$ CUMDANCauchy : num -0.176 -0.261 -0.371 -0.609 -0.289 ...

$ GMVNPSO : num -5.27 -4.45 -4.51 -4.37 -4.28 ...

$ HL\_PS\_VNSO : num -2.31 -2.48 -2.18 -2.51 -2.42 ...

$ VNSDEEPSO : num 1.93 1.93 1.91 1.91 1.93 ...

$ PSO\_GBP : num -0.0688 -0.278 -0.1745 -0.2739 -0.2721 ...

$ Firefly : num -0.371 -0.393 -0.348 -0.336 -0.373 ...

$ UPSO : int 0 0 0 0 0 0 0 0 0 0 ...

$ Guide\_DE : num -0.716 -0.658 -0.603 -0.666 -0.745 ...

$ chaotic\_deepso: num 0.246 0.213 0.808 0.271 1.183 ...

$ evdeepso : num 0.02736 0.01698 0.08708 0.00885 0.0099 ...

$ EPSO : num -4.58 -4.67 -4.78 -4.21 -4.11 ...

$ DESS : num -1.89 -0.86 -2.01 -1.06 -1.22 ...

$ ABC\_DE : num -2.0202 -1.0705 -1.0413 -1.0236 -0.0658 ...

$ HFEABC : num -53.6 -34.5 -62.4 -52.2 -53.5 ...

$ CE\_CMAES : num -0.444 -0.439 -0.462 -0.035 -0.662 ...

$ AJSO : num 0.128 0.134 0.129 0.129 0.326 ...

$ GAAPSO : num -0.731 -0.72 -0.743 -0.96 -0.939 ...

> #normality test < 100 cases (Shapiro-Wilks Test)

> #chaotic\_deepso

> shapiro.test(archive$chaotic\_deepso)

Shapiro-Wilk normality test

data: archive$chaotic\_deepso

W = 0.85969, p-value = 0.007779

> #DESS

> shapiro.test(archive$DESS)

Shapiro-Wilk normality test

data: archive$DESS

W = 0.97599, p-value = 0.8726

> #EPSO

> shapiro.test(archive$EPSO)

Shapiro-Wilk normality test

data: archive$EPSO

W = 0.94574, p-value = 0.3071

> #evdeepso

> shapiro.test(archive$evdeepso)

Shapiro-Wilk normality test

data: archive$evdeepso

W = 0.4049, p-value = 4.885e-08

> #Firefly

> shapiro.test(archive$Firefly)

Shapiro-Wilk normality test

data: archive$Firefly

W = 0.97645, p-value = 0.8805

> #Guide\_DE

> shapiro.test(archive$Guide\_DE)

Shapiro-Wilk normality test

data: archive$Guide\_DE

W = 0.89463, p-value = 0.03274

> #UPSO

> shapiro.test(archive$UPSO)

Error in shapiro.test(archive$UPSO) : all 'x' values are identical

> #GMVNPSO

> shapiro.test(archive$GMVNPSO)

Shapiro-Wilk normality test

data: archive$GMVNPSO

W = 0.96725, p-value = 0.696

> #VNSDEEPSO

> shapiro.test(archive$VNSDEEPSO)

Shapiro-Wilk normality test

data: archive$VNSDEEPSO

W = 0.85612, p-value = 0.006761

> #PSO\_GBP

> shapiro.test(archive$PSO\_GBP)

Shapiro-Wilk normality test

data: archive$PSO\_GBP

W = 0.73813, p-value = 0.0001182

> #CUMDANCauchy

> shapiro.test(archive$CUMDANCauchy)

Shapiro-Wilk normality test

data: archive$CUMDANCauchy

W = 0.97596, p-value = 0.8721

> #HL\_PS\_VNSO

> shapiro.test(archive$HL\_PS\_VNSO)

Shapiro-Wilk normality test

data: archive$HL\_PS\_VNSO

W = 0.92078, p-value = 0.1026

> #ABC\_DE

> shapiro.test(archive$ABC\_DE)

Shapiro-Wilk normality test

data: archive$ABC\_DE

W = 0.77381, p-value = 0.0003606

> #AJSO

> shapiro.test(archive$AJSO)

Shapiro-Wilk normality test

data: archive$AJSO

W = 0.56876, p-value = 1.421e-06

> #CE\_CMAES

> shapiro.test(archive$CE\_CMAES)

Shapiro-Wilk normality test

data: archive$CE\_CMAES

W = 0.94631, p-value = 0.3145

> #GASAPSO

> shapiro.test(archive$GASAPSO)

Error in shapiro.test(archive$GASAPSO) : is.numeric(x) is not TRUE

> #HFEABC

> shapiro.test(archive$HFEABC)

Shapiro-Wilk normality test

data: archive$HFEABC

W = 0.84485, p-value = 0.004375

> #GASAPSO

> shapiro.test(archive$GASAPSO)

Error in shapiro.test(archive$GASAPSO) : is.numeric(x) is not TRUE

> archive=read.csv("C://Users//Yoan M//Documents//miproyecto//GECCO\_CEC\_smartgrid\_experiments//avg\_conv\_rate.csv",header=T);

> str(archive)

'data.frame': 20 obs. of 17 variables:

$ CUMDANCauchy : num -0.176 -0.261 -0.371 -0.609 -0.289 ...

$ GMVNPSO : num -5.27 -4.45 -4.51 -4.37 -4.28 ...

$ HL\_PS\_VNSO : num -2.31 -2.48 -2.18 -2.51 -2.42 ...

$ VNSDEEPSO : num 1.93 1.93 1.91 1.91 1.93 ...

$ PSO\_GBP : num -0.0688 -0.278 -0.1745 -0.2739 -0.2721 ...

$ Firefly : num -0.371 -0.393 -0.348 -0.336 -0.373 ...

$ UPSO : int 0 0 0 0 0 0 0 0 0 0 ...

$ Guide\_DE : num -0.716 -0.658 -0.603 -0.666 -0.745 ...

$ chaotic\_deepso: num 0.246 0.213 0.808 0.271 1.183 ...

$ evdeepso : num 0.02736 0.01698 0.08708 0.00885 0.0099 ...

$ EPSO : num -4.58 -4.67 -4.78 -4.21 -4.11 ...

$ DESS : num -1.89 -0.86 -2.01 -1.06 -1.22 ...

$ ABC\_DE : num -2.0202 -1.0705 -1.0413 -1.0236 -0.0658 ...

$ HFEABC : num -53.6 -34.5 -62.4 -52.2 -53.5 ...

$ CE\_CMAES : num -0.444 -0.439 -0.462 -0.035 -0.662 ...

$ AJSO : num 0.128 0.134 0.129 0.129 0.326 ...

$ GASAPSO : num -0.731 -0.72 -0.743 -0.96 -0.939 ...

> #GASAPSO

> shapiro.test(archive$GASAPSO)

Shapiro-Wilk normality test

data: archive$GASAPSO

W = 0.88837, p-value = 0.0251

> #HFEABC

> shapiro.test(archive$HFEABC)

Shapiro-Wilk normality test

Data W= 0.84485, p-value = 0.004375

Friedman's rank sum test

data: x

Friedman's chi-squared = 280.67, df = 16, p-value < 2.2e-16

Iman Davenport's correction of Friedman's rank sum test

data: x

Corrected Friedman's chi-squared = 135.59, df1 = 16, df2 = 304, p-value <

2.2e-16

Ranking

UPSO 1.00

evdeepso 3.40

AJSO 3.90

PSO\_GBP 5.10

CUMDANCauchy 5.85

CE\_CMAES 6.25

Firefly 7.00

ABC\_DE 7.30

chaotic\_deepso 7.70

Guide\_DE 9.50

GASAPSO 9.50

DESS 11.75

VNSDEEPSO 12.95

HL\_PS\_VNSO 13.80

EPSO 15.45

GMVNPSO 15.55

HFEABC 17.00

P\_value Bonferroni BH Holm Hochberg

CUMDANCauchy 2.387966e-03 3.820746e-02 2.939035e-03 9.551865e-03 9.551865e-03

GMVNPSO 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00

HL\_PS\_VNSO 1.110223e-15 1.776357e-14 4.440892e-15 1.443290e-14 1.443290e-14

VNSDEEPSO 7.238654e-14 1.158185e-12 2.316369e-13 8.686385e-13 8.686385e-13

PSO\_GBP 1.024290e-02 1.638864e-01 1.170617e-02 3.072870e-02 3.072870e-02

Firefly 1.717252e-04 2.747602e-03 2.497820e-04 1.030351e-03 1.030351e-03

Guide\_DE 1.021223e-07 1.633956e-06 2.042445e-07 1.021223e-06 9.191003e-07

chaotic\_deepso 2.720268e-05 4.352429e-04 4.836032e-05 2.176215e-04 2.176215e-04

evdeepso 1.328550e-01 1.000000e+00 1.328550e-01 1.387253e-01 1.328550e-01

EPSO 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00

DESS 1.674483e-11 2.679172e-10 4.465287e-11 1.841931e-10 1.841931e-10

ABC\_DE 7.972906e-05 1.275665e-03 1.275665e-04 5.581034e-04 5.581034e-04

HFEABC 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00

CE\_CMAES 1.010175e-03 1.616280e-02 1.346900e-03 5.050874e-03 5.050874e-03

AJSO 6.936263e-02 1.000000e+00 7.398681e-02 1.387253e-01 1.328550e-01

GASAPSO 1.021223e-07 1.633956e-06 2.042445e-07 1.021223e-06 9.191003e-07

Hommel BY

CUMDANCauchy 9.551865e-03 9.936082e-03

GMVNPSO 0.000000e+00 0.000000e+00

HL\_PS\_VNSO 1.443290e-14 1.501345e-14

VNSDEEPSO 8.686385e-13 7.831017e-13

PSO\_GBP 3.072870e-02 3.957539e-02

Firefly 1.030351e-03 8.444454e-04

Guide\_DE 9.191003e-07 6.904954e-07

chaotic\_deepso 2.176215e-04 1.634931e-04

evdeepso 1.328550e-01 4.491466e-01

EPSO 0.000000e+00 0.000000e+00

DESS 1.841931e-10 1.509593e-10

ABC\_DE 5.581034e-04 4.312678e-04

HFEABC 0.000000e+00 0.000000e+00

CE\_CMAES 5.050874e-03 4.553503e-03

AJSO 1.328550e-01 2.501294e-01

GASAPSO 9.191003e-07 6.904954e-07

Wilcoxon Signed-Rank test

data: data

T = 0, p-value = 4.429e-05

> #CUMDANCauchy vs DESS

> Wilcoxontest(archive$CUMDANCauchy, archive$DESS)

Wilcoxon Signed-Rank test

data: data

T = 0, p-value = 4.429e-05

> #CUMDANCauchy vs EPSO

> Wilcoxontest( archive$CUMDANCauchy, archive$EPSO)

Wilcoxon Signed-Rank test

data: data

T = 0, p-value = 4.429e-05

> #CUMDANCauchy vs evdeepso

> Wilcoxontest( archive$CUMDANCauchy, archive$evdeepso)

Wilcoxon Signed-Rank test

data: data

T = 0, p-value = 4.429e-05

> #CUMDANCauchy vs Firefly

> Wilcoxontest( archive$CUMDANCauchy, archive$Firefly)

Wilcoxon Signed-Rank test

data: data

T = 56, p-value = 0.03368

> #CUMDANCauchy vs Guide\_DE

> Wilcoxontest( archive$CUMDANCauchy, archive$Guide\_DE)

Wilcoxon Signed-Rank test

data: data

T = 0, p-value = 4.429e-05

> #CUMDANCauchy vs UPSO

> Wilcoxontest( archive$CUMDANCauchy, archive$UPSO)

Wilcoxon Signed-Rank test

data: data

T = 0, p-value = 4.429e-05

> #CUMDANCauchy vs GMVNPSO

> Wilcoxontest( archive$CUMDANCauchy, archive$GMVNPSO)

Wilcoxon Signed-Rank test

data: data

T = 0, p-value = 4.429e-05

> #CUMDANCauchy vs VNSDEEPSO

> Wilcoxontest( archive$CUMDANCauchy, archive$VNSDEEPSO)

Wilcoxon Signed-Rank test

data: data

T = 0, p-value = 4.429e-05

> #CUMDANCauchy vs PSO\_GBP

> Wilcoxontest( archive$CUMDANCauchy, archive$PSO\_GBP)

Wilcoxon Signed-Rank test

data: data

T = 77, p-value = 0.1479

> #CUMDANCauchy vs HL\_PS\_VNSO

> Wilcoxontest( archive$CUMDANCauchy, archive$HL\_PS\_VNSO)

Wilcoxon Signed-Rank test

data: data

T = 0, p-value = 4.429e-05

> #CUMDANCauchy vs ABC\_DE

> Wilcoxontest( archive$CUMDANCauchy, archive$ABC\_DE)

Wilcoxon Signed-Rank test

data: data

T = 67, p-value = 0.078

> #CUMDANCauchy vs AJSO

> Wilcoxontest( archive$CUMDANCauchy, archive$AJSO)

Wilcoxon Signed-Rank test

data: data

T = 0, p-value = 4.429e-05

> #CUMDANCauchy vs CE\_CMAES

> Wilcoxontest( archive$CUMDANCauchy, archive$CE\_CMAES)

Wilcoxon Signed-Rank test

data: data

T = 104, p-value = 0.4851

> #CUMDANCauchy vs GASAPSO

> Wilcoxontest( archive$CUMDANCauchy, archive$GASAPSO)

Wilcoxon Signed-Rank test

data: data

T = 0, p-value = 4.429e-05

> #CUMDANCauchy vs HFEABC

> Wilcoxontest( archive$CUMDANCauchy, archive$HFEABC)

Wilcoxon Signed-Rank test

data: data

T = 0, p-value = 4.429e-05

> Wilcoxontest( archive$CUMDANCauchy, archive$CUMDANCauchy)

Wilcoxon Signed-Rank test

data: data

T = 210, p-value = 1