

```

#-----
# File Name:
#   binary_tree_statistics.R
#
# Purpose:
#   R script file for binary search tree statistics
#
# Parameters:
#
#
# Discussion:
#
#
# Licensing:
#
#   This code is distributed under the GNU LGPL license.
#
# Modified:
#
#   2018.11.12 Mon
#
# Author:
#
#   Young Won Lim
#-----
R <- 2
level_1 <- 2
level_2 <- 9
ngroup <- R^level_1
nleaf <- R^level_2
nnode <- nleaf/ngroup

#-----
read_th_vec <- function( fname, nelelem ) {
  to.read = file(fname, "rb")

  th_vec = c()
  ch = c()
  for (i in 1:nelelem) {
    # double theta -- Be careful for data alignment !!!
    # int branch -- (position, order ...)
    # int depth
    # int id
    # int child[2]
    # int parent

    th <- readBin(to.read, "double", n=1, size=8)
    br <- readBin(to.read, "int", n=1, size=4)
    dp <- readBin(to.read, "int", n=1, size=4)

    id <- readBin(to.read, "int", n=1, size=4)
    ch[1:R] <- readBin(to.read, "int", n=R, size=4)
    pa <- readBin(to.read, "int", n=1, size=4)

    if ((2+3+R+1) %% 2) readBin(to.read, "int", n=1, size=4)

    s1<- sprintf("th=%+10.6f, br=%2d, dp=%2d, id=%2d, ", th, br, dp, id)
    s2<- sprintf("ch[1:%d]= %s, ", R, paste(ch, collapse=", "))
    s3<- sprintf("pa=%2d", pa)
    print(paste(s1, s2, s3))

    th_vec = append(th_vec, th)

    # print(th_vec)
  }
  close(to.read)
}

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#t <- order(th_vec, decreasing=TRUE)

return(th_vec)

}

#-----
read_data <- function( level, group, ngroup ) {

  nogroup <- missing(group) & missing(ngroup)

  if (nogroup) {
    fname <- sprintf("binary_tree_L%02d.dat", level)
    nelelem <- R^level
  } else {
    fname <- sprintf("binary_tree_L%02d.G%02d.dat", level, group)
    nelelem <- R^level / ngroup
  }

  th_vec <- read_th_vec(fname,nelem)

  return(th_vec)

}

#-----
plot_ordering <- function(level, x, group, ngroup) {

  nogroup <- missing(group) & missing(ngroup)

  if (nogroup) {
    fname <- sprintf("binary_tree_L%02d.dat", level)
    plist <- list("level"=level, "fname"=fname)
    titles <- "Theta angle ordering - group"
  } else {
    fname <- sprintf("binary_tree_L%02d.G%02d.dat", level, group)
    plist <- list("level"=level, "group"=group-1, "ngroup"=ngroup)
    plist <- append(plist, list("fname"=fname))
    titles <- "Theta angle ordering - leaf"
  }

  local({
    rk.header (titles, parameters=plist)

    rk.graph.on ()
    try ({
      dotchart(x)
    })
    rk.graph.off ()
  })

}

#-----
print_diff_statistics <- function(level, x_diff, group, ngroup) {

  nogroup <- missing(group) & missing(ngroup)

  if (nogroup) {
    fname <- sprintf("binary_tree_L%02d.dat", level)
    plist <- list("level"=level, "fname"=fname)
    titles <- "Theta angle difference statistics - leaf"
  } else {
    fname <- sprintf("binary_tree_L%02d.G%02d.dat", level, group)
    plist <- list("level"=level, "group"=group-1, "ngroup"=ngroup)
    plist <- append(plist, list("fname"=fname))
    titles <- "Theta angle difference statistics - group"
  }

}

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local({
## Compute
vars <- rk.list (x_diff)
results <- data.frame ("Variable Name"=I(names (vars)), check.names=FALSE)
for (i in 1:length (vars)) {
  var <- vars[[i]]
  results[i, "Mean"] <- mean(var,na.rm=TRUE)
  results[i, "Variance"] <- var(var,na.rm=TRUE)
  results[i, "sd"] <- sd(var,na.rm=TRUE)
  results[i, "Minimum"] <- min(var,na.rm=TRUE)
  results[i, "Maximum"] <- max(var,na.rm=TRUE)
  results[i, "Median"] <- median(var,na.rm=TRUE)
  results[i, "Inter Quartile Range"] <- IQR(var,na.rm=TRUE)
  temp <- quantile (var,na.rm=TRUE)
  results[i, "Quartiles"] <- paste (names (temp), format (temp), sep=": ", collapse=" ")

  # robust statistics
}

## Print result
rk.header (titles, parameters=plist)

rk.results (results)
})
}

```

```

#-----
print_range_statistics <- function(level, x, group, ngroup) {

  nogroup <- missing(group) & missing(ngroup)

  if (nogroup) {
    fname <- sprintf("binary_tree_L%02d.dat", level)
    plist <- list("level"=level, "fname"=fname)
    titles <- "Theta angle range statistics - leaf"
  } else {
    fname <- sprintf("binary_tree_L%02d.G%02d.dat", level, group)
    plist <- list("level"=level, "group"=group-1, "ngroup"=ngroup)
    plist <- append(plist, list("fname"=fname))
    titles <- "Theta angle range statistics - Group"
  }

  local({
## Compute
vars <- rk.list (x)
results <- data.frame ("Variable Name"=I(names (vars)), check.names=FALSE)
for (i in 1:length (vars)) {
  var <- vars[[i]]
  results[i, "Minimum"] <- min(var,na.rm=TRUE)
  results[i, "Maximum"] <- max(var,na.rm=TRUE)
  results[i, "Mean"] <- mean(var,na.rm=TRUE)
  results[i, "Variance"] <- var(var,na.rm=TRUE)
  results[i, "sd"] <- sd(var,na.rm=TRUE)
  results[i, "Median"] <- median(var,na.rm=TRUE)
  # robust statistics
}

## Print result
rk.header (titles, parameters=plist)

rk.results (results)
})
}

```

```
#.....
th_vec <- read_data(level_2)
th_diff <- c(diff(th_vec), 0)
th_ord <- order(th_vec, decreasing=TRUE)

G <- matrix(ncol=ngroup, nrow=nnode)
G_diff <- matrix(ncol=ngroup, nrow=nnode)
G_ord <- matrix(ncol=ngroup, nrow=nnode)
for (i in 1:ngroup) {
  G[,i] <- read_data(level_2, i-1, ngroup)
  G_diff[,i] <- c(diff(G[,i]), 0)
  G_ord[,i] <- order(G[,i], decreasing=TRUE)
}

#.....
plot_ordering(level_2, th_ord)

for (i in 1:ngroup) {
  plot_ordering(level_2, G_ord[,i], i, ngroup)
}

#.....
print_diff_statistics(level_2, th_diff)

for (i in 1:ngroup) {
  print_diff_statistics(level_2, G_diff[,i], i, ngroup)
}

#.....
print_range_statistics(level_2, th_vec)

for (i in 1:ngroup) {
  print_range_statistics(level_2, G[,i], i, ngroup)
}
```