Testing mopsocd(Multi-objective Particle Swarm Optimization with Crowding Distance) and mopsopsa algorithm v.1

Here are results of running mopsocd and mopsopsa_v1 on testing functions.

Load algorithms, test functions and utilities:

```
source('../mopsocd.R')
source('../mopsocds.R')
source('../moea.test.dtlz2.R')
source('../mopsopsa_v1.R')
```

Set number of points to be generated for True Pareto Front:

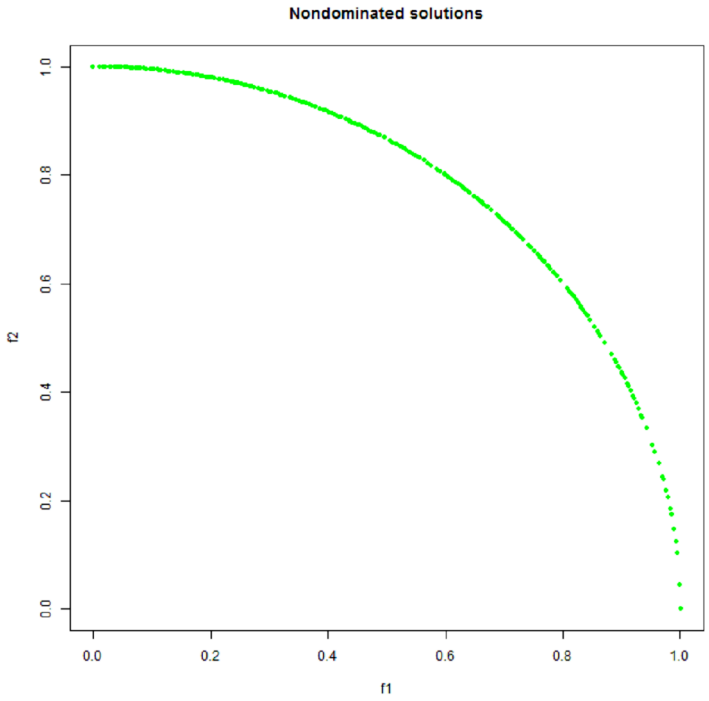
```
pfpoints <- 10000
```

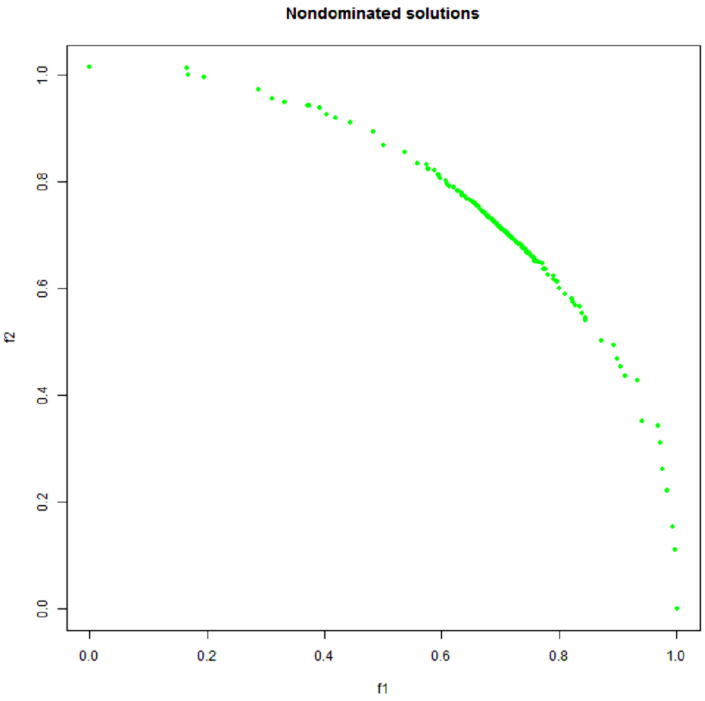
Visualizations of solutions MOPSOCD vs MOPSOPSA_V1

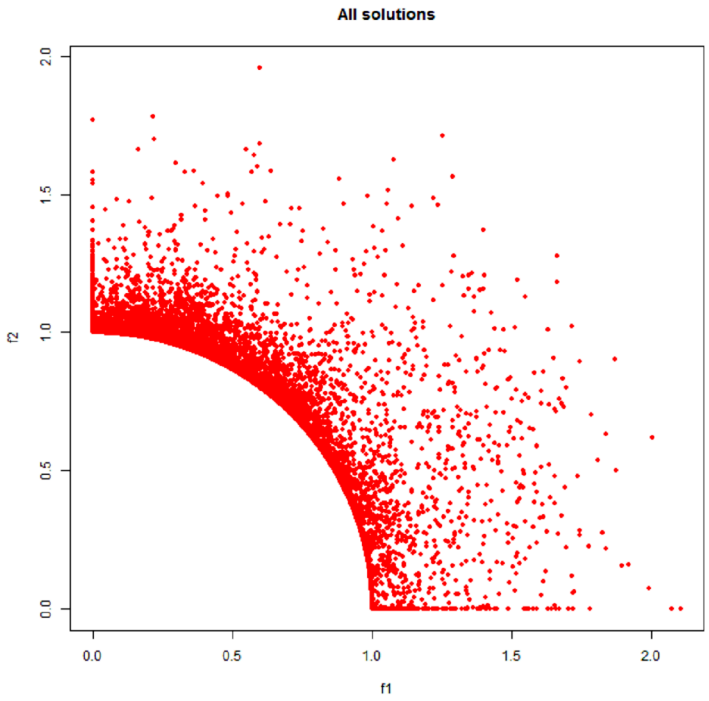
Color conventions: Black = True Pareto front, Green = Nondominated solutions, Red = All stored solutions

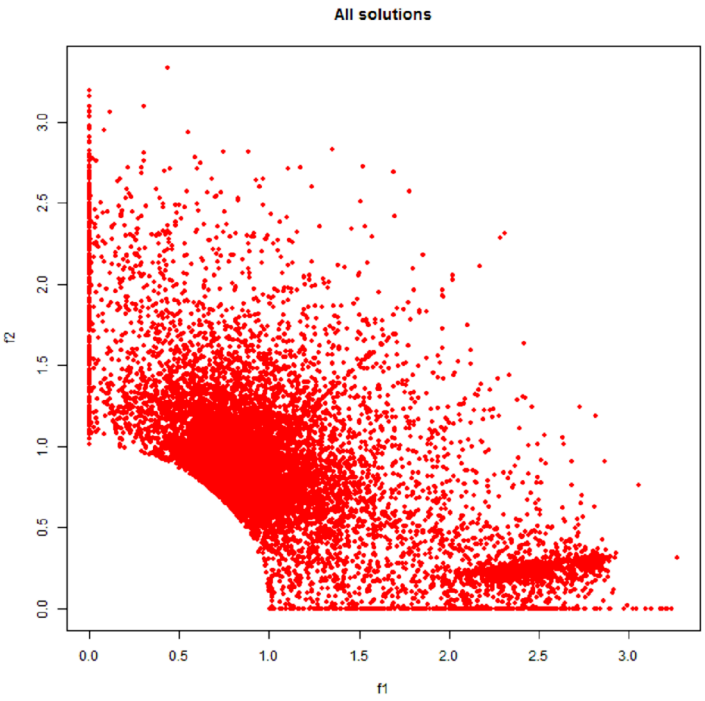
DTLZ2 Test Functions

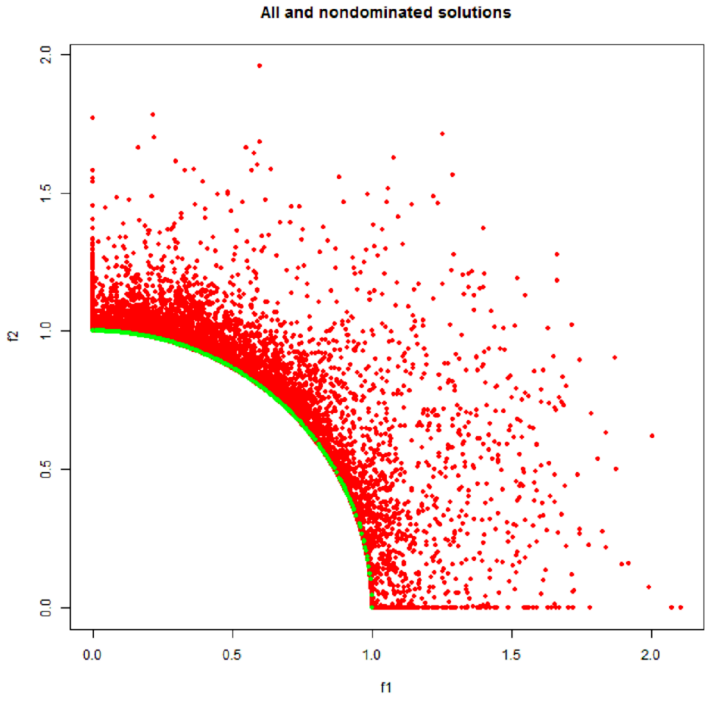
```
d <- 11
s1 <- mopsocds(dtlz2_2, varcnt=d, fncnt=2, lowerbound=rep(0, d), upperbound=rep(1,d), opt=0)
s2 <- mopsopsa_v1(dtlz2_2, varcnt=d, fncnt=2, lowerbound=rep(0, d), upperbound=rep(1,d), opt=0)
draw_n(s1, s2, dtlz2_2front, pfpoints)
```

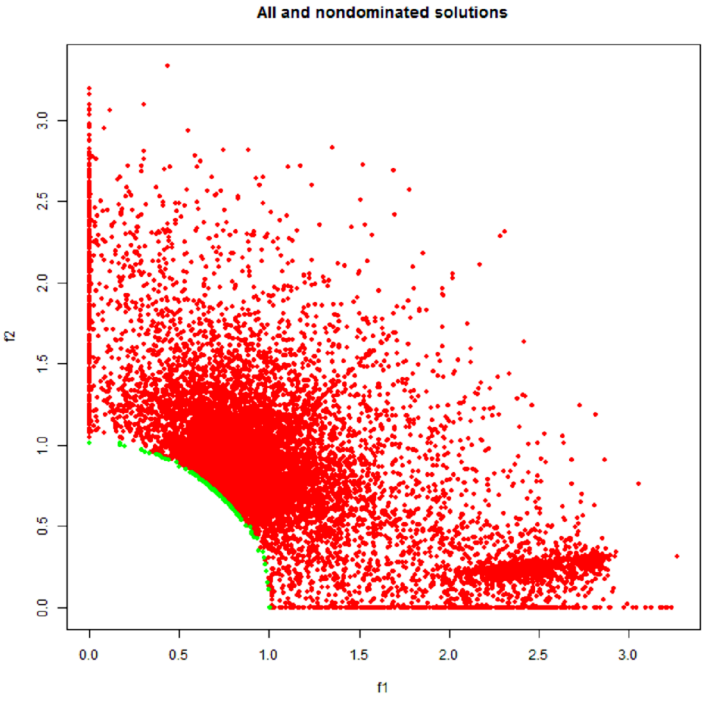


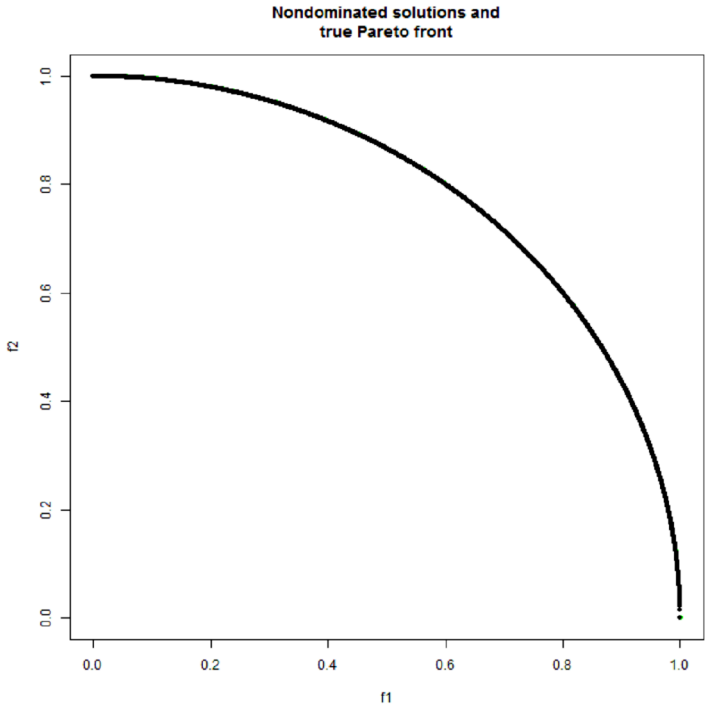


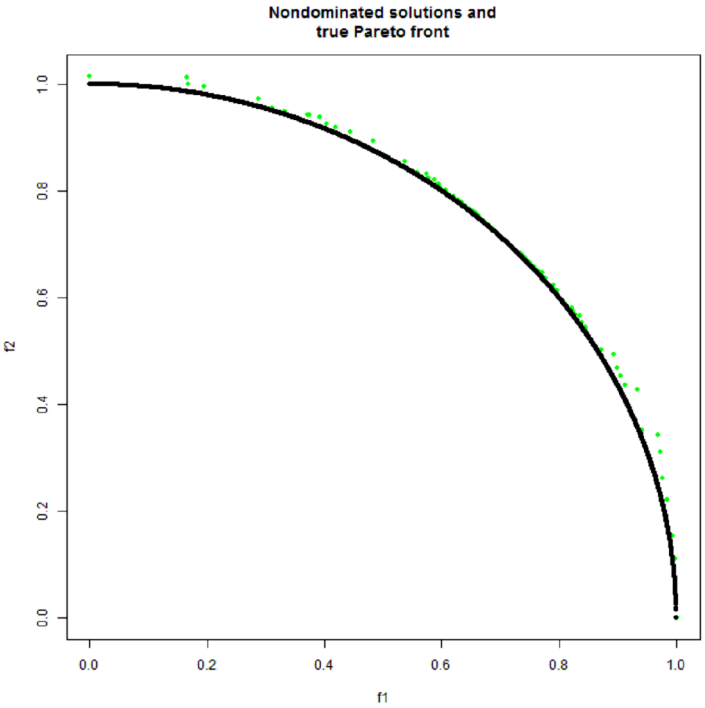




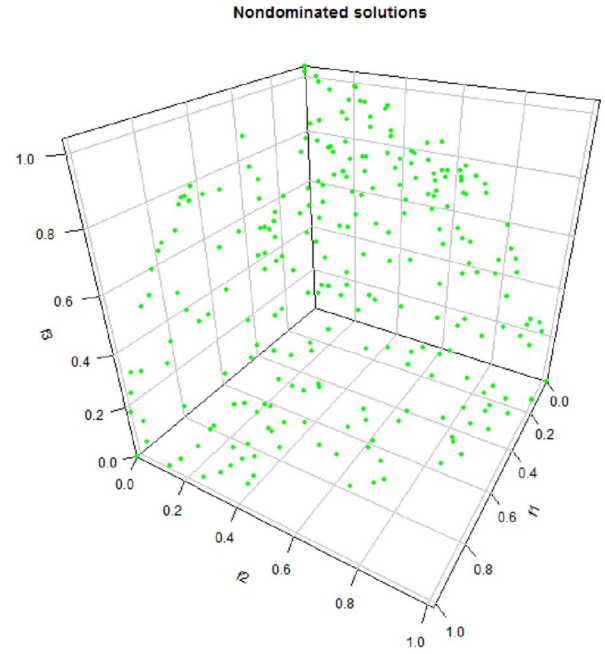


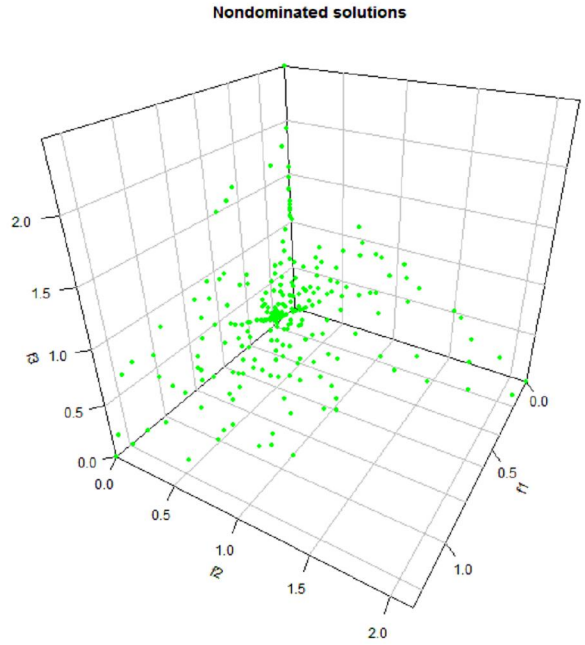


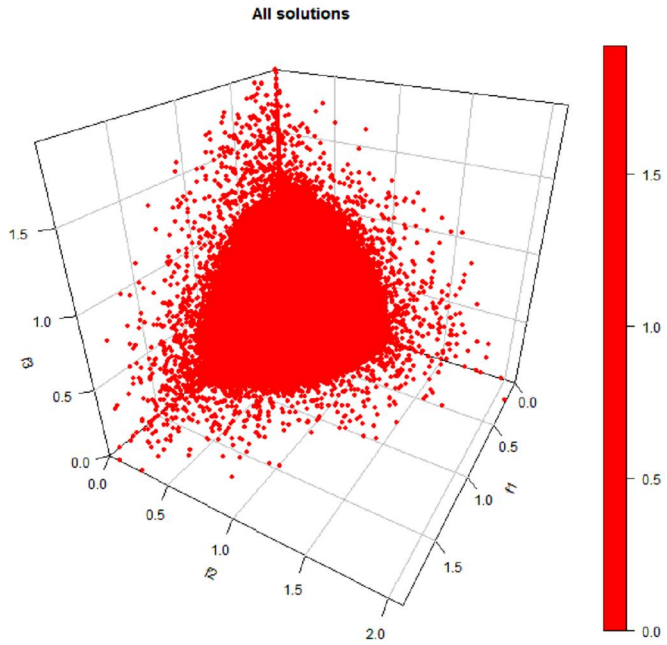


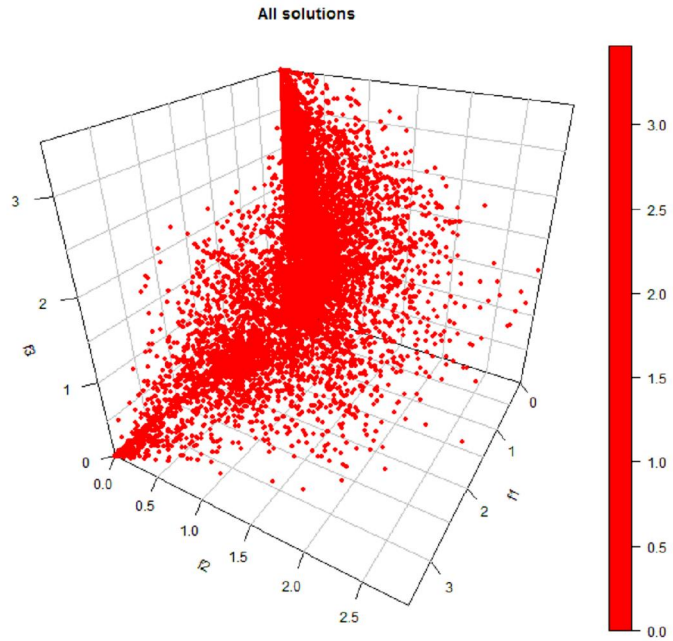


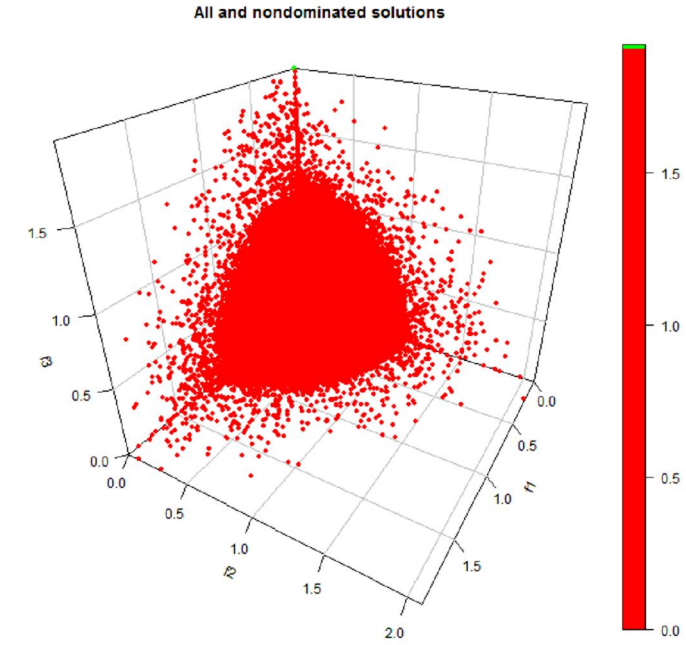

```
d <- 12
s1 <- mopsocds(dtlz2_□, varcnt=d, fncnt=□, lowerbound=rep(0, d), upperbound=rep(1,d), opt=0)
s2 <- mopsopsa_v1(dtlz2_□, varcnt=d, fncnt=□, lowerbound=rep(0, d), upperbound=rep(1,d), opt=0)
draw_n(s1, s2, dtlz2_□front, pfpoints)
```

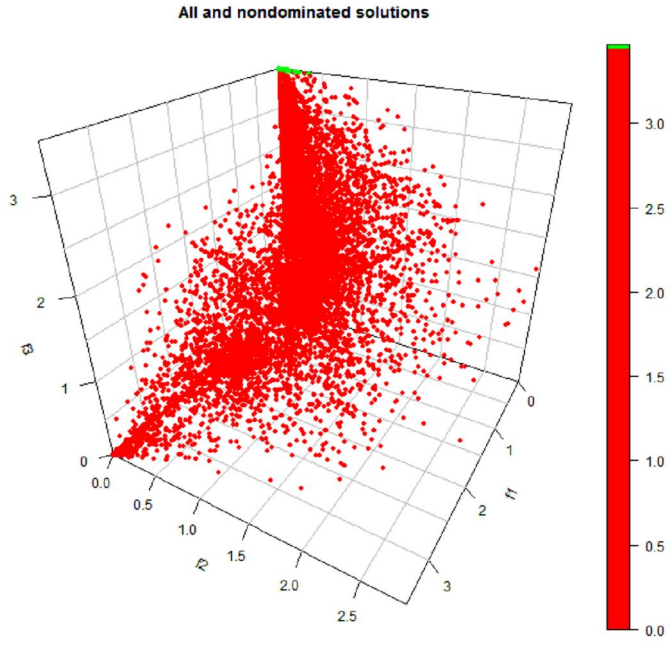

Nondominated solutions
f3
f2
f1

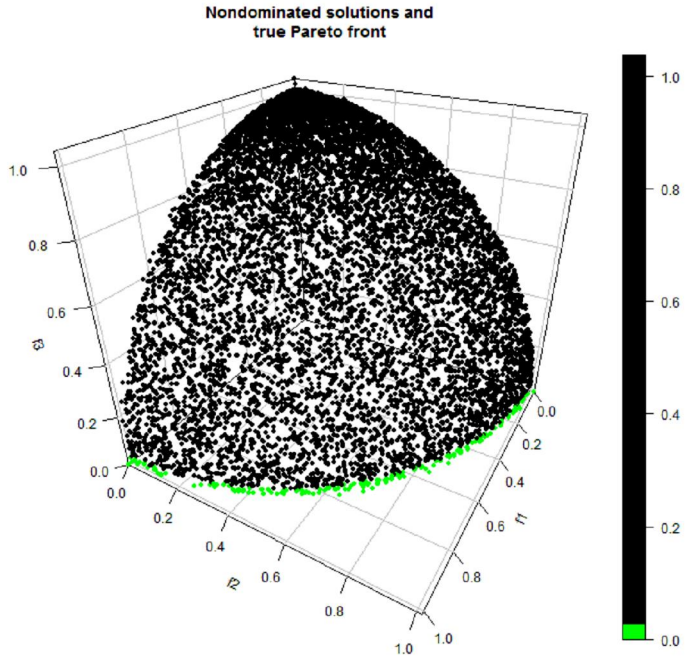

Nondominated solutions
f3
f2
f1

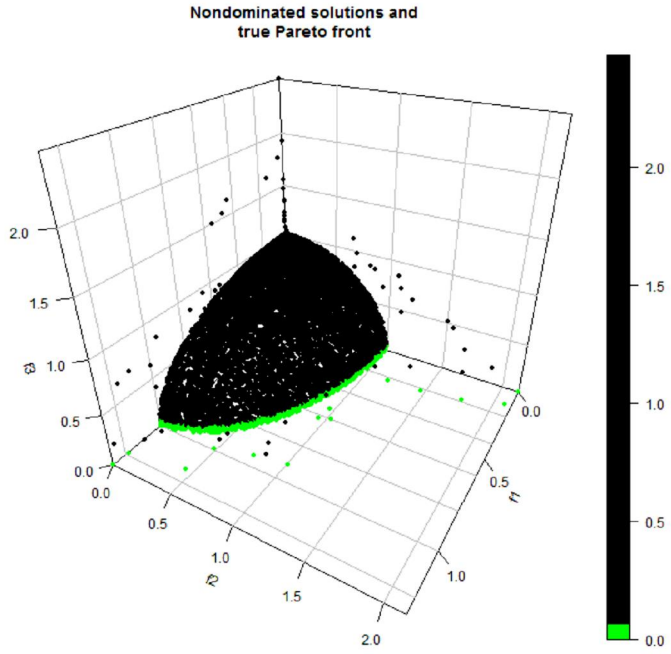

All solutions
f3
f2
f1


All solutions
f3
f2
f1





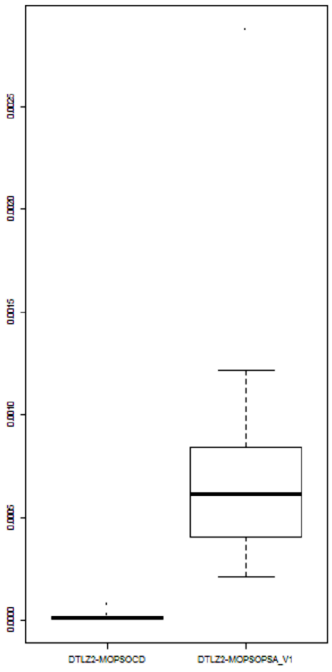




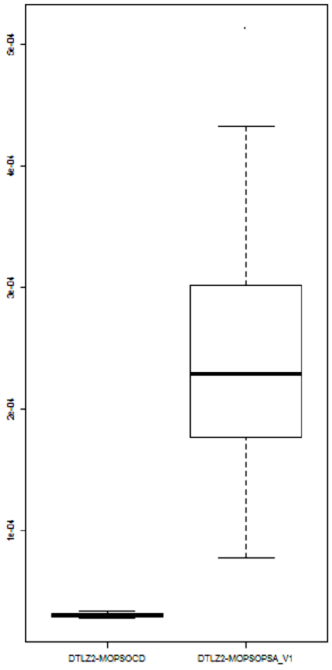
Boplots of results from 20 independent runs of MOPSOCD and MOPSOPSA_V1 on test functions for 2 objectives:

```
n <- 20
ob□ <- 2
mat <- per _ es (n, test_functions2□, test_functions_fronts2□, ob□=2, d=11, pfpoints, al□_func=c(mopsocds, mopsopsa_v1))
titles = c('□□□□2-M□□□□□□□', '□□□□2-M□□□□□□□_□1')
per _ o p o s(n, mat, titles)
```

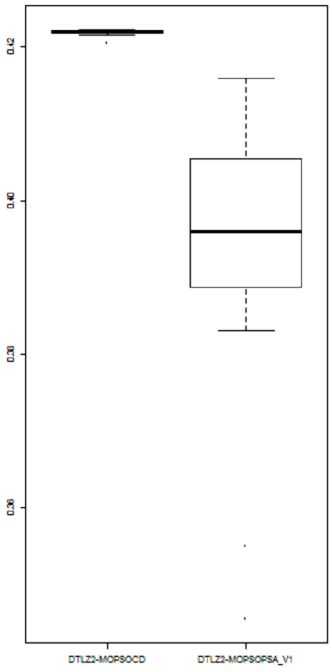
```
□□ □1□ "□□ performance measures on 20 runs□"
```



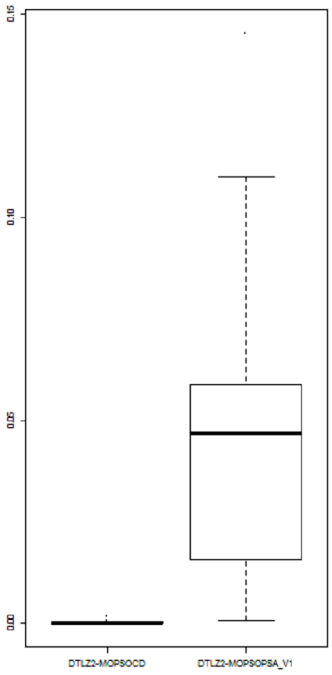

```
□□ □1□ "□□□ performance measures on 20 runs□"
```




```
□□ □1□ "□□ performance measures on 20 runs□"
```



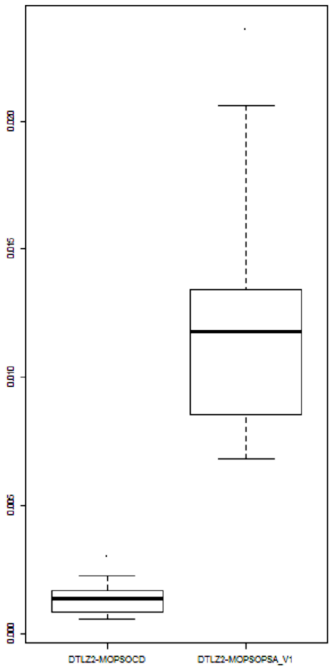

```
□□ □1□ "□□ performance measures on 20 runs□"
```



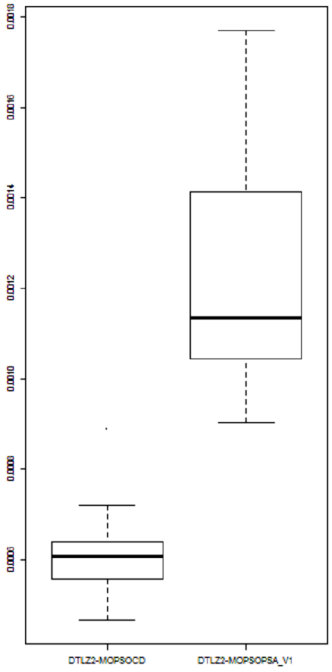

```
mat_2ob□ <- as.data.frame(mat)
```

```
ob□ <- □
mat <- perf_test(n, test_functions□□, test_functions_fronts□□, ob□=□, d=12, pf□points, al□_func=c(mopsocds, mopsopsa_v1))
titles = c('□□□□2-M□□□□□□□', '□□□□2-M□□□□□□□□_□1')
perf_boxplots(n, mat, titles)
```

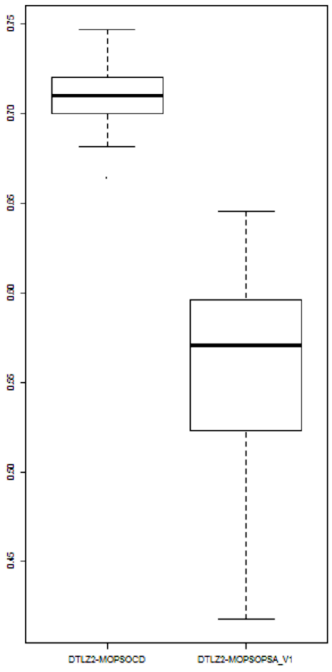
```
□□ □1□ "□□ performance measures on 20 runs□"
```



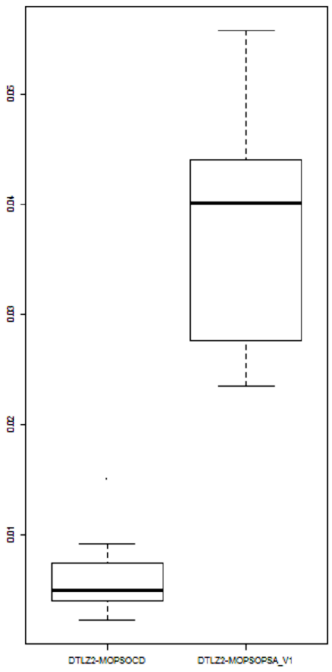
□□ □1□ "□□□ performance measures on 20 runs□"



□□ □1□ "□□ performance measures on 20 runs□"



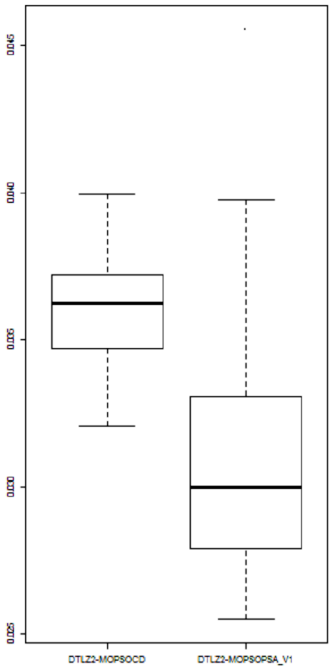

```
□□ □1□ "□□ performance measures on 20 runs□"
```



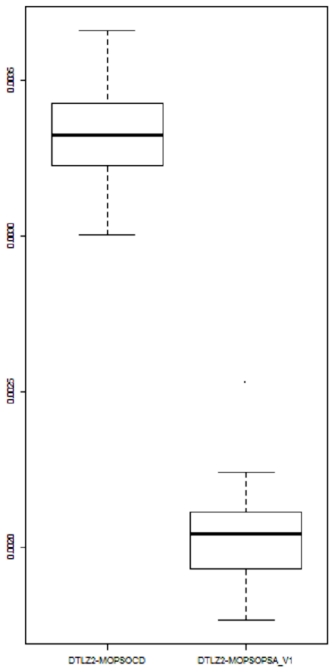

```
mat_□ob□ <- as.data.frame(mat)
```

```
ob□ <- □
mat <- perf_test(n, test_functions□□, test_functions_fronts□□, ob□=□, d=1□, pfpoints, al□_func=c(mopsocd, mopsopsa_v1))
titles = c('□□□□2-M□□□□□□□', '□□□□2-M□□□□□□□_□1')
perf_boxplots(n, mat, titles)
```

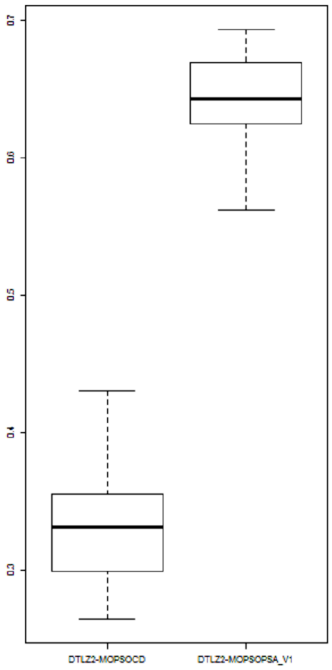
```
□□ □1□ "□□ performance measures on 20 runs□"
```



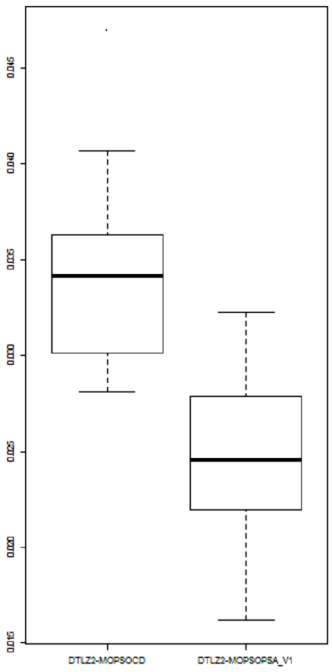
□□ □1□ "□□□ performance measures on 20 runs□"



□□ □1□ "□□ performance measures on 20 runs□"



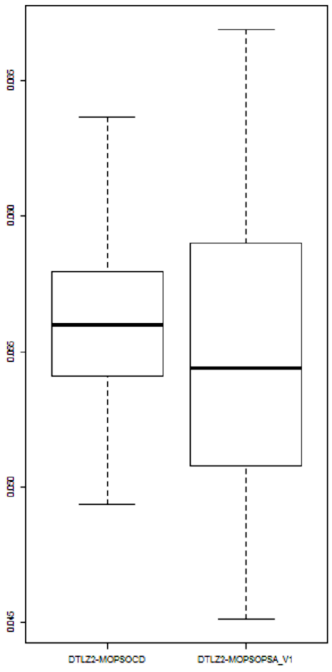
□□ □1□ "□□ performance measures on 20 runs□"



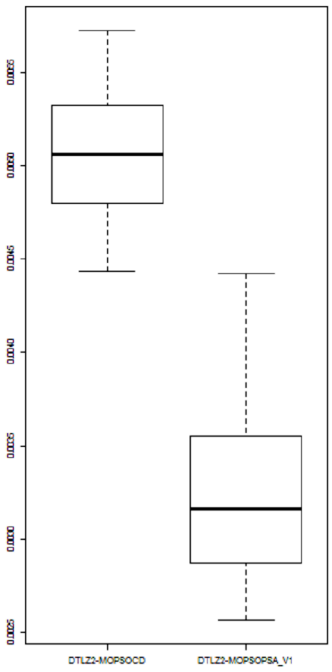

```
mat_□ob□ <- as.data.frame(mat)
```

```
ob□ <- □
mat <- perf_test(n, test_functions□□, test_functions_fronts□□, ob□=□, d=1□, pfpoints, al□_func=c(mopsocd, mopsopsa_v1))
titles = c('□□□□2-M□□□□□□□', '□□□□2-M□□□□□□□_□1')
perf_boxplots(n, mat, titles)
```

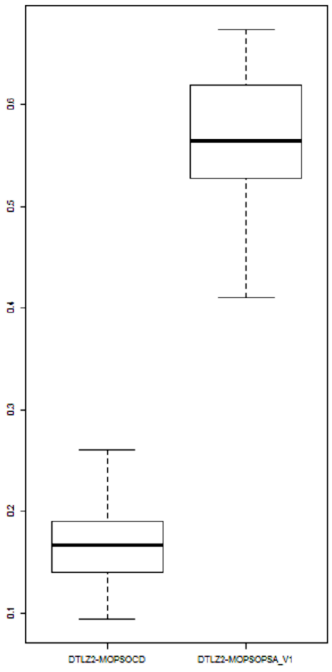
□□ □1□ "□□ performance measures on 20 runs□"



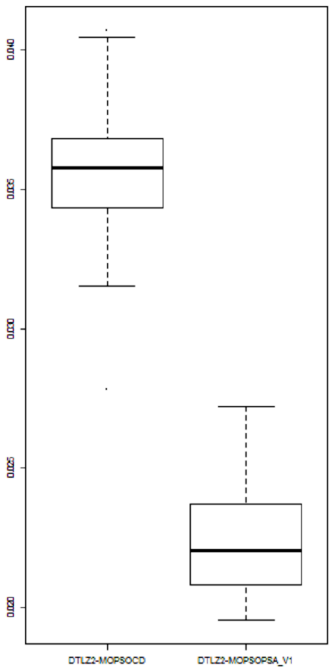
□□ □1□ "□□□ performance measures on 20 runs□"



□□ □1□ "□□ performance measures on 20 runs□"



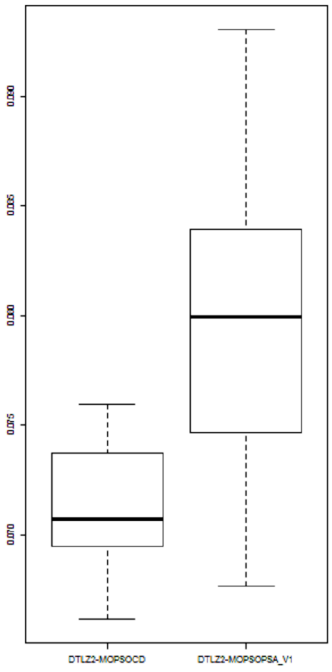
□□ □1□ "□□ performance measures on 20 runs□"



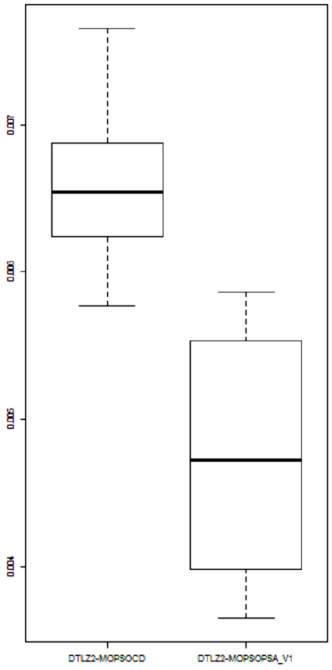

```
mat_□ob□ <- as.data.frame(mat)
```

```
ob□ <- □
mat <- perf_test(n, test_functions□□, test_functions_fronts□□, ob□=□, d=1□, pfpoints, al□_func=c(mopsocd, mopsopsa_v1))
titles = c('□□□□2-M□□□□□□□', '□□□□2-M□□□□□□□□_□1')
perf_boxplots(n, mat, titles)
```

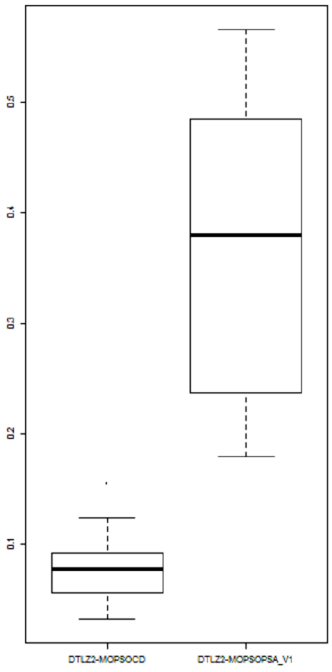
□□ □1□ "□□ performance measures on 20 runs□"



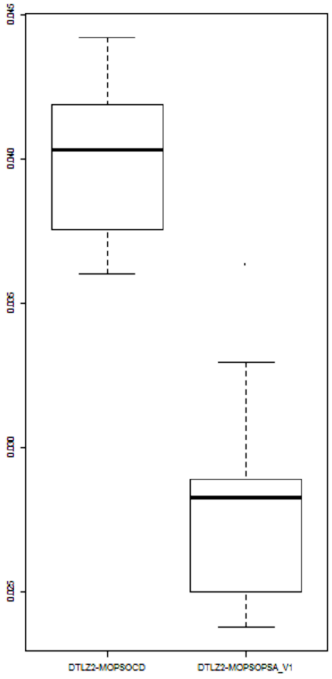
□□ □1□ "□□□ performance measures on 20 runs□"



□□ □1□ "□□ performance measures on 20 runs□"



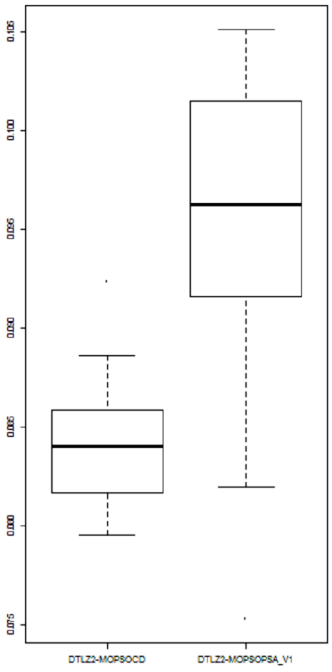

```
□□ □1□ "□□ performance measures on 20 runs□"
```



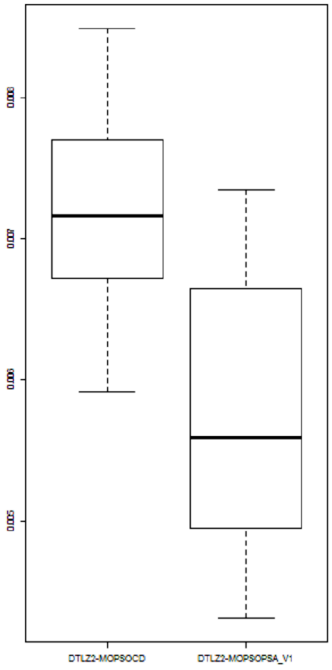

```
mat_□ob□ <- as.data.frame(mat)
```

```
ob□ <- □
mat <- perf_test(n, test_functions□□, test_functions_fronts□□, ob□=□, d=1□, pfpoints, al□_func=c(mopsocd, mopsopsa_v1))
titles = c('□□□□2-M□□□□□□□', '□□□□2-M□□□□□□□_□1')
perf_boxplots(n, mat, titles)
```

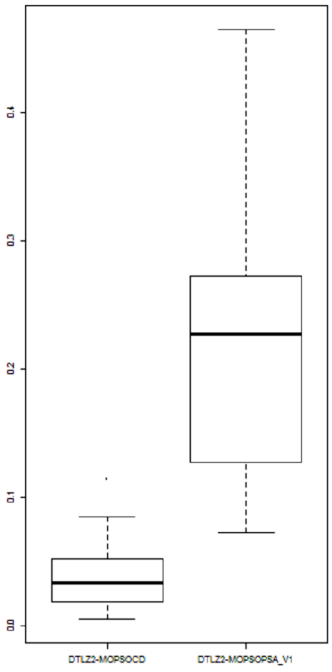
```
□□ □1□ "□□ performance measures on 20 runs□"
```



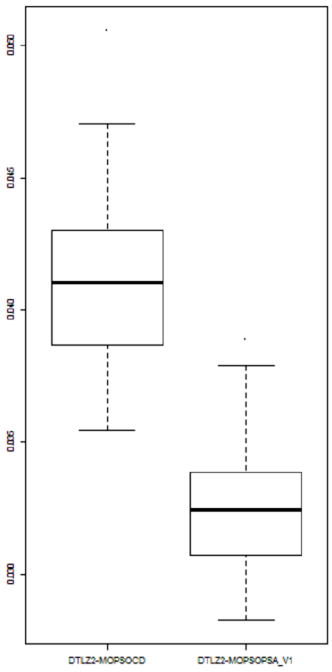
□□ □1□ "□□□ performance measures on 20 runs□"



□□ □1□ "□□ performance measures on 20 runs□"



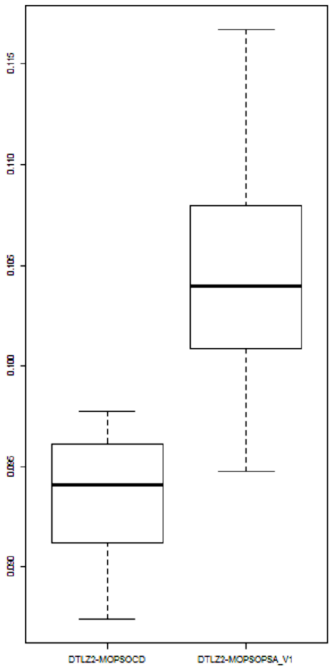
□□ □1□ "□□ performance measures on 20 runs□"



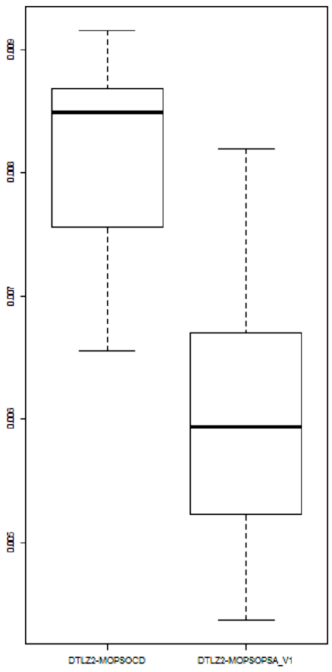

```
mat_□ob□ <- as.data.frame(mat)
```

```
ob□ <- □
mat <- perf_test(n, test_functions□□, test_functions_fronts□□, ob□=□, d=1□, pf_points, al□_func=c(mopsocd, mopsopsa_v1))
titles = c('□□□□2-M□□□□□□□', '□□□□2-M□□□□□□□_□1')
perf_boxplots(n, mat, titles)
```

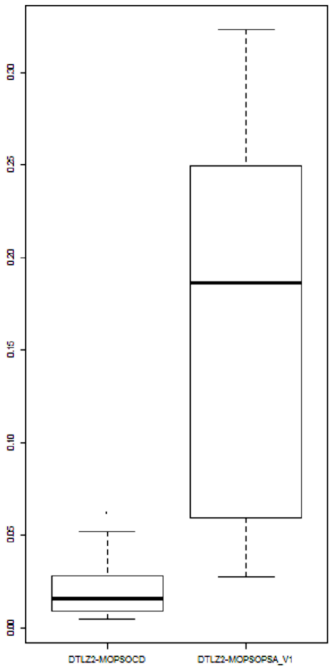
□□ □1□ "□□ performance measures on 20 runs□"



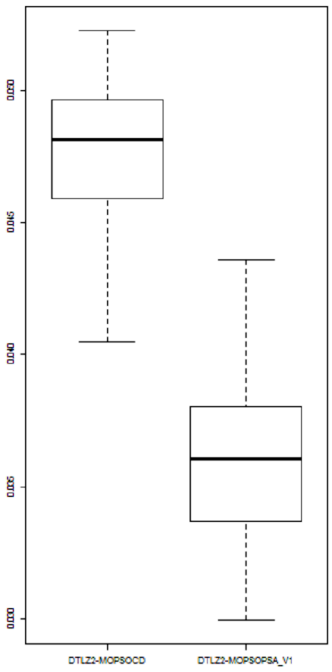
□□ □1□ "□□□ performance measures on 20 runs□"



□□ □1□ "□□ performance measures on 20 runs□"



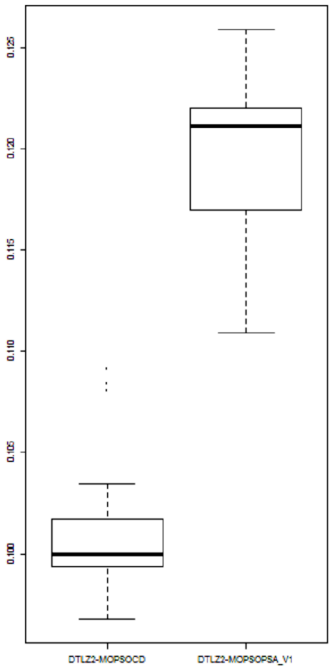
□□ □1□ "□□ performance measures on 20 runs□"



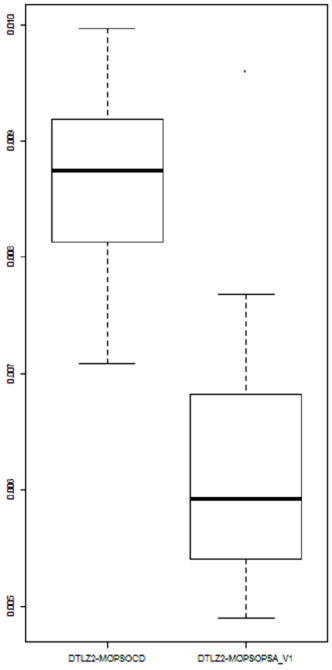

```
mat_□ob□ <- as.data.frame(mat)
```

```
ob□ <- 10
mat <- perf_test(n, test_functions10□, test_functions_fronts10□, ob□=10, d=1□, pfpoints, al□_func=c(mopsocd, mopsopsa_v1))
titles = c('□□□□2-M□□□□□□□', '□□□□2-M□□□□□□□□_□1')
perf_boxplots(n, mat, titles)
```

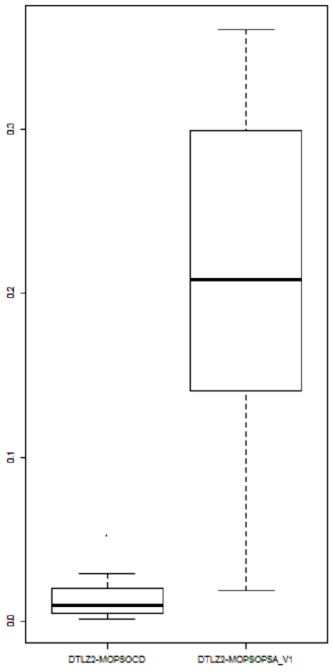
□□ □1□ "□□ performance measures on 20 runs□"



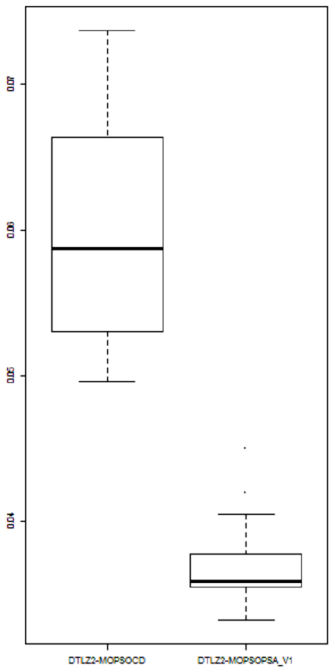
□□ □1□ "□□□ performance measures on 20 runs□"



□□ □1□ "□□ performance measures on 20 runs□"



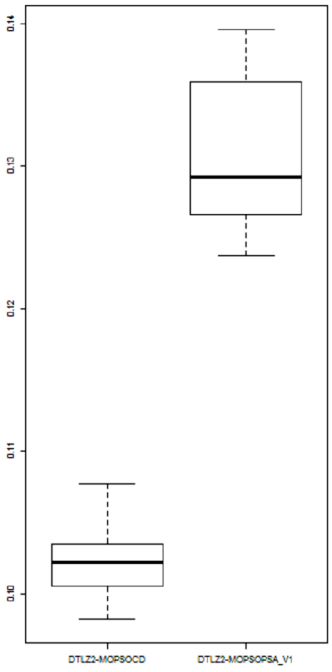

```
□□ □1□ "□□ performance measures on 20 runs□"
```



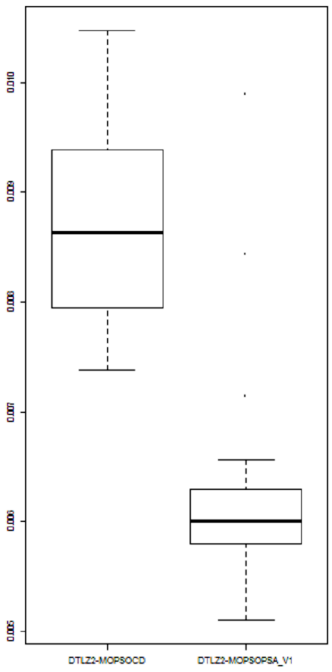

```
mat_10ob□ <- as.data.frame(mat)
```

```
ob□ <- 12
mat <- perf_test(n, test_functions12□, test_functions_fronts12□, ob□=12, d=21, pfpoints, al□_func=c(mopsocd, mopsopsa_v1))
titles = c('□□□□2-M□□□□□□□', '□□□□2-M□□□□□□□□_□1')
perf_boxplots(n, mat, titles)
```

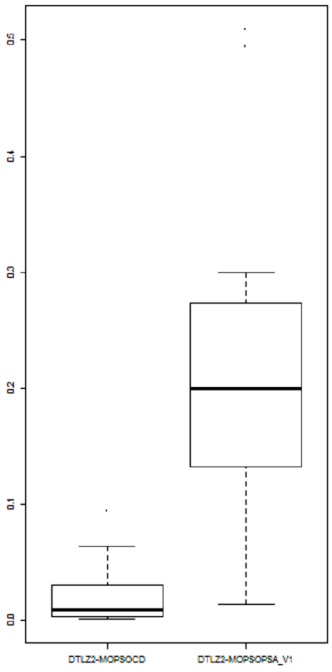
```
□□ □1□ "□□ performance measures on 20 runs□"
```



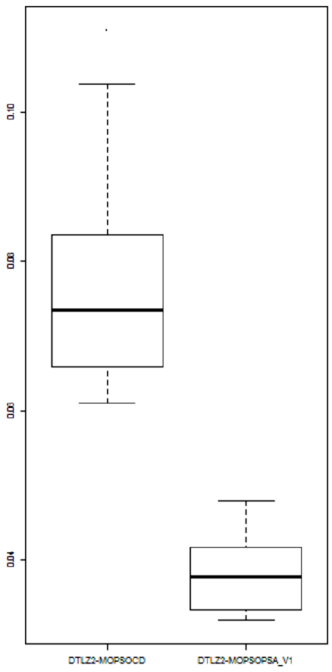
□□ □1□ "□□□ performance measures on 20 runs□"



□□ □1□ "□□ performance measures on 20 runs□"



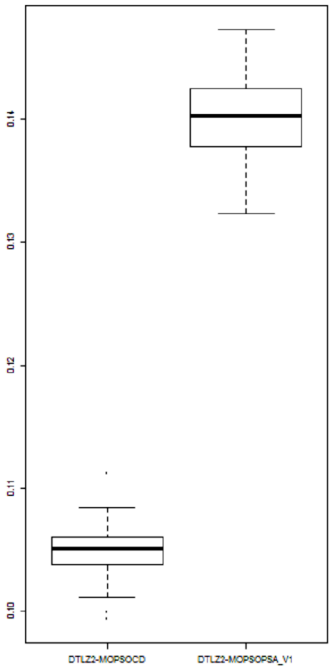
□□ □1□ "□□ performance measures on 20 runs□"



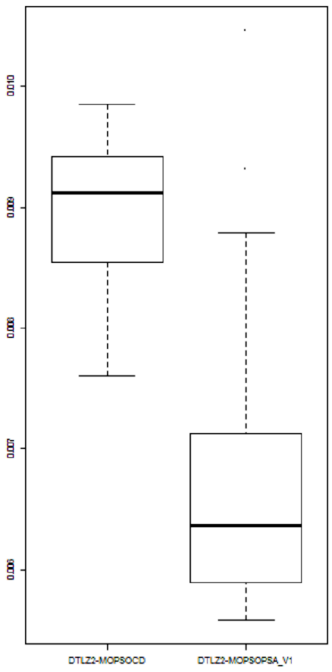

```
mat_12ob□ <- as.data.frame(mat)
```

```
ob□ <- 1□
mat <- perf_test(n, test_functions1□□, test_functions_fronts1□□, ob□=1□, d=2□, pfpoints, al□_func=c(mopsocd, mopsopsa_v1))
titles = c('□□□□2-M□□□□□□□', '□□□□2-M□□□□□□□_□1')
perf_boxplots(n, mat, titles)
```

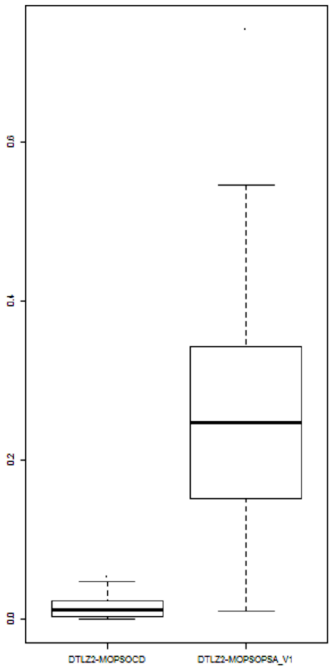
□□ □1□ "□□ performance measures on 20 runs□"



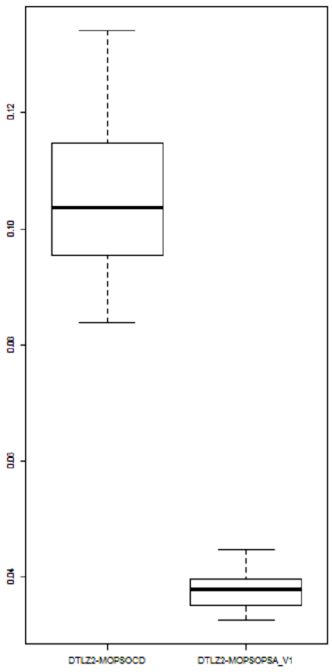
□□ □1□ "□□□ performance measures on 20 runs□"



□□ □1□ "□□ performance measures on 20 runs□"



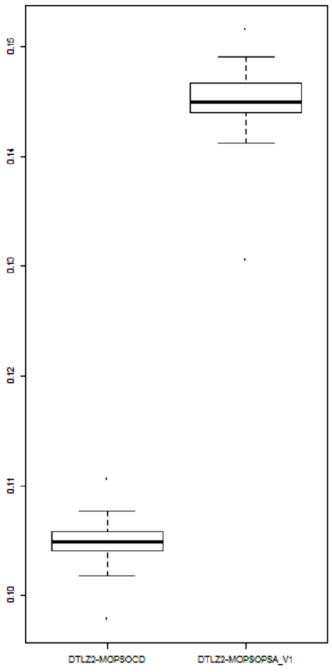

```
□□ □1□ "□□ performance measures on 20 runs□"
```



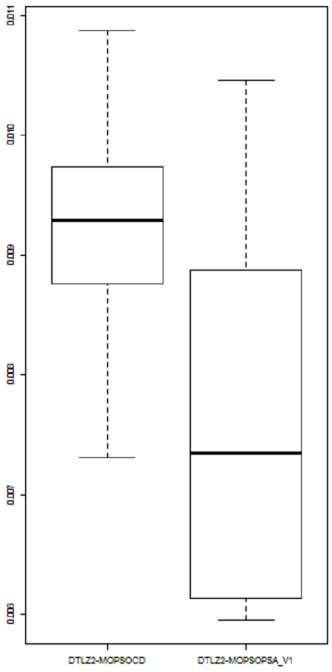

```
mat_1□ob□ <- as.data.frame(mat)
```

```
ob□ <- 1□
mat <- perf_test(n, test_functions1□□, test_functions_fronts1□□, ob□=1□, d=2□, pfpoints, al□_func=c(mopsocd, mopsopsa_v1))
titles = c('□□□□2-M□□□□□□', '□□□□2-M□□□□□□□_□1')
perf_boxplots(n, mat, titles)
```

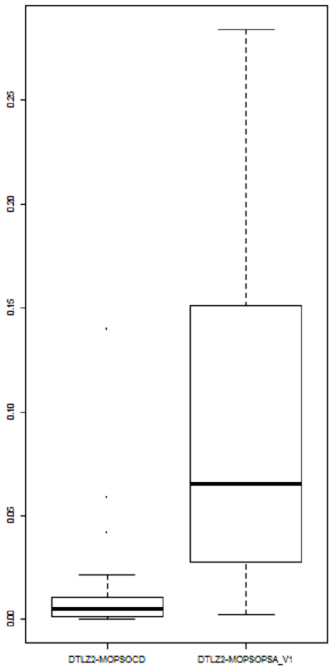
```
□□ □1□ "□□ performance measures on 20 runs□"
```



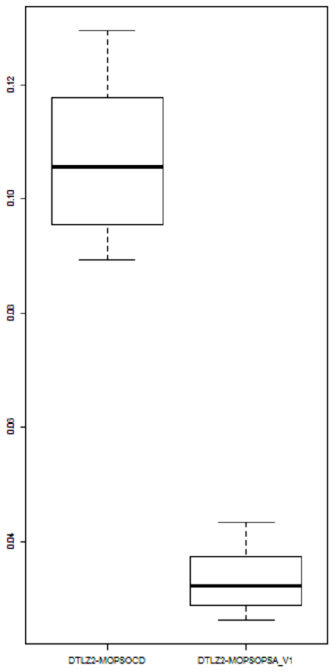
□□ □1□ "□□□ performance measures on 20 runs□"



□□ □1□ "□□ performance measures on 20 runs□"



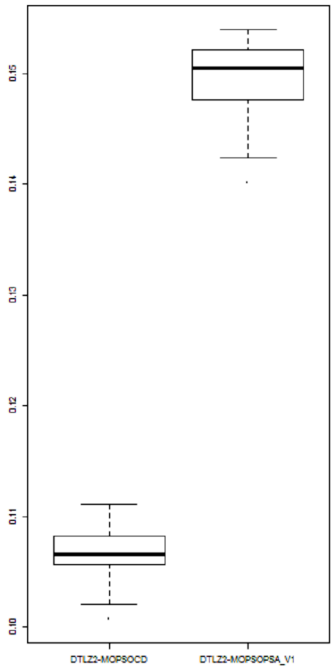
□□ □1□ "□□ performance measures on 20 runs□"



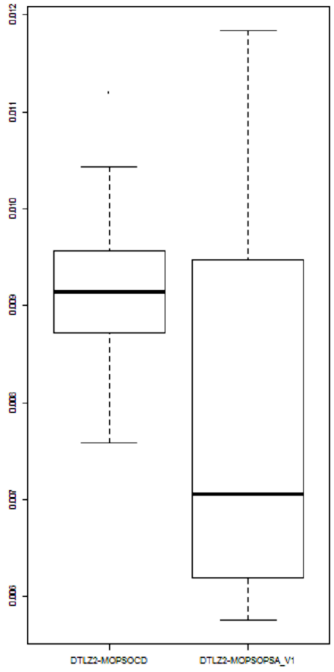

```
mat_1□ob□ <- as.data.frame(mat)
```

```
ob□ <- 20
mat <- perf_test(n, test_functions20□, test_functions_fronts20□, ob□=20, d=2□, pfpoints, al□_func=c(mopsocd, mopsopsa_v1))
titles = c('□□□□2-M□□□□□□', '□□□□2-M□□□□□□□_□1')
perf_boxplots(n, mat, titles)
```

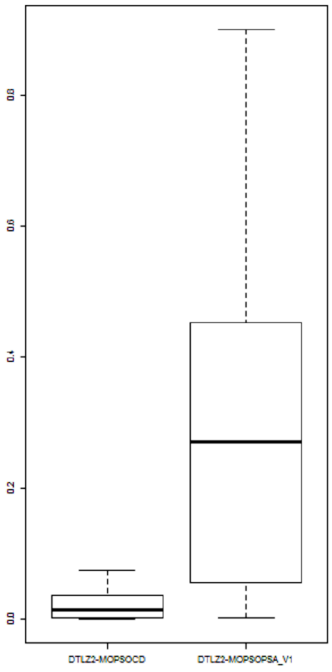
□□ □1□ "□□ performance measures on 20 runs□"



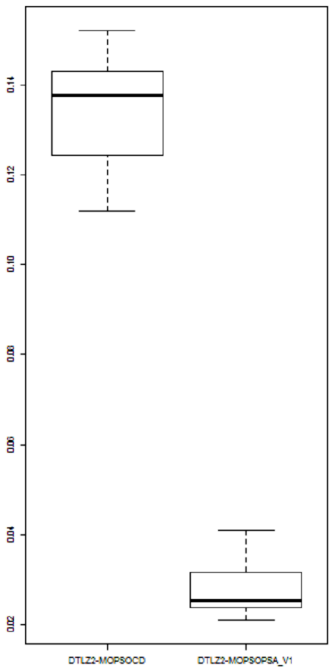
□□ □1□ "□□□ performance measures on 20 runs□"



□□ □1□ "□□ performance measures on 20 runs□"




```
□□ □1□ "□□ performance measures on 20 runs□"
```




```
mat_20ob□ <- as.data.frame(mat)
```