Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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Report of Experiment ExpC. 3-Symmetry: Replay.

Andreas Geyer-Schulz

May 11, 2025

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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Abstract

This experiment tests exact replication and stochastic replication for `xegaRun` of R-package xega. In the experiment, the 3-symmetry problem is solved by grammar-based genetic programming for fixed seeding and for Rs system seeding (option `replay` of `xegaRun`).

Contents I

1 Design of Experiment

2 Exploratory Analysis
- Do we **always** solve the 3 symmetry problem?
- Time of Treatments in Seconds
- Number of Generations of Treatments

3 Testing of Effects
- Exact Replicability
- Stochastic Replicability

4 A Summary

5 B Treatments
- Treatment BoolT1SGPreplayXIII
- Treatment BoolT1SGPreplayXIX
- Treatment BoolT1SGPreplayZa

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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Contents II

- Treatment BoolT1SGPreplayZb

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

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Definitions

Exact replicability of a computational experiment means that the experiment procudes in each trial **identical** numerical result.
Stochastic replicability of a computational experiment means that the experiment procudes in each trial the same expected result.

Description of Experiment

The purpose of this computational experiment is to show the difference between **exact** and **stochastic** replicability of the experiment.

The **problem environment** is the 3-symmetry problem: Finding a boolean expression (with and, or, and not) which is TRUE for symmetric 3-bit strings.

The **solution method** is grammar-based genetic programming (option algorithm="sgp" of xegaRun). The **solver** used is xegaRun from the R-package xega.

The experiment consists of 4 treatments, two for each choice of seeding.

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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Common Parameters of Experiment ExpC

	Parameter Value
Experiment	ExpC
Problem.Environment	3-Symmetry Problem
Optimize	Minimize!
Algorithm	sgp
Max.Depth.of.DTs	7
Grammar	AndOrNotTuned1.txt
Evaluation.Method	Deterministic
Execution.Model	MultiCore
Verbose	1
Semantics	byValue
Report.Eval.Errors	TRUE
Termination.Condition	AbsoluteError
Termination.Eps	-0.1
Worst.Fitness	-8
Gene.Map	Bin2Dec

Table: Common Parameters of Experiment ExpC (Part 1)

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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Common Parameters of Experiment ExpC

	Parameter Value
Init.Gene	InitGene
Codons	120
Codon.Precision	LCM
Population.Size	50
Max.Generations	5000
Crossover.Rate	0.2
Mutation.Rate	0.4
IV.Crossover.Rate	Const
Crossover.Rate.2	0.4
IV.Mutation.Rate	Const
Mutation.Rate.2	0.8

Table: Common Parameters of Experiment ExpC (Part 2)

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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Parameters of Treatments of Experiment ExpC

	Treatment	Trials	Replay
1	BoolT1SGPreplayXIII	50	13
2	BoolT1SGPreplayXIX	50	19
3	BoolT1SGPreplayZa	100	0
4	BoolT1SGPreplayZb	100	0

Table: Parameters of Treatments of Experiment ExpC

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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The Production Table of Experiment ExpC

	LHS	RHS
1	\<fe\>	\<f0\>
2	\<fe\>	\<f1\>(\<fe\>)
3	\<fe\>	\<f2\>(\<fe\>,\<fe\>)
4	\<fe\>	OR(AND(\<f0\>,\<f0\>),AND(NOT(\<f0\>),NOT(\<f0\>)))
5	\<f2\>	OR
6	\<f2\>	AND
7	\<f2\>	OR
8	\<f1\>	NOT
9	\<f0\>	D1
10	\<f0\>	D2
11	\<f0\>	D3

Table: The Production Table of Experiment ExpC

Design of Experiment
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Exploratory Analysis
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OOOO

Testing of Effects
OO
OOOOOO

A Summary
OO

B Treatments

C xega
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Treatments 1 and 2 test the seeding of the random number generator in xegaRun:

Repetition of a treatment should produce exactly the same result. But different seeds should lead to different results.

Treatments 3 and 4 use the system seed of the random number generator:

Repetitions produce random results.

We expect that for enough trials both treatments have the same mean performance.

Design of Experiment	Exploratory Analysis	Testing of Effects	A Summary	B Treatments	C xega
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Do we **always** solve the 3 symmetry problem?

Observation

In this experiment, the 3-symmetry problem is **always** correctly solved.
Evidence: In all trials of all treatments the optimal fitness of 0 was reached. See next table.

Andreas Geyer-Schulz

Report of Experiment ExpC. 3-Symmetry: Replay.

Design of Experiment   Exploratory Analysis   Testing of Effects   A Summary   B Treatments   C xega
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Do we **always** solve the 3 symmetry problem?

Fitness (Number of errors).

	Treatment	Trials	Variable	min	mean	sd	max
1	BoolT1SGPreplayXIII	50	Fitness	0.00	0.00	0.00	0.00
5	BoolT1SGPreplayXIX	50	Fitness	0.00	0.00	0.00	0.00
9	BoolT1SGPreplayZa	100	Fitness	0.00	0.00	0.00	0.00
13	BoolT1SGPreplayZb	100	Fitness	0.00	0.00	0.00	0.00

Table: Fitness (Number of errors).

3-Symmetry: Replay.

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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Time of Treatments in Seconds

Time (s).

	Treatment	Trials	Variable	min	mean	sd	max
2	BoolT1SGPreplayXIII	50	Seconds	0.10	0.12	0.02	0.22
6	BoolT1SGPreplayXIX	50	Seconds	0.17	0.19	0.01	0.23
10	BoolT1SGPreplayZa	100	Seconds	0.10	0.18	0.11	0.58
14	BoolT1SGPreplayZb	100	Seconds	0.10	0.16	0.08	0.60

Table: Time (s).

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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Time of Treatments in Seconds

3-Symmetry: Replay.

(Without outliers).

Design of Experiment	Exploratory Analysis	Testing of Effects	A Summary	B Treatments	C xega

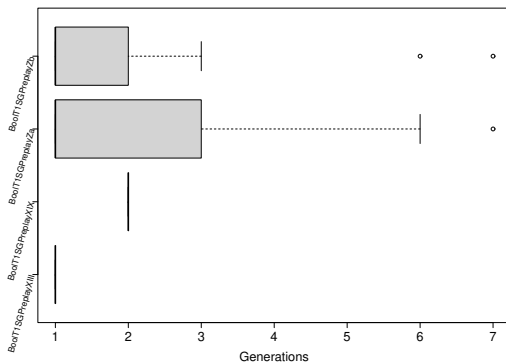Time of Treatments in Seconds
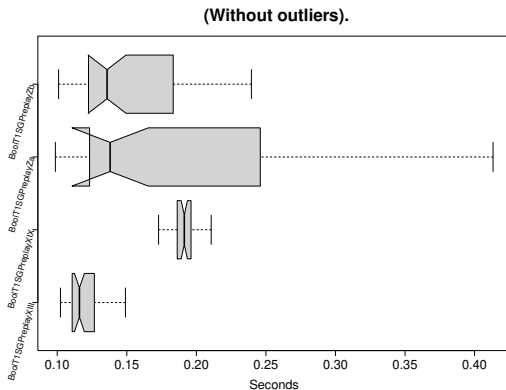
Conclusion

The execution time (in seconds) does not allow to identify deterministic results, because it may depend on other system activity e.g. I/O operations.
Evidence: The time variation in execution time for all treatments.

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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Number of Generations of Treatments

3-Symmetry: Replay.

Generations

	Treatment	Trials	Variable	min	mean	sd	max
3	BoolT1SGPreplayXIII	50	Generations	1.00	1.00	0.00	1.00
7	BoolT1SGPreplayXIX	50	Generations	2.00	2.00	0.00	2.00
11	BoolT1SGPreplayZa	100	Generations	1.00	1.84	1.43	7.00
15	BoolT1SGPreplayZb	100	Generations	1.00	1.60	1.21	7.00

Table: Generations

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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Number of Generations of Treatments

3-Symmetry: Replay.

(Without outliers).

Design of Experiment	Exploratory Analysis	Testing of Effects	A Summary	B Treatments	C xega
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Number of Generations of Treatments
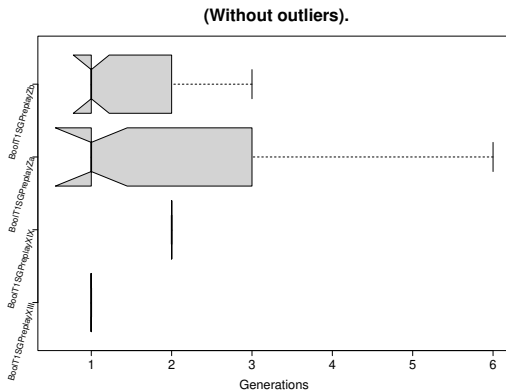
Observation

The number of generations needed allows to recognize randomness because of non-zero standard deviation.
The number of generations indicates determinism, if the standard deviation is 0.

Design of Experiment	Exploratory Analysis	Testing of Effects	A Summary	B Treatments	C xega
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	○○○○	○○○○○○			
	○○○○				

Exact Replicability

Distribution of the variable Generations for repeated trials.

	Treatment	Trials	Variable	min	mean	sd	max
3	BoolT1SGPreplayXIII	50	Generations	1.00	1.00	0.00	1.00
7	BoolT1SGPreplayXIX	50	Generations	2.00	2.00	0.00	2.00

Table: Distribution of the variable Generations for repeated trials.

Design of Experiment	Exploratory Analysis	Testing of Effects	A Summary	B Treatments	C xega
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Exact Replicability

Result

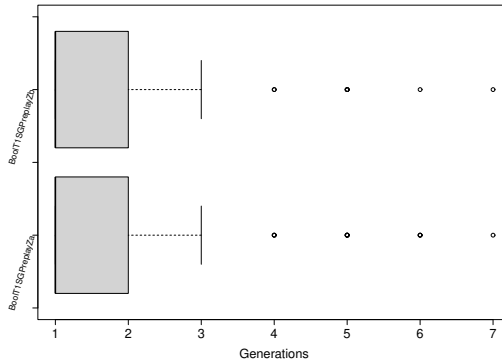Each treatment is deterministic.
Evidence:
The standard deviation *sd* of each treatment is 0.00 (for any number of trials).
Only 1 solution is found by repeated trials.
Different seeds (may) result in different results: One treatment needs 1 generation, the other 2 generations to reach the optimum.
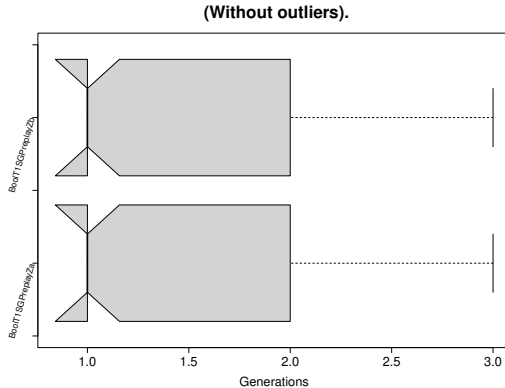
Design of Experiment   Exploratory Analysis   **Testing of Effects**   A Summary   B Treatments   C xega
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Stochastic Replicability

Comparing a treatment and its repetition. Hypothesis: Equal expected mean number of generations.

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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Stochastic Replicability

Comparing a treatment and its repetition. Hypothesis: Equal expected mean number of generations.

(Without outliers).

Design of Experiment Exploratory Analysis **Testing of Effects** A Summary B Treatments C xega
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Stochastic Replicability

Distribution of the variable Generations for repeated trials.

	Treatment	Trials	Variable	min	mean	sd	max
3	BoolT1SGPreplayZa	100	Generations	1.00	1.84	1.43	7.00
7	BoolT1SGPreplayZb	100	Generations	1.00	1.60	1.21	7.00

Table: Distribution of the variable Generations for repeated trials.

Design of Experiment	Exploratory Analysis	Testing of Effects	A Summary	B Treatments	C xega
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Stochastic Replicability

Test of H_0: Means of treatments BoolT1SGPreplayZa and BoolT1SGPreplayZb of variable Generations are equal.

For variable Generations of treatments BoolT1SGPreplayZa and BoolT1SGPreplayZb of experiment ExpC:

Hypothesis 0: mean(Generations of BoolT1SGPreplayZa)=1.84 - mean(Generations of BoolT1SGPreplayZb)=1.6 is equal to 0.

is tested at a significance level 0.05 against:

Hypothesis 1: mean(Generations of BoolT1SGPreplayZa)=1.84 - mean(Generations of BoolT1SGPreplayZb)=1.6 is not equal to 0.

Outliers of treatment BoolT1SGPreplayZa are not removed (coef=0).
Outliers of treatment BoolT1SGPreplayZb are not removed (coef=0).

The test-statistic W of the Wilcoxon rank sum test with continuity correction is 5382 with a p-value of 0.259 . Since the p-value 0.259 is above the significance level $\alpha = 0.05$, for variable Generations of treatments BoolT1SGPreplayZa and BoolT1SGPreplayZb of experiment ExpC **Hypothesis 0**: mean(Generations of BoolT1SGPreplayZa)=1.84 - mean(Generations of BoolT1SGPreplayZb)=1.6 is equal to 0. is **accepted**.

Design of Experiment	Exploratory Analysis	Testing of Effects	A Summary	B Treatments	C xega
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Stochastic Replicability

Test of H_0: Means of treatments BoolT1SGPreplayZa and BoolT1SGPreplayZb of variable Generations are equal.

For variable Generations of treatments BoolT1SGPreplayZa and BoolT1SGPreplayZb of experiment ExpC:

Hypothesis 0: mean(Generations of BoolT1SGPreplayZa)=1.39 - mean(Generations of BoolT1SGPreplayZb)=1.29 is equal to 0.

is tested at a significance level 0.05 against:

Hypothesis 1: mean(Generations of BoolT1SGPreplayZa)=1.39 - mean(Generations of BoolT1SGPreplayZb)=1.29 is not equal to 0.

12 outliers of treatment BoolT1SGPreplayZa are removed (coef=1.5).
8 outliers of treatment BoolT1SGPreplayZb are removed (coef=1.5).

The test-statistic W of the Wilcoxon rank sum test with continuity correction is 4228 with a p-value of 0.493 . Since the p-value 0.493 is above the significance level $\alpha = 0.05$, for variable Generations of treatments BoolT1SGPreplayZa and BoolT1SGPreplayZb of experiment ExpC **Hypothesis 0**: mean(Generations of BoolT1SGPreplayZa)=1.39 - mean(Generations of BoolT1SGPreplayZb)=1.29 is equal to 0. is **accepted**.

Design of Experiment	Exploratory Analysis	Testing of Effects	A Summary	B Treatments	C xega
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Stochastic Replicability

Result

Each treatment produces a sample drawn from the **same** random process.

Evidence:

The standard deviation *sd* of each treatment is **not** 0.00 (for any number of trials).

The treatments find 14 and 12 **different, but equivalent** boolean expressions. (See solution tables in section B Treatements.)

Different seeds (may) result in **different samples**:

The hypothesis test **supports** the conjecture that the sample means of the variable Generations of the treatments are equal.

This implies that the two treatments come from the same random process.

Summary of statistics of experiment ExpC.

	Treatment	Trials	Variable	min	mean	sd	max
4	BoolT1SGPreplayXIII	50	Evaluations	50.00	50.00	0.00	50.00
8	BoolT1SGPreplayXIX	50	Evaluations	100.00	100.00	0.00	100.00
12	BoolT1SGPreplayZa	100	Evaluations	50.00	92.00	71.68	350.00
16	BoolT1SGPreplayZb	100	Evaluations	50.00	80.00	60.72	350.00
1	BoolT1SGPreplayXIII	50	Fitness	0.00	0.00	0.00	0.00
5	BoolT1SGPreplayXIX	50	Fitness	0.00	0.00	0.00	0.00
9	BoolT1SGPreplayZa	100	Fitness	0.00	0.00	0.00	0.00
13	BoolT1SGPreplayZb	100	Fitness	0.00	0.00	0.00	0.00
3	BoolT1SGPreplayXIII	50	Generations	1.00	1.00	0.00	1.00
7	BoolT1SGPreplayXIX	50	Generations	2.00	2.00	0.00	2.00
11	BoolT1SGPreplayZa	100	Generations	1.00	1.84	1.43	7.00
15	BoolT1SGPreplayZb	100	Generations	1.00	1.60	1.21	7.00
2	BoolT1SGPreplayXIII	50	Seconds	0.10	0.12	0.02	0.22
6	BoolT1SGPreplayXIX	50	Seconds	0.17	0.19	0.01	0.23
10	BoolT1SGPreplayZa	100	Seconds	0.10	0.18	0.11	0.58

Table: Summary of statistics of experiment ExpC. (Part 1)

Summary of statistics of experiment ExpC.

	Treatment	Trials	Variable	min	mean	sd	max
14	BoolT1SGPreplayZb	100	Seconds	0.10	0.16	0.08	0.60

Table: Summary of statistics of experiment ExpC. (Part 2)

Treatment BoolT1SGPreplayXIII

Parameters of treatment: BoolT1SGPreplayXIII

	Parameter Values
tRNG	L'Ecuyer-CMRG Inversion Rejection
tReplay	0
experimentName	ExpC
treatmentName	BoolT1SGPreplayXIII
trials	50
everyK	10
outpath	data
batchPath	.
tVerbose	1

Table: Parameters of treatment: BoolT1SGPreplayXIII

Treatment BoolT1SGPreplayXIII

Parameters of treatment BoolT1SGPreplayXIII passed to xegaRun

	Parameter Values
penv	3-Symmetry Problem
grammar	/home/dj2333/dev/cran/kSymmetry/BNF/AndOrNotTuned1.txt
replay	13
algorithm	sgp
maxdepth	7
max	FALSE
worstFitness	-8
popsize	50
generations	5000
crossrate	0.2
mutrate	0.4
ivmutrate	Const
mutrate2	0.8
ivcrossrate	Const
crossrate2	0.4

Table: Parameters of treatment BoolT1SGPreplayXIII passed to xegaRun
(Part 1)

Design of Experiment ○○○○○○○ Exploratory Analysis ○○ ○○○○ Testing of Effects ○○ ○○○○○○ A Summary ○○ **B Treatments** C xega ○○○○○○

Treatment BoolT1SGPreplayXIII

Parameters of treatment BoolT1SGPreplayXIII passed to xegaRun

	Parameter Values
scalefactor	Uniform
genemap	Bin2Dec
initgene	InitGene
selection	SUS
mateselection	SUS
replication	Kid2
crossover	Cross2Gene
mutation	MutateGene
accept	All
reportEvalErrors	TRUE
codons	120
codonPrecision	LCM
terminationEps	-0.1
terminationCondition	AbsoluteError
evalmethod	Deterministic

Table: Parameters of treatment BoolT1SGPreplayXIII passed to xegaRun (Part 2)

Design of Experiment ○○○○○○○   Exploratory Analysis ○○ ○○○○ ○○○○   Testing of Effects ○○ ○○○○○○   A Summary ○○   **B Treatments**   C xega ○○○○○○

Treatment BoolT1SGPreplayXIII

Parameters of treatment BoolT1SGPreplayXIII passed to xegaRun

	Parameter Values
executionModel	MultiCore
verbose	1
batch	FALSE
semantics	byValue
path	.

Table: Parameters of treatment BoolT1SGPreplayXIII passed to xegaRun (Part 3)

Design of Experiment ○○○○○○○   Exploratory Analysis ○○ ○○○○ ○○○○   Testing of Effects ○○ ○○○○○○   A Summary ○○   **B Treatments**   C xega ○○○○○○

Treatment BoolT1SGPreplayXIII

Treatment: BoolT1SGPreplayXIII

	Treatment	Trials	Variable	min	mean	sd	max
4	BoolT1SGPreplayXIII	50	Evaluations	50.00	50.00	0.00	50.00
1	BoolT1SGPreplayXIII	50	Fitness	0.00	0.00	0.00	0.00
3	BoolT1SGPreplayXIII	50	Generations	1.00	1.00	0.00	1.00
2	BoolT1SGPreplayXIII	50	Seconds	0.10	0.12	0.02	0.22

Table: Treatment: BoolT1SGPreplayXIII

Design of Experiment ○○○○○○○ | Exploratory Analysis ○○ ○○○○ ○○○○ | Testing of Effects ○○ ○○○○○○ | A Summary ○○ | B Treatments | C xega ○○○○○○

Treatment BoolT1SGPreplayXIII
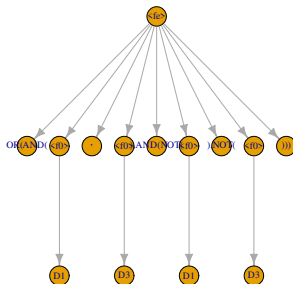
The Solution Table of Treatment BoolT1SGPreplayXIII of Experiment ExpC. Fit: 0. Unique Shortest Solutions: 1.

	Solution
1	OR(AND(D1, D3), AND(NOT(D1), NOT(D3)))

Table: The Solution Table of Treatment BoolT1SGPreplayXIII of Experiment ExpC. Fit: 0. Unique Shortest Solutions: 1.

The Derivation Tree of a Solution of Treatment BoolT1SGPreplayXIII of Experiment ExpC

Design of Experiment
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Exploratory Analysis
oo
oooo
oooo

Testing of Effects
oo
oooooo

A Summary
oo

B Treatments
oooooo

C xega
oooooo

Treatment BoolT1SGPreplayXIII

Plot of last xegaRun for Treatment BoolT1SGPreplayXIII of Experiment ExpC

Minimize Population Fitness: 3–Symmetry Problem

| Design of Experiment | Exploratory Analysis | Testing of Effects | A Summary | B Treatments | C xega |
| ○○○○○○○ | ○○○ ○○○○ ○○○○ | ○○ ○○○○○○ | ○○ | **B Treatments** | ○○○○○○ |
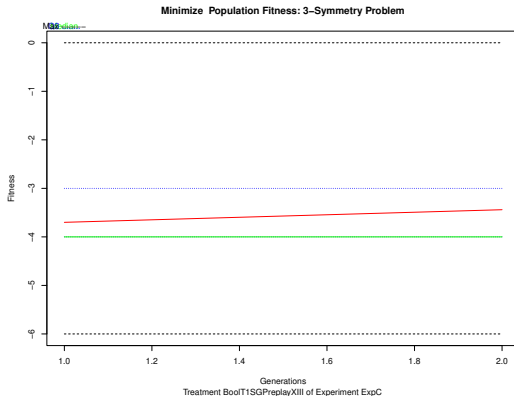
Treatment BoolT1SGPreplayXIX

Parameters of treatment: BoolT1SGPreplayXIX

	Parameter Values
tRNG	L'Ecuyer-CMRG Inversion Rejection
tReplay	0
experimentName	ExpC
treatmentName	BoolT1SGPreplayXIX
trials	50
everyK	10
outpath	data
batchPath	.
tVerbose	1

Table: Parameters of treatment: BoolT1SGPreplayXIX

Parameters of treatment BoolT1SGPreplayXIX passed to xegaRun

	Parameter Values
penv	3-Symmetry Problem
grammar	/home/dj2333/dev/cran/kSymmetry/BNF/AndOrNotTuned1.txt
replay	19
algorithm	sgp
maxdepth	7
max	FALSE
worstFitness	-8
popsize	50
generations	5000
crossrate	0.2
mutrate	0.4
ivmutrate	Const
mutrate2	0.8
ivcrossrate	Const
crossrate2	0.4

Table: Parameters of treatment BoolT1SGPreplayXIX passed to xegaRun
(Part 1)

Treatment BoolT1SGPreplayXIX

Parameters of treatment BoolT1SGPreplayXIX passed to xegaRun

	Parameter Values
scalefactor	Uniform
genemap	Bin2Dec
initgene	InitGene
selection	SUS
mateselection	SUS
replication	Kid2
crossover	Cross2Gene
mutation	MutateGene
accept	All
reportEvalErrors	TRUE
codons	120
codonPrecision	LCM
terminationEps	-0.1
terminationCondition	AbsoluteError
evalmethod	Deterministic

Table: Parameters of treatment BoolT1SGPreplayXIX passed to xegaRun (Part 2)

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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○○○○○○

A Summary
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B Treatments
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C xega
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Treatment BoolT1SGPreplayXIX

Parameters of treatment BoolT1SGPreplayXIX passed to xegaRun

	Parameter Values
executionModel	MultiCore
verbose	1
batch	FALSE
semantics	byValue
path	.

Table: Parameters of treatment BoolT1SGPreplayXIX passed to xegaRun (Part 3)

Design of Experiment ○○○○○○○   Exploratory Analysis ○○ ○○○○ ○○○○   Testing of Effects ○○ ○○○○○○   A Summary ○○   **B Treatments**   C xega ○○○○○○

Treatment BoolT1SGPreplayXIX

Treatment: BoolT1SGPreplayXIX

	Treatment	Trials	Variable	min	mean	sd	max
8	BoolT1SGPreplayXIX	50	Evaluations	100.00	100.00	0.00	100.00
5	BoolT1SGPreplayXIX	50	Fitness	0.00	0.00	0.00	0.00
7	BoolT1SGPreplayXIX	50	Generations	2.00	2.00	0.00	2.00
6	BoolT1SGPreplayXIX	50	Seconds	0.17	0.19	0.01	0.23

Table: Treatment: BoolT1SGPreplayXIX

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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Treatment BoolT1SGPreplayXIX

The Solution Table of Treatment BoolT1SGPreplayXIX of Experiment ExpC. Fit: 0.
Unique Shortest Solutions: 1.

	Solution
1	AND(NOT(NOT(OR(AND(D1, D1), AND(NOT(D1), NOT(D3))))), OR(AND(D3, D1), AND(NOT(D3), NOT(D1))))

Table: The Solution Table of Treatment BoolT1SGPreplayXIX of
Experiment ExpC. Fit: 0. Unique Shortest Solutions: 1.

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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OOOOOO

A Summary
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B Treatments
OOOOOO

C xega
OOOOOO

Treatment BoolT1SGPreplayXIX

The Derivation Tree of a Solution of Treatment BoolT1SGPreplayXIX of Experiment ExpC

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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○○○○○○

A Summary
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B Treatments
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C xega
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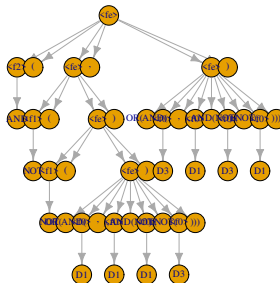
Treatment BoolT1SGPreplayXIX

Plot of last xegaRun for Treatment BoolT1SGPreplayXIX of Experiment ExpC

Treatment BoolT1SGPreplayXIX of Experiment ExpC

Design of Experiment   Exploratory Analysis   Testing of Effects   A Summary   **B Treatments**   C xega
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                        ○○○○   ○○○○○○
                        ○○○○
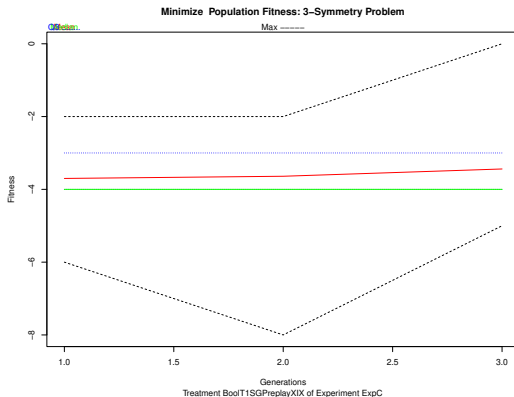
Treatment BoolT1SGPreplayZa

Parameters of treatment: BoolT1SGPreplayZa

	Parameter Values
tRNG	L'Ecuyer-CMRG Inversion Rejection
tReplay	0
experimentName	ExpC
treatmentName	BoolT1SGPreplayZa
trials	100
everyK	10
outpath	data
batchPath	.
tVerbose	1

Table: Parameters of treatment: BoolT1SGPreplayZa

Treatment BoolT1SGPreplayZa

Parameters of treatment BoolT1SGPreplayZa passed to xegaRun

	Parameter Values
penv	3-Symmetry Problem
grammar	/home/dj2333/dev/cran/kSymmetry/BNF/AndOrNotTuned1.txt
replay	0
algorithm	sgp
maxdepth	7
max	FALSE
worstFitness	-8
popsize	50
generations	5000
crossrate	0.2
mutrate	0.4
ivmutrate	Const
mutrate2	0.8
ivcrossrate	Const
crossrate2	0.4

Table: Parameters of treatment BoolT1SGPreplayZa passed to xegaRun (Part 1)

Treatment BoolT1SGPreplayZa

Parameters of treatment BoolT1SGPreplayZa passed to xegaRun

	Parameter Values
scalefactor	Uniform
genemap	Bin2Dec
initgene	InitGene
selection	SUS
mateselection	SUS
replication	Kid2
crossover	Cross2Gene
mutation	MutateGene
accept	All
reportEvalErrors	TRUE
codons	120
codonPrecision	LCM
terminationEps	-0.1
terminationCondition	AbsoluteError
evalmethod	Deterministic

Table: Parameters of treatment BoolT1SGPreplayZa passed to xegaRun
(Part 2)

Design of Experiment   Exploratory Analysis   Testing of Effects   A Summary   B Treatments   C xega
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                     ○○○○   ○○○○○○
                     ○○○○

Treatment BoolT1SGPreplayZa

Parameters of treatment BoolT1SGPreplayZa passed to xegaRun

	Parameter Values
executionModel	MultiCore
verbose	1
batch	FALSE
semantics	byValue
path	.

Table: Parameters of treatment BoolT1SGPreplayZa passed to xegaRun (Part 3)

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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Treatment BoolT1SGPreplayZa

Treatment: BoolT1SGPreplayZa

	Treatment	Trials	Variable	min	mean	sd	max
12	BoolT1SGPreplayZa	100	Evaluations	50.00	92.00	71.68	350.00
9	BoolT1SGPreplayZa	100	Fitness	0.00	0.00	0.00	0.00
11	BoolT1SGPreplayZa	100	Generations	1.00	1.84	1.43	7.00
10	BoolT1SGPreplayZa	100	Seconds	0.10	0.18	0.11	0.58

Table: Treatment: BoolT1SGPreplayZa

Treatment BoolT1SGPreplayZa

The Solution Table of Treatment BoolT1SGPreplayZa of Experiment ExpC. Fit: 0. Unique Shortest Solutions: 14.

	Solution
1	OR(AND(D3, D1), AND(NOT(D1), NOT(D3)))

Table: The Solution Table of Treatment BoolT1SGPreplayZa of Experiment ExpC. Fit: 0. Unique Shortest Solutions: 14.

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments
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C xega
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Treatment BoolT1SGPreplayZa

The Derivation Tree of a Solution of Treatment BoolT1SGPreplayZa of Experiment ExpC

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments
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C xega
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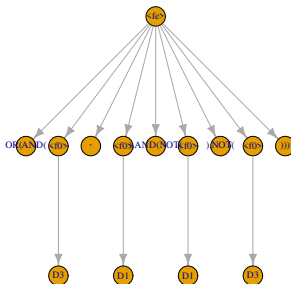
Treatment BoolT1SGPreplayZa

Plot of last xegaRun for Treatment BoolT1SGPreplayZa of Experiment ExpC
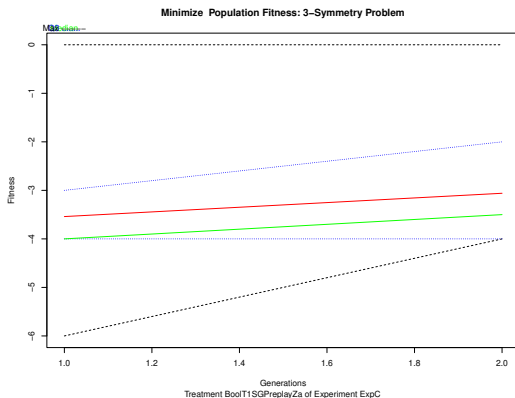
Treatment BoolT1SGPreplayZb

Parameters of treatment: BoolT1SGPreplayZb

	Parameter Values
tRNG	L'Ecuyer-CMRG Inversion Rejection
tReplay	0
experimentName	ExpC
treatmentName	BoolT1SGPreplayZb
trials	100
everyK	10
outpath	data
batchPath	.
tVerbose	1

Table: Parameters of treatment: BoolT1SGPreplayZb

Treatment BoolT1SGPreplayZb

Parameters of treatment BoolT1SGPreplayZb passed to xegaRun

	Parameter Values
penv	3-Symmetry Problem
grammar	/home/dj2333/dev/cran/kSymmetry/BNF/AndOrNotTuned1.txt
replay	0
algorithm	sgp
maxdepth	7
max	FALSE
worstFitness	-8
popsize	50
generations	5000
crossrate	0.2
mutrate	0.4
ivmutrate	Const
mutrate2	0.8
ivcrossrate	Const
crossrate2	0.4

Table: Parameters of treatment BoolT1SGPreplayZb passed to xegaRun (Part 1)

Treatment BoolT1SGPreplayZb

Parameters of treatment BoolT1SGPreplayZb passed to xegaRun

	Parameter Values
scalefactor	Uniform
genemap	Bin2Dec
initgene	InitGene
selection	SUS
mateselection	SUS
replication	Kid2
crossover	Cross2Gene
mutation	MutateGene
accept	All
reportEvalErrors	TRUE
codons	120
codonPrecision	LCM
terminationEps	-0.1
terminationCondition	AbsoluteError
evalmethod	Deterministic

Table: Parameters of treatment BoolT1SGPreplayZb passed to xegaRun (Part 2)

Design of Experiment ○○○○○○○ Exploratory Analysis ○○ ○○○○ ○○○○ Testing of Effects ○○ ○○○○○○ A Summary ○○ **B Treatments** C xega ○○○○○○

Treatment BoolT1SGPreplayZb

Parameters of treatment BoolT1SGPreplayZb passed to xegaRun

	Parameter Values
executionModel	MultiCore
verbose	1
batch	FALSE
semantics	byValue
path	.

Table: Parameters of treatment BoolT1SGPreplayZb passed to xegaRun (Part 3)

Design of Experiment ○○○○○○○ Exploratory Analysis ○○ ○○○○ ○○○○ Testing of Effects ○○ ○○○○○○ A Summary ○○ **B Treatments** C xega ○○○○○○

Treatment BoolT1SGPreplayZb

Treatment: BoolT1SGPreplayZb

	Treatment	Trials	Variable	min	mean	sd	max
16	BoolT1SGPreplayZb	100	Evaluations	50.00	80.00	60.72	350.00
13	BoolT1SGPreplayZb	100	Fitness	0.00	0.00	0.00	0.00
15	BoolT1SGPreplayZb	100	Generations	1.00	1.60	1.21	7.00
14	BoolT1SGPreplayZb	100	Seconds	0.10	0.16	0.08	0.60

Table: Treatment: BoolT1SGPreplayZb

Treatment BoolT1SGPreplayZb

The Solution Table of Treatment BoolT1SGPreplayZb of Experiment ExpC. Fit: 0. Unique Shortest Solutions: 12.

	Solution
1	OR(AND(D3, D1), AND(NOT(D1), NOT(D3)))

Table: The Solution Table of Treatment BoolT1SGPreplayZb of Experiment ExpC. Fit: 0. Unique Shortest Solutions: 12.

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments
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C xega
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Treatment BoolT1SGPreplayZb

The Derivation Tree of a Solution of Treatment BoolT1SGPreplayZb of Experiment ExpC

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments
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C xega
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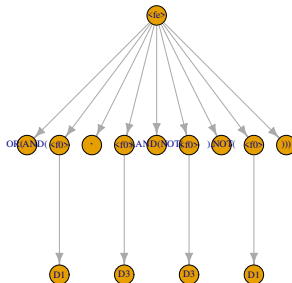
Treatment BoolT1SGPreplayZb

Plot of last xegaRun for Treatment BoolT1SGPreplayZb of Experiment ExpC
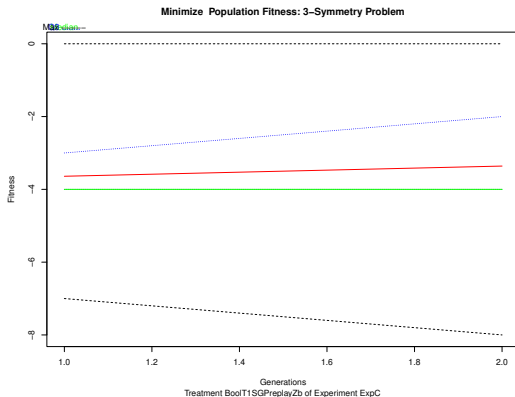
Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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All parameters of xegaRun of treatment BoolT1SGPreplayXIII

	Parameter Values
penv	3-Symmetry Problem
grammar	/home/dj2333/dev/cran/kSymmetry/BNF/AndOrNotTuned1.txt
max	FALSE
algorithm	sgp
popsize	50
generations	5000
crossrate	0.2
mutrate	0.4
elitist	TRUE
replay	13
maxdepth	7
maxtrials	5
codons	120
codonBits	0
codonPrecision	LCM

Table: All parameters of xegaRun of treatment BoolT1SGPreplayXIII
(Part 1)

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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All parameters of xegaRun of treatment BoolT1SGPreplayXIII

	Parameter Values
maxPBias	0.01
evalmethod	Deterministic
evalrep	1
reportEvalErrors	TRUE
genemap	Bin2Dec
decoder	DecodeGene
crossrate2	0.4
ivcrossrate	Const
crossover	Cross2Gene
uCrossSwap	0.2
mincrossdepth	1
maxcrossdepth	7
ivmutrate	Const
mutrate2	0.8
bitmutrate	0.005

Table: All parameters of xegaRun of treatment BoolT1SGPreplayXIII
(Part 2)

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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All parameters of xegaRun of treatment BoolT1SGPreplayXIII

	Parameter Values
bitmutrate2	0.01
maxmutdepth	3
minmutinsertiondepth	1
maxmutinsertiondepth	7
lambda	0.05
max2opt	100
scalefactor1	0.9
scalefactor2	0.3
scalefactor	Uniform
cutoffFit	0.5
mutation	MutateGene
replication	Kid2
initgene	InitGene
offset	1
eps	0.01

Table: All parameters of xegaRun of treatment BoolT1SGPreplayXIII (Part 3)

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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All parameters of xegaRun of treatment BoolT1SGPreplayXIII

	Parameter Values
tournamentSize	2
selectionBias	1.5
maxTSR	1.5
selection	SUS
mateselection	SUS
selectionContinuation	TRUE
scaling	NoScaling
scalingThreshold	0
scalingExp	1
scalingExp2	1
rdmWeight	1
drMax	2
drMin	0.5
dispersionMeasure	var
scalingDelay	1

Table: All parameters of xegaRun of treatment BoolT1SGPreplayXIII (Part 4)

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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A Summary
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B Treatments

C xega
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All parameters of xegaRun of treatment BoolT1SGPreplayXIII

	Parameter Values
accept	All
alpha	0.99
beta	2
cooling	ExponentialMultiplicative
coolingPower	1
temp0	40
tempN	0.01
verbose	1
logevals	FALSE
allsolutions	FALSE
early	FALSE
terminationCondition	AbsoluteError
terminationEps	-0.1
terminationThreshold	0
worstFitness	-8

Table: All parameters of xegaRun of treatment BoolT1SGPreplayXIII (Part 5)

Design of Experiment
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Exploratory Analysis
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Testing of Effects
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○○○○○○

A Summary
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B Treatments

C xega
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All parameters of xegaRun of treatment BoolT1SGPreplayXIII

	Parameter Values
PACdelta	0.01
fSpace	Hilbert
cores	16
executionModel	MultiCore
uParApply	NULL
Cluster	NULL
profile	FALSE
batch	FALSE
path	.
semantics	byValue

Table: All parameters of xegaRun of treatment BoolT1SGPreplayXIII
(Part 6)