clpdf.r

denis

2021-07-12

```
#!/usr/bin/r

# An L p norm is also called a p-norm, or 1-norm, 2-norm, or -norm in those
# special cases.
# It is easy to see that, for any n-vector x, the L p norms have the relation-
#  ships
# (2.12)
# x   x 2  x 1 .
q <- 19
pnorm(q, mean = 0, sd = 1, lower.tail = TRUE, log.p = FALSE)
```

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

```
q + sin(q)
```

```
## [1] 19.14988
```

```
# More generally, for given x and for p  1, we see that x p is a nonincreasing
# function of p.
# We also have bounds that involve the number of elements in the vector:
#
# (2.13)
# x   x 2  nx
p = 16
p > 1
```

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

```
p + sin(p) + c(0:999)
```

```
##    [1]   15.7121   16.7121   17.7121   18.7121   19.7121   20.7121   21.7121
##    [8]   22.7121   23.7121   24.7121   25.7121   26.7121   27.7121   28.7121
##   [15]   29.7121   30.7121   31.7121   32.7121   33.7121   34.7121   35.7121
##   [22]   36.7121   37.7121   38.7121   39.7121   40.7121   41.7121   42.7121
##   [29]   43.7121   44.7121   45.7121   46.7121   47.7121   48.7121   49.7121
##   [36]   50.7121   51.7121   52.7121   53.7121   54.7121   55.7121   56.7121
##   [43]   57.7121   58.7121   59.7121   60.7121   61.7121   62.7121   63.7121
##   [50]   64.7121   65.7121   66.7121   67.7121   68.7121   69.7121   70.7121
##   [57]   71.7121   72.7121   73.7121   74.7121   75.7121   76.7121   77.7121
##  [64]  78.7121  79.7121  80.7121  81.7121  82.7121  83.7121  84.7121
##  [71]  85.7121  86.7121  87.7121  88.7121  89.7121  90.7121  91.7121
##  [78]  92.7121  93.7121  94.7121  95.7121  96.7121  97.7121  98.7121
##  [85]  99.7121 100.7121 101.7121 102.7121 103.7121 104.7121 105.7121
##  [92] 106.7121 107.7121 108.7121 109.7121 110.7121 111.7121 112.7121
##  [99] 113.7121 114.7121 115.7121 116.7121 117.7121 118.7121 119.7121
## [106] 120.7121 121.7121 122.7121 123.7121 124.7121 125.7121 126.7121
## [113] 127.7121 128.7121 129.7121 130.7121 131.7121 132.7121 133.7121
## [120] 134.7121 135.7121 136.7121 137.7121 138.7121 139.7121 140.7121
## [127] 141.7121 142.7121 143.7121 144.7121 145.7121 146.7121 147.7121
## [134] 148.7121 149.7121 150.7121 151.7121 152.7121 153.7121 154.7121
## [141] 155.7121 156.7121 157.7121 158.7121 159.7121 160.7121 161.7121
## [148] 162.7121 163.7121 164.7121 165.7121 166.7121 167.7121 168.7121
## [155] 169.7121 170.7121 171.7121 172.7121 173.7121 174.7121 175.7121
## [162] 176.7121 177.7121 178.7121 179.7121 180.7121 181.7121 182.7121
## [169] 183.7121 184.7121 185.7121 186.7121 187.7121 188.7121 189.7121
## [176] 190.7121 191.7121 192.7121 193.7121 194.7121 195.7121 196.7121
## [183] 197.7121 198.7121 199.7121 200.7121 201.7121 202.7121 203.7121
## [190] 204.7121 205.7121 206.7121 207.7121 208.7121 209.7121 210.7121
## [197] 211.7121 212.7121 213.7121 214.7121 215.7121 216.7121 217.7121
## [204] 218.7121 219.7121 220.7121 221.7121 222.7121 223.7121 224.7121
## [211] 225.7121 226.7121 227.7121 228.7121 229.7121 230.7121 231.7121
## [218] 232.7121 233.7121 234.7121 235.7121 236.7121 237.7121 238.7121
## [225] 239.7121 240.7121 241.7121 242.7121 243.7121 244.7121 245.7121
## [232] 246.7121 247.7121 248.7121 249.7121 250.7121 251.7121 252.7121
## [239] 253.7121 254.7121 255.7121 256.7121 257.7121 258.7121 259.7121
## [246] 260.7121 261.7121 262.7121 263.7121 264.7121 265.7121 266.7121
## [253] 267.7121 268.7121 269.7121 270.7121 271.7121 272.7121 273.7121
## [260] 274.7121 275.7121 276.7121 277.7121 278.7121 279.7121 280.7121
## [267] 281.7121 282.7121 283.7121 284.7121 285.7121 286.7121 287.7121
## [274] 288.7121 289.7121 290.7121 291.7121 292.7121 293.7121 294.7121
## [281] 295.7121 296.7121 297.7121 298.7121 299.7121 300.7121 301.7121
## [288] 302.7121 303.7121 304.7121 305.7121 306.7121 307.7121 308.7121
## [295] 309.7121 310.7121 311.7121 312.7121 313.7121 314.7121 315.7121
## [302] 316.7121 317.7121 318.7121 319.7121 320.7121 321.7121 322.7121
## [309] 323.7121 324.7121 325.7121 326.7121 327.7121 328.7121 329.7121
## [316] 330.7121 331.7121 332.7121 333.7121 334.7121 335.7121 336.7121
## [323] 337.7121 338.7121 339.7121 340.7121 341.7121 342.7121 343.7121
## [330] 344.7121 345.7121 346.7121 347.7121 348.7121 349.7121 350.7121
## [337] 351.7121 352.7121 353.7121 354.7121 355.7121 356.7121 357.7121
## [344] 358.7121 359.7121 360.7121 361.7121 362.7121 363.7121 364.7121
## [351] 365.7121 366.7121 367.7121 368.7121 369.7121 370.7121 371.7121
## [358] 372.7121 373.7121 374.7121 375.7121 376.7121 377.7121 378.7121
## [365] 379.7121 380.7121 381.7121 382.7121 383.7121 384.7121 385.7121
## [372] 386.7121 387.7121 388.7121 389.7121 390.7121 391.7121 392.7121
## [379] 393.7121 394.7121 395.7121 396.7121 397.7121 398.7121 399.7121
## [386] 400.7121 401.7121 402.7121 403.7121 404.7121 405.7121 406.7121
## [393] 407.7121 408.7121 409.7121 410.7121 411.7121 412.7121 413.7121
## [400] 414.7121 415.7121 416.7121 417.7121 418.7121 419.7121 420.7121
## [407] 421.7121 422.7121 423.7121 424.7121 425.7121 426.7121 427.7121
## [414] 428.7121 429.7121 430.7121 431.7121 432.7121 433.7121 434.7121
## [421] 435.7121 436.7121 437.7121 438.7121 439.7121 440.7121 441.7121
## [428] 442.7121 443.7121 444.7121 445.7121 446.7121 447.7121 448.7121
## [435] 449.7121 450.7121 451.7121 452.7121 453.7121 454.7121 455.7121
##  [442]  456.7121  457.7121  458.7121  459.7121  460.7121  461.7121  462.7121
##  [449]  463.7121  464.7121  465.7121  466.7121  467.7121  468.7121  469.7121
##  [456]  470.7121  471.7121  472.7121  473.7121  474.7121  475.7121  476.7121
##  [463]  477.7121  478.7121  479.7121  480.7121  481.7121  482.7121  483.7121
##  [470]  484.7121  485.7121  486.7121  487.7121  488.7121  489.7121  490.7121
##  [477]  491.7121  492.7121  493.7121  494.7121  495.7121  496.7121  497.7121
##  [484]  498.7121  499.7121  500.7121  501.7121  502.7121  503.7121  504.7121
##  [491]  505.7121  506.7121  507.7121  508.7121  509.7121  510.7121  511.7121
##  [498]  512.7121  513.7121  514.7121  515.7121  516.7121  517.7121  518.7121
##  [505]  519.7121  520.7121  521.7121  522.7121  523.7121  524.7121  525.7121
##  [512]  526.7121  527.7121  528.7121  529.7121  530.7121  531.7121  532.7121
##  [519]  533.7121  534.7121  535.7121  536.7121  537.7121  538.7121  539.7121
##  [526]  540.7121  541.7121  542.7121  543.7121  544.7121  545.7121  546.7121
##  [533]  547.7121  548.7121  549.7121  550.7121  551.7121  552.7121  553.7121
##  [540]  554.7121  555.7121  556.7121  557.7121  558.7121  559.7121  560.7121
##  [547]  561.7121  562.7121  563.7121  564.7121  565.7121  566.7121  567.7121
##  [554]  568.7121  569.7121  570.7121  571.7121  572.7121  573.7121  574.7121
##  [561]  575.7121  576.7121  577.7121  578.7121  579.7121  580.7121  581.7121
##  [568]  582.7121  583.7121  584.7121  585.7121  586.7121  587.7121  588.7121
##  [575]  589.7121  590.7121  591.7121  592.7121  593.7121  594.7121  595.7121
##  [582]  596.7121  597.7121  598.7121  599.7121  600.7121  601.7121  602.7121
##  [589]  603.7121  604.7121  605.7121  606.7121  607.7121  608.7121  609.7121
##  [596]  610.7121  611.7121  612.7121  613.7121  614.7121  615.7121  616.7121
##  [603]  617.7121  618.7121  619.7121  620.7121  621.7121  622.7121  623.7121
##  [610]  624.7121  625.7121  626.7121  627.7121  628.7121  629.7121  630.7121
##  [617]  631.7121  632.7121  633.7121  634.7121  635.7121  636.7121  637.7121
##  [624]  638.7121  639.7121  640.7121  641.7121  642.7121  643.7121  644.7121
##  [631]  645.7121  646.7121  647.7121  648.7121  649.7121  650.7121  651.7121
##  [638]  652.7121  653.7121  654.7121  655.7121  656.7121  657.7121  658.7121
##  [645]  659.7121  660.7121  661.7121  662.7121  663.7121  664.7121  665.7121
##  [652]  666.7121  667.7121  668.7121  669.7121  670.7121  671.7121  672.7121
##  [659]  673.7121  674.7121  675.7121  676.7121  677.7121  678.7121  679.7121
##  [666]  680.7121  681.7121  682.7121  683.7121  684.7121  685.7121  686.7121
##  [673]  687.7121  688.7121  689.7121  690.7121  691.7121  692.7121  693.7121
##  [680]  694.7121  695.7121  696.7121  697.7121  698.7121  699.7121  700.7121
##  [687]  701.7121  702.7121  703.7121  704.7121  705.7121  706.7121  707.7121
##  [694]  708.7121  709.7121  710.7121  711.7121  712.7121  713.7121  714.7121
##  [701]  715.7121  716.7121  717.7121  718.7121  719.7121  720.7121  721.7121
##  [708]  722.7121  723.7121  724.7121  725.7121  726.7121  727.7121  728.7121
##  [715]  729.7121  730.7121  731.7121  732.7121  733.7121  734.7121  735.7121
##  [722]  736.7121  737.7121  738.7121  739.7121  740.7121  741.7121  742.7121
##  [729]  743.7121  744.7121  745.7121  746.7121  747.7121  748.7121  749.7121
##  [736]  750.7121  751.7121  752.7121  753.7121  754.7121  755.7121  756.7121
##  [743]  757.7121  758.7121  759.7121  760.7121  761.7121  762.7121  763.7121
##  [750]  764.7121  765.7121  766.7121  767.7121  768.7121  769.7121  770.7121
##  [757]  771.7121  772.7121  773.7121  774.7121  775.7121  776.7121  777.7121
##  [764]  778.7121  779.7121  780.7121  781.7121  782.7121  783.7121  784.7121
##  [771]  785.7121  786.7121  787.7121  788.7121  789.7121  790.7121  791.7121
##  [778]  792.7121  793.7121  794.7121  795.7121  796.7121  797.7121  798.7121
##  [785]  799.7121  800.7121  801.7121  802.7121  803.7121  804.7121  805.7121
##  [792]  806.7121  807.7121  808.7121  809.7121  810.7121  811.7121  812.7121
##  [799]  813.7121  814.7121  815.7121  816.7121  817.7121  818.7121  819.7121
##  [806]  820.7121  821.7121  822.7121  823.7121  824.7121  825.7121  826.7121
##  [813]  827.7121  828.7121  829.7121  830.7121  831.7121  832.7121  833.7121
##  [820]  834.7121  835.7121  836.7121  837.7121  838.7121  839.7121  840.7121
##  [827]  841.7121  842.7121  843.7121  844.7121  845.7121  846.7121  847.7121
##  [834]  848.7121  849.7121  850.7121  851.7121  852.7121  853.7121  854.7121
##  [841]  855.7121  856.7121  857.7121  858.7121  859.7121  860.7121  861.7121
##  [848]  862.7121  863.7121  864.7121  865.7121  866.7121  867.7121  868.7121
##  [855]  869.7121  870.7121  871.7121  872.7121  873.7121  874.7121  875.7121
##  [862]  876.7121  877.7121  878.7121  879.7121  880.7121  881.7121  882.7121
##  [869]  883.7121  884.7121  885.7121  886.7121  887.7121  888.7121  889.7121
##  [876]  890.7121  891.7121  892.7121  893.7121  894.7121  895.7121  896.7121
##  [883]  897.7121  898.7121  899.7121  900.7121  901.7121  902.7121  903.7121
##  [890]  904.7121  905.7121  906.7121  907.7121  908.7121  909.7121  910.7121
##  [897]  911.7121  912.7121  913.7121  914.7121  915.7121  916.7121  917.7121
##  [904]  918.7121  919.7121  920.7121  921.7121  922.7121  923.7121  924.7121
##  [911]  925.7121  926.7121  927.7121  928.7121  929.7121  930.7121  931.7121
##  [918]  932.7121  933.7121  934.7121  935.7121  936.7121  937.7121  938.7121
##  [925]  939.7121  940.7121  941.7121  942.7121  943.7121  944.7121  945.7121
##  [932]  946.7121  947.7121  948.7121  949.7121  950.7121  951.7121  952.7121
##  [939]  953.7121  954.7121  955.7121  956.7121  957.7121  958.7121  959.7121
##  [946]  960.7121  961.7121  962.7121  963.7121  964.7121  965.7121  966.7121
##  [953]  967.7121  968.7121  969.7121  970.7121  971.7121  972.7121  973.7121
##  [960]  974.7121  975.7121  976.7121  977.7121  978.7121  979.7121  980.7121
##  [967]  981.7121  982.7121  983.7121  984.7121  985.7121  986.7121  987.7121
##  [974]  988.7121  989.7121  990.7121  991.7121  992.7121  993.7121  994.7121
##  [981]  995.7121  996.7121  997.7121  998.7121  999.7121 1000.7121 1001.7121
##  [988] 1002.7121 1003.7121 1004.7121 1005.7121 1006.7121 1007.7121 1008.7121
##  [995] 1009.7121 1010.7121 1011.7121 1012.7121 1013.7121 1014.7121
```

```
# The triangle inequality obviously holds
# for the L 1 and L  norms. For the

# L 2 norm it can be seen by expanding (x i + y i ) 2 and then using the Cauchy-
#  Schwartz inequality (2.10) on page 16. Rather than approaching it that way,
# however, we will show below that the L 2 norm can be defined in terms of an
# inner product, and then we will establish the triangle inequality for any norm
# defined similarly by an inner product; see inequality (2.19). Showing that the
# triangle inequality holds for other L p norms is more difficult; see Exercise 2
# .6.
# A generalization of the L p vector norm is the weighted L p vector norm
# defined by
trigamma(p)
```

```
## [1] 0.06449378
```

```
# Basis Norms
# If {v 1 , . . . , v k } is a basis for a vector space that includes a
# vector x with
# x = c 1 v 1 + · · · + c k v k , then
baseenv()
```

```
## <environment: base>
```

```
variable.names(p, "output")
```

```
## NULL
```

```
for (p in q:999) {
  c(p)
}
p
```

```
## [1] 999
```

```
# is a norm. It is straightforward to see that (x) is a norm by checking the
# following three conditions:
p + sin(p)
```

```
## [1] 998.9735
```

```
# (x)  0 and (x) = 0 if and only if x = 0 because x = 0 if and only if
# c i = 0 for all i.
if (p > 1) {
   for (p in q:999 + sin(p)) {
     c(p)
   }
}
p
```

```
## [1] 998.9735
```

```
# (ax) =
# i a c i
# i a c i
# If y = b 1 v 1 + · · · + b k v k , then
p <- c(10, 5, 20, 5, 30, 5)
p + sin(p)
```

```
## [1]  9.455979  4.041076 20.912945  4.041076 29.011968  4.041076
```

```
# The last inequality is just the triangle inequality for the L 2 norm for the
# vectors (c 1 , · · · , c k ) and (b 1 , · · · , b k )
trigamma(p)
```

```
## [1] 0.10516634 0.22132296 0.05127082 0.22132296 0.03389506 0.22132296
```

```
# In Section 2.2.5, we will consider special forms of basis sets in which the
# norm in equation (2.16) is identically the L 2 norm. (This is called
# Parseval's
# identity, equation (2.38).)
p + sin(p)
```

```
## [1]  9.455979  4.041076 20.912945  4.041076 29.011968  4.041076
```

```
# Equivalence of Norms
# There is an equivalence among any two norms over a formed linear space in
# the sense that if   ·  a and   ·  b are norms, then there are positive numbers r
# and s such that for any x in the space,
# r x b  x a  s x b .
p + cos(p)
```

```
## [1]  9.160928  5.283662 20.408082  5.283662 30.154251  5.283662
```

```
# Expressions (2.13) and (2.14) are examples of this general equivalence for
# three L p norms.
Lp <- c(p, type = c("O", "I", "F", "M", "2"))
Lp
```

```
##                                       type1 type2 type3 type4 type5
##  "10"   "5"  "20"   "5"  "30"   "5"   "O"   "I"   "F"   "M"   "2"
```

```
# We can prove inequality (2.17) by using the norm defined in equal-
# son (2.16). We need only consider the case x = 0, because the inequality
# is obviously true if x = 0. Let   ·  a be any norm over a given formed linear
# space and let {v 1 , . . . , v k } be a basis for the space. Any x in the
# space has a
# representation in terms of the basis, x = c 1 v 1 + · · · + c k v k . Then
eq <- base::abs(p)
eq
```

```
## [1] 10  5 20  5 30  5
```

```
# Hence, with s v i 2 a ) 2 , which must be positive, we have
postscriptFonts()
```

```
## $serif
## $family
## [1] "Times"
##
## $metrics
## [1] "Times-Roman.afm"      "Times-Bold.afm"       "Times-Italic.afm"
## [4] "Times-BoldItalic.afm" "Symbol.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $sans
## $family
## [1] "Helvetica"
##
## $metrics
## [1] "Helvetica.afm"             "Helvetica-Bold.afm"
## [3] "Helvetica-Oblique.afm"     "Helvetica-BoldOblique.afm"
## [5] "Symbol.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $mono
## $family
## [1] "Courier"
##
## $metrics
## [1] "Courier.afm"             "Courier-Bold.afm"
## [3] "Courier-Oblique.afm"     "Courier-BoldOblique.afm"
## [5] "Symbol.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $AvantGarde
## $family
## [1] "AvantGarde"
##
## $metrics
## [1] "agw_____.afm" "agd_____.afm" "agwo____.afm" "agdo____.afm" "Symbol.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $Bookman
## $family
## [1] "Bookman"
##
## $metrics
## [1] "bkl_____.afm" "bkd_____.afm" "bkli____.afm" "bkdi____.afm" "Symbol.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $Courier
## $family
## [1] "Courier"
##
```

```
## $metrics
## [1] "Courier.afm"             "Courier-Bold.afm"
## [3] "Courier-Oblique.afm"     "Courier-BoldOblique.afm"
## [5] "Symbol.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $Helvetica
## $family
## [1] "Helvetica"
##
## $metrics
## [1] "Helvetica.afm"             "Helvetica-Bold.afm"
## [3] "Helvetica-Oblique.afm"     "Helvetica-BoldOblique.afm"
## [5] "Symbol.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $`Helvetica-Narrow`
## $family
## [1] "Helvetica-Narrow"
##
## $metrics
## [1] "hvn_____.afm" "hvnb____.afm" "hvno____.afm" "hvnbo___.afm" "Symbol.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $NewCenturySchoolbook
## $family
## [1] "NewCenturySchoolbook"
##
## $metrics
## [1] "ncr_____.afm" "ncb_____.afm" "nci_____.afm" "ncbi____.afm" "Symbol.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $Palatino
## $family
## [1] "Palatino"
##
## $metrics
## [1] "por_____.afm" "pob_____.afm" "poi_____.afm" "pobi____.afm" "Symbol.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $Times
## $family
## [1] "Times"
##
## $metrics
## [1] "Times-Roman.afm"      "Times-Bold.afm"       "Times-Italic.afm"
## [4] "Times-BoldItalic.afm" "Symbol.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $URWGothic
## $family
## [1] "URWGothic"
##
## $metrics
## [1] "a010013l.afm" "a010015l.afm" "a010033l.afm" "a010035l.afm" "s050000l.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $URWBookman
## $family
## [1] "URWBookman"
##
## $metrics
## [1] "b018012l.afm" "b018015l.afm" "b018032l.afm" "b018035l.afm" "s050000l.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $NimbusMon
## $family
## [1] "NimbusMon"
```

```
##
## $metrics
## [1] "n022003l.afm" "n022004l.afm" "n022023l.afm" "n022024l.afm" "s050000l.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $NimbusSan
## $family
## [1] "NimbusSan"
##
## $metrics
## [1] "n019003l.afm" "n019004l.afm" "n019023l.afm" "n019024l.afm" "s050000l.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $URWHelvetica
## $family
## [1] "URWHelvetica"
##
## $metrics
## [1] "n019003l.afm" "n019004l.afm" "n019023l.afm" "n019024l.afm" "s050000l.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $NimbusSanCond
## $family
## [1] "NimbusSanCond"
##
## $metrics
## [1] "n019043l.afm" "n019044l.afm" "n019063l.afm" "n019064l.afm" "s050000l.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $CenturySch
## $family
## [1] "CenturySch"
##
## $metrics
## [1] "c059013l.afm" "c059016l.afm" "c059033l.afm" "c059036l.afm" "s050000l.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $URWPalladio
## $family
## [1] "URWPalladio"
##
## $metrics
## [1] "p052003l.afm" "p052004l.afm" "p052023l.afm" "p052024l.afm" "s050000l.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $NimbusRom
## $family
## [1] "NimbusRom"
##
## $metrics
## [1] "n021003l.afm" "n021004l.afm" "n021023l.afm" "n021024l.afm" "s050000l.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $URWTimes
## $family
## [1] "URWTimes"
##
## $metrics
## [1] "n021003l.afm" "n021004l.afm" "n021023l.afm" "n021024l.afm" "s050000l.afm"
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $ArialMT
## $family
## [1] "ArialMT"
##
## $metrics
## [1] "ArialMT.afm"            "ArialMT-Bold.afm"       "ArialMT-Italic.afm"
## [4] "ArialMT-BoldItalic.afm" "Symbol.afm"
```

```
##
## $encoding
## [1] "default"
##
## attr(,"class")
## [1] "Type1Font"
##
## $ComputerModern
## $family
## [1] "ComputerModern"
##
## $metrics
## [1] "CM_regular_10.afm"      "CM_boldx_10.afm"        "CM_italic_10.afm"
## [4] "CM_boldx_italic_10.afm" "CM_symbol_10.afm"
##
## $encoding
## [1] "TeXtext.enc"
##
## attr(,"class")
## [1] "Type1Font"
##
## $ComputerModernItalic
## $family
## [1] "ComputerModernItalic"
##
## $metrics
## [1] "CM_regular_10.afm" "CM_boldx_10.afm"   "cmti10.afm"
## [4] "cmbxti10.afm"      "CM_symbol_10.afm"
##
## $encoding
## [1] "TeXtext.enc"
##
## attr(,"class")
## [1] "Type1Font"
##
## $Japan1
## $family
## [1] "HeiseiKakuGo-W5"
##
## $metrics
## [1] ""           ""           ""           ""           "Symbol.afm"
##
## $cmap
## [1] "EUC-H"
##
## $cmapEncoding
## [1] "EUC-JP"
##
## $pdfresource
## [1] ""
##
## attr(,"class")
## [1] "CIDFont"
##
```

```
## $Japan1HeiMin
## $family
## [1] "HeiseiMin-W3"
##
## $metrics
## [1] ""           ""           ""           ""           "Symbol.afm"
##
## $cmap
## [1] "EUC-H"
##
## $cmapEncoding
## [1] "EUC-JP"
##
## $pdfresource
## [1] ""
##
## attr(,"class")
## [1] "CIDFont"
##
## $Japan1GothicBBB
## $family
## [1] "GothicBBB-Medium"
##
## $metrics
## [1] ""           ""           ""           ""           "Symbol.afm"
##
## $cmap
## [1] "EUC-H"
##
## $cmapEncoding
## [1] "EUC-JP"
##
## $pdfresource
## [1] ""
##
## attr(,"class")
## [1] "CIDFont"
##
## $Japan1Ryumin
## $family
## [1] "Ryumin-Light"
##
## $metrics
## [1] ""           ""           ""           ""           "Symbol.afm"
##
## $cmap
## [1] "EUC-H"
##
## $cmapEncoding
## [1] "EUC-JP"
##
## $pdfresource
## [1] ""
##
```

```
## attr(,"class")
## [1] "CIDFont"
##
## $Korea1
## $family
## [1] "Baekmuk-Batang"
##
## $metrics
## [1] ""           ""           ""           ""           "Symbol.afm"
##
## $cmap
## [1] "KSCms-UHC-H"
##
## $cmapEncoding
## [1] "CP949"
##
## $pdfresource
## [1] ""
##
## attr(,"class")
## [1] "CIDFont"
##
## $Korea1deb
## $family
## [1] "Batang-Regular"
##
## $metrics
## [1] ""           ""           ""           ""           "Symbol.afm"
##
## $cmap
## [1] "KSCms-UHC-H"
##
## $cmapEncoding
## [1] "CP949"
##
## $pdfresource
## [1] ""
##
## attr(,"class")
## [1] "CIDFont"
##
## $CNS1
## $family
## [1] "MOESung-Regular"
##
## $metrics
## [1] ""           ""           ""           ""           "Symbol.afm"
##
## $cmap
## [1] "B5pc-H"
##
## $cmapEncoding
## [1] "CP950"
##
```

```
## $pdfresource
## [1] ""
##
## attr(,"class")
## [1] "CIDFont"
##
## $GB1
## $family
## [1] "BousungEG-Light-GB"
##
## $metrics
## [1] ""           ""           ""           ""           "Symbol.afm"
##
## $cmap
## [1] "GBK-EUC-H"
##
## $cmapEncoding
## [1] "GBK"
##
## $pdfresource
## [1] ""
##
## attr(,"class")
## [1] "CIDFont"
```