Global fitness \_T1

Shapiro-Wilk normality test

data: archive$RDG3\_DEEPSO

W = 0.7699, p-value = 0.0003178

> shapiro.test(archive$CE\_CMAES)

Shapiro-Wilk normality test

data: archive$CE\_CMAES

W = 0.88469, p-value = 0.02151

> shapiro.test(archive$HFEABC)

Shapiro-Wilk normality test

data: archive$HFEABC

W = 0.93359, p-value = 0.181

> shapiro.test(archive$DE\_TLBO)

Shapiro-Wilk normality test

data: archive$DE\_TLBO

W = 0.96843, p-value = 0.7214

> shapiro.test(archive$PSO\_GBP)

Shapiro-Wilk normality test

data: archive$PSO\_GBP

W = 0.90287, p-value = 0.0467

> shapiro.test(archive$GASAPSO)

Shapiro-Wilk normality test

data: archive$GASAPSO

W = 0.96018, p-value = 0.5474

> shapiro.test(archive$AJSO)

Shapiro-Wilk normality test

data: archive$AJSO

W = 0.92662, p-value = 0.1329

> shapiro.test(archive$CUMDANCauchy)

Shapiro-Wilk normality test

data: archive$CUMDANCauchy

W = 0.95645, p-value = 0.4755

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

Shapiro-Wilk normality test

data: archive$EHL\_PS\_VNSO

W = 0.69296, p-value = 3.203e-05

> shapiro.test(archive$Ensembled\_method\_of\_CBBO\_Cauchy\_and\_DEEPSO)

Shapiro-Wilk normality test

data: archive$Ensembled\_method\_of\_CBBO\_Cauchy\_and\_DEEPSO

W = 0.9827, p-value = 0.964

> shapiro.test(archive$`Ensembled\_method\_of\_CBBO\_Cauchy and DEEPSO`)

Error in shapiro.test(archive$`Ensembled\_method\_of\_CBBO\_Cauchy and DEEPSO`) :

is.numeric(x) is not TRUE

In addition: Warning message:

Unknown or uninitialised column: 'Ensembled\_method\_of\_CBBO\_Cauchy and DEEPSO'.

> shapiro.test(archive$DEEDA)

Shapiro-Wilk normality test

data: archive$DEEDA

W = 0.95867, p-value = 0.5176

Wilcoxon Signed-Rank test

data: data

T = 50, p-value = 0.02002

> #CUMDANCauchy vs DESS

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

Wilcoxon Signed-Rank test

data: data

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

> #CUMDANCauchy vs EPSO

> Wilcoxontest( archive$CUMDANCauchy, archive$HFEABC)

Wilcoxon Signed-Rank test

data: data

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

> #CUMDANCauchy vs evdeepso

> Wilcoxontest( archive$CUMDANCauchy, archive$DE\_TLBO)

Wilcoxon Signed-Rank test

data: data

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

> #CUMDANCauchy vs Firefly

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

Wilcoxon Signed-Rank test

data: data

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

> #CUMDANCauchy vs Guide\_DE

> Wilcoxontest( archive$CUMDANCauchy, archive$GASAPSO)

Wilcoxon Signed-Rank test

data: data

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

> #CUMDANCauchy vs UPSO

> Wilcoxontest( archive$CUMDANCauchy, archive$AJSO)

Wilcoxon Signed-Rank test

data: data

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

> #CUMDANCauchy vs GMVNPSO

> Wilcoxontest( archive$CUMDANCauchy, archive$CUMDANCauchy)

Wilcoxon Signed-Rank test

data: data

T = 210, p-value = 1

> #CUMDANCauchy vs VNSDEEPSO

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

Wilcoxon Signed-Rank test

data: data

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

> #CUMDANCauchy vs PSO\_GBP

> Wilcoxontest( archive$CUMDANCauchy, archive$Ensembled\_method\_of\_CBBO\_Cauchy\_and\_DEEPSO)

Wilcoxon Signed-Rank test

data: data

T = 77, p-value = 0.1479

> Wilcoxontest( archive$CUMDANCauchy, archive$Ensembled\_method\_of\_CBBO\_Cauchy.and.DEEPSO)

C:\Users\Yoan M\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\3C1AE0AB.tmp Show Traceback

C:\Users\Yoan M\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\D8FD2AF1.tmp Rerun with Debug

Error in wilcoxonSignedTest(x, y) :

This is a paired test, so the two vectors have to have the same length

> #CUMDANCauchy vs HL\_PS\_VNSO

> Wilcoxontest( archive$CUMDANCauchy, archive$DEEDA)

Wilcoxon Signed-Rank test

data: data

T = 55, p-value = 0.03098

Friedman's rank sum test

data: x

Friedman's chi-squared = 171.89, df = 10, p-value < 2.2e-16

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

data: x

Corrected Friedman's chi-squared = 116.19, df1 = 10, df2 = 190, p-value <

2.2e-16

Ranking

CUMDANCauchy 1.80

DEEDA 2.20

Ensembled\_method\_of\_CBBO\_Cauchy\_and\_DEEPSO 2.65

RDG3\_DEEPSO 3.65

HFEABC 5.00

DE\_TLBO 7.20

GASAPSO 7.80

EHL\_PS\_VNSO 8.10

PSO\_GBP 8.15

CE\_CMAES 8.45

AJSO 11.00

P\_value Bonferroni BH

RDG3\_DEEPSO 7.774784e-02 7.774784e-01 9.718480e-02

CE\_CMAES 2.289817e-10 2.289817e-09 1.144909e-09

HFEABC 2.280196e-03 2.280196e-02 3.257423e-03

DE\_TLBO 2.623008e-07 2.623008e-06 4.371681e-07

PSO\_GBP 1.408655e-09 1.408655e-08 4.695515e-09

GASAPSO 1.060389e-08 1.060389e-07 2.120778e-08

AJSO 0.000000e+00 0.000000e+00 0.000000e+00

EHL\_PS\_VNSO 1.892040e-09 1.892040e-08 4.730100e-09

Ensembled\_method\_of\_CBBO\_Cauchy\_and\_DEEPSO 4.176855e-01 1.000000e+00 4.640950e-01

DEEDA 7.029176e-01 1.000000e+00 7.029176e-01

Holm Hochberg Hommel

RDG3\_DEEPSO 2.332435e-01 2.332435e-01 2.332435e-01

CE\_CMAES 2.060836e-09 2.060836e-09 2.060836e-09

HFEABC 9.120784e-03 9.120784e-03 9.120784e-03

DE\_TLBO 1.311504e-06 1.311504e-06 1.311504e-06

PSO\_GBP 1.126924e-08 1.126924e-08 9.860582e-09

GASAPSO 6.362335e-08 6.362335e-08 6.362335e-08

AJSO 0.000000e+00 0.000000e+00 0.000000e+00

EHL\_PS\_VNSO 1.324428e-08 1.324428e-08 1.324428e-08

Ensembled\_method\_of\_CBBO\_Cauchy\_and\_DEEPSO 8.353710e-01 7.029176e-01 7.029176e-01

DEEDA 8.353710e-01 7.029176e-01 7.029176e-01

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RDG3\_DEEPSO 2.846512e-01

CE\_CMAES 3.353401e-09

HFEABC 9.540888e-03

DE\_TLBO 1.280451e-06

PSO\_GBP 1.375301e-08

GASAPSO 6.211692e-08

AJSO 0.000000e+00

EHL\_PS\_VNSO 1.385431e-08

Ensembled\_method\_of\_CBBO\_Cauchy\_and\_DEEPSO 1.000000e+00

DEEDA 1.000000e+00

Global fitness T2

Shapiro-Wilk normality test

data: archive$RDG3\_DEEPSO

W = 0.73959, p-value = 0.0001235

> shapiro.test(archive$CE\_CMAES)

Shapiro-Wilk normality test

data: archive$CE\_CMAES

W = 0.95532, p-value = 0.4551

> shapiro.test(archive$HFEABC)

Shapiro-Wilk normality test

data: archive$HFEABC

W = 0.56278, p-value = 1.241e-06

> shapiro.test(archive$DE\_TLBO)

Shapiro-Wilk normality test

data: archive$DE\_TLBO

W = 0.89816, p-value = 0.03809

> shapiro.test(archive$PSO\_GBP)

Shapiro-Wilk normality test

data: archive$PSO\_GBP

W = 0.97029, p-value = 0.761

> shapiro.test(archive$GASAPSO)

Shapiro-Wilk normality test

data: archive$GASAPSO

W = 0.9778, p-value = 0.9026

> shapiro.test(archive$AJSO)

Shapiro-Wilk normality test

data: archive$AJSO

W = 0.95341, p-value = 0.4218

> shapiro.test(archive$CUMDANCauchy)

Shapiro-Wilk normality test

data: archive$CUMDANCauchy

W = 0.69695, p-value = 3.579e-05

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

Shapiro-Wilk normality test

data: archive$EHL\_PS\_VNSO

W = 0.23587, p-value = 2.693e-09

> shapiro.test(archive$Ensembled\_method\_of\_CBBO\_Cauchy\_and\_DEEPSO)

Shapiro-Wilk normality test

data: archive$Ensembled\_method\_of\_CBBO\_Cauchy\_and\_DEEPSO

W = 0.87172, p-value = 0.0126

> shapiro.test(archive$`Ensembled\_method\_of\_CBBO\_Cauchy and DEEPSO`)

Error in shapiro.test(archive$`Ensembled\_method\_of\_CBBO\_Cauchy and DEEPSO`) :

is.numeric(x) is not TRUE

In addition: Warning message:

Unknown or uninitialised column: 'Ensembled\_method\_of\_CBBO\_Cauchy and DEEPSO'.

> shapiro.test(archive$DEEDA)

Shapiro-Wilk normality test

data: archive$DEEDA

W = 0.95322, p-value = 0.4186

> shapiro.test(archive$VNS\_DEEPSO)

Shapiro-Wilk normality test

data: archive$VNS\_DEEPSO

W = 0.28289, p-value = 5.756e-09

Wilcoxon Signed-Rank test

data: data

T = 13, p-value = 0.0002967

> #CUMDANCauchy vs DESS

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

Wilcoxon Signed-Rank test

data: data

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

> #CUMDANCauchy vs EPSO

> Wilcoxontest( archive$CUMDANCauchy, archive$HFEABC)

Wilcoxon Signed-Rank test

data: data

T = 58, p-value = 0.03966

> #CUMDANCauchy vs evdeepso

> Wilcoxontest( archive$CUMDANCauchy, archive$DE\_TLBO)

Wilcoxon Signed-Rank test

data: data

T = 96, p-value = 0.3684

> #CUMDANCauchy vs Firefly

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

Wilcoxon Signed-Rank test

data: data

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

> #CUMDANCauchy vs Guide\_DE

> Wilcoxontest( archive$CUMDANCauchy, archive$GASAPSO)

Wilcoxon Signed-Rank test

data: data

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

> #CUMDANCauchy vs UPSO

> Wilcoxontest( archive$CUMDANCauchy, archive$AJSO)

Wilcoxon Signed-Rank test

data: data

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

> #CUMDANCauchy vs GMVNPSO

> Wilcoxontest( archive$CUMDANCauchy, archive$CUMDANCauchy)

Wilcoxon Signed-Rank test

data: data

T = 210, p-value = 1

> #CUMDANCauchy vs VNSDEEPSO

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

Wilcoxon Signed-Rank test

data: data

T = 74, p-value = 0.1236

> #CUMDANCauchy vs PSO\_GBP

> Wilcoxontest( archive$CUMDANCauchy, archive$Ensembled\_method\_of\_CBBO\_Cauchy\_and\_DEEPSO)

Wilcoxon Signed-Rank test

data: data

T = 91, p-value = 0.3006

> Wilcoxontest( archive$CUMDANCauchy, archive$Ensembled\_method\_of\_CBBO\_Cauchy.and.DEEPSO)

C:\Users\Yoan M\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\46615B27.tmp Show Traceback

C:\Users\Yoan M\AppData\Local\Microsoft\Windows\INetCache\Content.MSO\E4A896CD.tmp Rerun with Debug

Error in wilcoxonSignedTest(x, y) :

This is a paired test, so the two vectors have to have the same length

> #CUMDANCauchy vs HL\_PS\_VNSO

> Wilcoxontest( archive$CUMDANCauchy, archive$DEEDA)

Wilcoxon Signed-Rank test

data: data

T = 38, p-value = 0.006187

Friedman's rank sum test

data: x

Friedman's chi-squared = 180.83, df = 11, p-value < 2.2e-16

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

data: x

Corrected Friedman's chi-squared = 87.722, df1 = 11, df2 = 209, p-value <

2.2e-16

Ranking

VNS\_DEEPSO 1.100

CE\_CMAES 2.200

RDG3\_DEEPSO 4.300

EHL\_PS\_VNSO 4.825

Ensembled\_method\_of\_CBBO\_Cauchy\_and\_DEEPSO 5.200

CUMDANCauchy 6.075

HFEABC 6.400

DEEDA 7.650

DE\_TLBO 7.950

GASAPSO 10.000

AJSO 10.300

PSO\_GBP 12.000

P\_value Bonferroni BH

RDG3\_DEEPSO 5.006960e-03 5.507656e-02 5.507656e-03

CE\_CMAES 3.346631e-01 1.000000e+00 3.346631e-01

HFEABC 3.345076e-06 3.679583e-05 6.132639e-06

DE\_TLBO 1.880026e-09 2.068029e-08 5.170072e-09

PSO\_GBP 0.000000e+00 0.000000e+00 0.000000e+00

GASAPSO 5.995204e-15 6.594725e-14 2.198242e-14

AJSO 6.661338e-16 7.327472e-15 3.663736e-15

CUMDANCauchy 1.280778e-05 1.408856e-04 2.012651e-05

EHL\_PS\_VNSO 1.086779e-03 1.195457e-02 1.328285e-03

Ensembled\_method\_of\_CBBO\_Cauchy\_and\_DEEPSO 3.232249e-04 3.555474e-03 4.444343e-04

DEEDA 9.206776e-09 1.012745e-07 2.025491e-08

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RDG3\_DEEPSO 1.001392e-02 1.001392e-02 1.001392e-02

CE\_CMAES 3.346631e-01 3.346631e-01 3.346631e-01

HFEABC 2.007045e-05 2.007045e-05 2.007045e-05

DE\_TLBO 1.504021e-08 1.504021e-08 1.504021e-08

PSO\_GBP 0.000000e+00 0.000000e+00 0.000000e+00

GASAPSO 5.395684e-14 5.395684e-14 5.395684e-14

AJSO 6.661338e-15 6.661338e-15 6.661338e-15

CUMDANCauchy 6.403889e-05 6.403889e-05 6.403889e-05

EHL\_PS\_VNSO 3.260337e-03 3.260337e-03 3.260337e-03

Ensembled\_method\_of\_CBBO\_Cauchy\_and\_DEEPSO 1.292900e-03 1.292900e-03 1.292900e-03

DEEDA 6.444743e-08 6.444743e-08 6.444743e-08

BY

RDG3\_DEEPSO 1.663244e-02

CE\_CMAES 1.000000e+00

HFEABC 1.851982e-05

DE\_TLBO 1.561298e-08

PSO\_GBP 0.000000e+00

GASAPSO 6.638420e-14

AJSO 1.106403e-14

CUMDANCauchy 6.077959e-05

EHL\_PS\_VNSO 4.011259e-03

Ensembled\_method\_of\_CBBO\_Cauchy\_and\_DEEPSO 1.342137e-03

DEEDA 6.116734e-08