1908  311  736  913 2039  679 1405
##  [85] 1403 1433 2100 1022  349 1052 1854  918 1743 1694  240 1848 1015 1387
##  [99] 1961 1377 1616 2001 1442 1345  268 1339  631  182 1387 2593  261 1414
## [113]  872  826 1804 2131  886 1953 1871 -342 1471 1606  192  755 -328  810
## [127] 2762  225 1839  315 1001 2605  811  725 1013 1239 2662  765   80  474
## [141]  417 1656  277 1878 1405  291   -1    0  514  677 1116 1332 1917   25
## [155] 1361 1801 1079 1733 1504  152  787  618  -30   69 1453 2347  213  834
## [169]   82 1357 1412 1217 2018 1579  862 1306  197 1846  -26 1262 1022 1956
## [183]  700  500 1429 1411  382  302 2219  300 1166  756 1324   72 1204 2836
## [197]  613   94 1826 1123 2015 1034 2148  971 1325 1155  390 1072  845 1593
## [211] 2591  783 1318  451 1852 1404 -225 1353 1109 1840 1650  529  325 1067
## [225] 1616 1290 1468  962   36  648  -30  748  984 1417 2195  755 -490 1290
## [239] 1164 1048 1055  553 1487 1699 1279 1513 1331 1073
```

```
hw17 = sum(exp(-xVec[c(2:length(xVec))])/(xVec[c(1:(length(xVec)-1))]+10)
)
hw17
```

```
## [1] 7.114177e-05
```

```
hw18 <- yVec[yVec>600]
hw18
```

```
##   [1] 945 891 920 718 828 808 804 821 672 657 709 617 950 756 725 930 635
##  [18] 702 663 642 971 853 601 662 888 901 944 964 739 886 945 796 652 978
##  [35] 987 735 907 920 620 612 920 849 645 606 881 865 755 708 745 825 706
##  [52] 896 756 656 906 968 893 855 910 870 717 879 859 720 759 688 804 642
##  [69] 955 710 817 920 725 947 805 829 897 862 942 657 771 668 933 667 607
##  [86] 829 882 865 773 845 799 798 894 686 901 996 931 823 976 882 640
```

```
yVec
```

```
##   [1] 450 284 945 891 193 109 920 504 718 828 808 160  19 804 136 821 672
##  [18] 127 657 561 709 321 437 305 389 617  28 950 525 169  99 756  30 725
##  [35] 152 930 464 635 289 702  37 541 663 642 971 390 853 464  39 287 601
##  [52] 462 318 662 888 901 215 944 186 213 964 739 886  21 945 451  36 537
##  [69] 796 652 978   8 987  31 439 735 907 920 559 620 612 422 320 920 849
##  [86] 645   9 102 234 299 492 356 526  51 150 589   5 549  66 552  26 606
## [103] 206 130 276 881 865 755  63 240 382 708 745 485  21 220 520 568 825
## [120] 706  95 896 473  50 422 492 135 756  96 656 906 144 537 586 363 268
## [137] 968 893 855 476  36 910 417 194 134 190 870 717 152 879 532 244 560
## [154] 489 468 539 557 859 720 759 538 688 474 379 438 804 215 243 592 468
## [171] 642 210 314  79 955  82  44 710 817 920 417 429 725 417 348 315 131
## [188] 538 522 543 947 805 829 465  76 452 454 897 424 862 258 598 942 657
## [205] 771 668 933 109 667 336 607 829 505 132 267 118 146 882 865 444 487
```

```
## [222]  43 230 590 572 773 129 845 171  23 321 308 799 548 593 404 798 894
## [239] 686 399 901 541 996 407 931 823 976  16 882 640
```

```
?order()
hw19 <- c(1:length(yVec))[yVec>600]
hw19
```

```
##   [1]   3   4   7   9  10  11  14  16  17  19  21  26  28  32  34  36  38
##  [18]  40  43  44  45  47  51  54  55  56  58  61  62  63  65  69  70  71
##  [35]  73  76  77  78  80  81  84  85  86 102 106 107 108 112 113 119 120
##  [52] 122 128 130 131 137 138 139 142 147 148 150 158 159 160 162 166 171
##  [69] 175 178 179 180 183 191 192 193 198 200 203 204 205 206 207 209 211
##  [86] 212 218 219 226 228 233 237 238 239 241 243 245 246 247 249 250
```

```
hw20 = xVec[hw19]
xVec
```

```
##   [1] 697 244 459 470 723 517 371  82 211   7 704 224  80 920 440 786 426
##  [18] 948 179 190 256 511 475  33 341 671 214 672 764 845 375 293 930 938
##  [35] 449 876 516 786 861 451 211 991 521  82 520 983 457 825 304 782 165
##  [52] 208 833 591 131 966 733 569  52 961 396 113 429 670 777 484 177 901
##  [69] 974 872 356 440  52 404 505 474 732 790 629 140 598 600 885 331 868
##  [86] 662 789 807 303 391 736 811 504 901 563 333 989 463 900 876 691 881
## [103] 837 554 503 215 665 206 446 916 891 105 840 371 710 965 836 506 962
## [120] 477  45 909 392  87 374  80 862 994  88 945 139 908 954 211 565 616
## [137] 784 945  12 204 340 410 743 240 946 254  49  61 172 405 468 664 680
## [154] 692 147 961 708 576 781 405  87 427 154 117 418 884 733   3 526 221
## [171] 886 636 746 911 550 432 552 230 815  14 869 490 827 188 503 694 462
## [188] 207 494 893  61 715 325 609 219 975 965  69 490 955 574 980 519 984
## [205] 339 691 396 328 662 580 977 941 268 694 338 919 324 163 875 560 886
## [222] 492 220 403 701 738 561 570 233  74 345 116 607 582 787 739  70 124
## [239] 808 450 544 490 469 875 732 640 733 593 588 696
```

```
hw20
```

```
##   [1] 459 470 371 211   7 704 920 786 426 179 256 671 672 293 938 876 786
##  [18] 451 521  82 520 457 165 591 131 966 569 396 113 429 777 974 872 356
##  [35]  52 474 732 790 140 598 331 868 662 881 215 665 206 105 840 962 477
##  [52] 909 994 945 139 784 945  12 410  49  61 405 576 781 405 427 884 886
##  [69] 550 230 815  14 827  61 715 325  69 955 519 984 339 691 396 662 977
##  [86] 941 163 875 738 570 607  70 124 808 544 469 732 640 733 588 696
```

```
hw21 = abs(xVec-mean(xVec))^0.5
hw21
```

```
##   [1] 12.503120 17.224169  9.037256  8.406664 13.502889  4.865388 13.025821
##   [8] 21.416629 18.156872 23.101342 12.779984 17.795280 21.463271 19.476345
##  [15] 10.033544 15.662950 10.708501 20.182369 19.017676 18.726238 16.872226
##  [22]  5.447201  8.103826 22.531578 14.130534 11.416129 18.074070 11.459843
##  [29] 14.944163 17.444999 12.871364 15.737598 19.731396 19.933088  9.574550
##  [36] 18.311963  4.967092 15.662950 17.897709  9.469530 18.156872 21.220933
##  [43]  4.435313 21.416629  4.546647 21.031595  9.147240 16.862028 15.384148
##  [50] 15.534735 19.382260 18.239298 17.097602  7.094223 20.240356 20.623482
##  [57] 13.868237  5.322405 22.105927 20.501902 12.027967 20.680232 10.567497
##  [64] 11.372247 15.372963  7.528081 19.070186 18.982308 20.816532 18.202417
##  [71] 13.589408 10.033544 22.105927 11.690680  5.972604  8.165292 13.832136
##  [78] 15.790123  9.398298 20.016793  7.571526  7.702467 18.556077 14.480055
##  [85] 18.092208 11.014899 15.758426 16.319559 15.416614 12.234051 13.975979
```

```
##  [92] 16.441654  6.055741 18.982308  4.725251 14.410829 21.173757  8.813172
##  [99] 18.955949 18.311963 12.260832 18.447981 17.214180  3.650753  6.137752
## [106] 18.046385 11.150247 18.294043  9.729954 19.373384 18.717051 20.872757
## [113] 17.301098 13.025821 13.012609 20.599223 17.185110  5.888293 20.526276
## [120]  7.979474 22.263692 19.191873 12.193113 21.299577 12.910151 21.463271
## [127] 17.925624 21.291501 21.276090 20.107909 20.041756 19.165803 20.330470
## [134] 18.156872  4.932342  8.679170 15.598974 20.107909 22.992868 18.348624
## [141] 14.165874 11.431185 14.224205 17.339896 20.132759 16.931391 22.173678
## [148] 21.901415 19.200833 11.647832  8.524787 11.105314 11.803728 12.301545
## [155] 19.841169 20.501902 12.935532  5.943736 15.502516 11.647832 21.299577
## [162] 10.661707 19.663977 20.583294 11.075739 18.529112 13.868237 23.187755
## [169]  3.830405 17.879374 18.583003  9.763606 14.329271 19.243908  3.054177
## [176] 10.424586  3.365709 17.625890 16.562850 22.949336 18.119823  7.118427
## [183] 16.921229 18.779563  6.137752 12.382568  8.869724 18.266691  6.831691
## [190] 18.770402 21.901415 13.203333 14.685775  8.266075 17.935217 20.840537
## [197] 20.599223 21.718011  7.118427 20.355049  5.773041 20.960153  4.655320
## [204] 21.055356 14.201127 12.260832 12.027967 14.583278 11.014899  6.271204
## [211] 20.888466 20.008198 16.512783 12.382568 14.236292 19.450656 14.719783
## [218] 19.433785 18.284638  4.396362 18.583003  6.976532 17.907317 11.733371
## [225] 12.662069 14.047349  4.508658  5.415533 17.540582 21.602592 13.988281
## [232] 20.607571  8.144200  6.428686 15.694840 14.082897 21.694976 20.412545
## [239] 16.350168  9.522185  1.824281  7.118427  8.465932 18.284638 13.832136
## [246]  9.966343 13.868237  7.233810  6.879535 12.463065
```

```
length(yVec[yVec>max(yVec)-200])
```

```
## [1] 59
```

```
hw22 = length(yVec[yVec>max(yVec)-200])
hw23 = length(xVec[xVec%%2==0])
1%%2
```

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

```
2%%2
```

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

```
2%%2==0
```

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

```
hw23
```

```
## [1] 130
```

```
?sort
order(c(3:1))
```

```
## [1] 3 2 1
```

```
order(c(1,3,2))
```

```
## [1] 1 3 2
```

```
hw25 = yVec[c(1:83)*3-2]
hw25
```

```
##  [1] 450 891 920 828  19 821 657 321 389 950  99 725 464 702 663 390  39
## [18] 462 888 944 964  21  36 652 987 735 559 422 849 102 492  51   5 552
## [35] 206 881  63 708  21 568  95  50 135 656 537 268 855 910 134 717 532
```

```
## [52] 489 557 759 474 804 592 210 955 710 417 417 131 543 829 452 424 598
## [69] 771 109 607 132 146 444 230 773 171 308 593 894 901 407 976
```

```
?cumprod
hw26 = sum(cumprod(seq(from=2,to=38,by=2)/seq(from=3,to=39,by=2)))+1
hw26
```

```
## [1] 6.976346
```

```
cumprod(seq(from=2,to=38,by=2)/seq(from=3,to=39,by=2))
```

```
##  [1] 0.6666667 0.5333333 0.4571429 0.4063492 0.3694084 0.3409923 0.3182595
##  [8] 0.2995384 0.2837732 0.2702602 0.2585097 0.2481694 0.2389779 0.2307373
## [15] 0.2232941 0.2165276 0.2103411 0.2046562 0.1994087
```