Package ‘cec2005benchmark’

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Title Benchmark for the CEC 2005 Special Session on Real-Parameter Optimization
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Description This package is a wrapper for the C implementation of the 25 benchmark functions for the CEC 2005 Special Session on Real-Parameter Optimization. The original C code by Santosh Tiwari and related documentation are available at http://www.ntu.edu.sg/home/EPNSugan/index_files/CEC-05/CEC05.htm.
License GPL (>= 3)
URL https://github.com/yasserglez/cec2005benchmark
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**Description**

Common interface to all benchmark functions

**Usage**

`cec2005benchmark(i, x)`

**Arguments**

- `i` Function number between 1 and 25
- `x` Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

**Value**

A vector with the evaluation of the function for each row of `x`

**References**

Function Number 1

Description

Shifted Sphere Function

- \( x \in [-100, 100]^D \)
- Global optimum \( F(x^*) = -450 \)

Usage

`cecs05benchmark1(x)`

Arguments

- `x` Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of `x`

References


See Also

- `cecs05benchmark`

Examples

`cecs05benchmark1(runif(10, -100, 100))`
Function Number 10

Description

Shifted Rotated Rastrigin’s Function

- \( x \in [-5, 5]^D \)
- Global optimum \( F(x^*) = -330 \)

Usage

\( \text{cec2005benchmark10}(x) \)

Arguments

\( x \)

Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of \( x \)

References


See Also

\( \text{cec2005benchmark} \)

Examples

\( \text{cec2005benchmark10}(\text{runif}(10, -5, 5)) \)
Function Number 11

Description

Shifted Rotated Weierstrass Function

- \( x \in [-0.5, 0.5]^D \)
- Global optimum \( F(x^*) = 90 \)

Usage

`cec2005benchmark11(x)`

Arguments

- \( x \)
  - Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

- A vector with the evaluation of the function for each row of \( x \)

References


See Also

- `cec2005benchmark`

Examples

- `cec2005benchmark11(runif(10, -0.5, 0.5))`
Schwefel’s Problem 2.13

- $x \in [-\pi, \pi]^D$
- Global optimum $F(x^*) = -460$

Usage

`cec2005benchmark12(x)`

Arguments

$x$ Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of $x$

References


See Also

`cec2005benchmark`

Examples

`cec2005benchmark12(runif(10, -pi, pi))`
Description

Shifted Expanded Griewank’s plus Rosenbrock’s Function (F8F2)

- \( x \in [-5,5]^D \)
- Global optimum \( F(x^*) = -130 \)

Usage

\[ \text{cec2005benchmark13}(x) \]

Arguments

- \( x \)
  
  Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of \( x \)

References


See Also

- \texttt{cec2005benchmark}

Examples

\[ \text{cec2005benchmark13}(\text{runif}(10, -5, 5)) \]
As shown in the image, the document contains the description of a mathematical function. Here is a structured representation of the content:

### Definition

**Function Number 14**

**Description**

Shifted Rotated Expanded Scaffer’s F6 Function

- $x \in [-100, 100]^D$
- Global optimum $F(x^*) = -300$

**Usage**

`cec2005benchmark14(x)`

**Arguments**

- **x**: Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated.

**Value**

A vector with the evaluation of the function for each row of **x**

**References**


**See Also**

`cec2005benchmark`

**Examples**

`cec2005benchmark14(runif(10, -100, 100))`
Function Number 15

Description

Hybrid Composition Function

- \( x \in [-5, 5]^D \)
- Global optimum \( F(x^*) = 120 \)

Usage

\texttt{cec2005benchmark15(x)}

Arguments

\( x \)
Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of \( x \)

References


See Also

\texttt{cec2005benchmark}

Examples

\texttt{cec2005benchmark15(runif(10, -5, 5))}
cec2005benchmark16 Function Number 16

Description

Rotated Version of Hybrid Composition Function F15

- \( x \in [-5, 5]^D \)
- Global optimum \( F(x^*) = 120 \)

Usage

\[
\text{cec2005benchmark16}(x)
\]

Arguments

\( x \) Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of \( x \)

References


See Also

\texttt{cec2005benchmark}

Examples

\[
\text{cec2005benchmark16(runif(10, -5, 5))}
\]
Function Number 17

F16 with Noise in Fitness

\[ x \in [-5, 5]^D \]

- Global optimum \( F(x^*) = 120 \)

Usage

\[ \text{cecc2005benchmark17}(x) \]

Arguments

\( x \) 

Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of \( x \)

References


See Also

\texttt{cecc2005benchmark}

Examples

\[ \text{cecc2005benchmark17(runif(10, -5, 5))} \]
Function Number 18

**Description**

Rotated Hybrid Composition Function

- $x \in [-5, 5]^D$
- Global optimum $F(x^*) = 10$

**Usage**

`cec2005benchmark18(x)`

**Arguments**

- $x$ Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

**Value**

A vector with the evaluation of the function for each row of $x$

**References**


**See Also**

`cec2005benchmark`

**Examples**

`cec2005benchmark18(runif(10, -5, 5))`
Function Number 19

Description

Rotated Hybrid Composition Function with a Narrow Basin for the Global Optimum

- \( x \in [-5, 5]^D \)
- Global optimum \( F(x^*) = 10 \)

Usage

\[ \text{cec2005benchmark19}(x) \]

Arguments

- \( x \)
  Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of \( x \)

References


See Also

- cec2005benchmark

Examples

\[ \text{cec2005benchmark19}(\text{runif}(10, -5, 5)) \]
Description

Shifted Schwefel’s Problem 1.2

- \( x \in [-100, 100]^D \)
- Global optimum \( F(x^*) = -450 \)

Usage

\texttt{cec2005benchmark2(x)}

Arguments

\( x \) Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of \( x \)

References


See Also

\texttt{cec2005benchmark}

Examples

\texttt{cec2005benchmark2(runif(10, -100, 100))}
Function Number 20

Description

Rotated Hybrid Composition Function with Global Optimum on the Bounds

- \( x \in [-5, 5]^D \)
- Global optimum \( F(x^*) = 10 \)

Usage

`cec2005benchmark20(x)`

Arguments

- \( x \)
  - Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of \( x \)

References


See Also

`cec2005benchmark`

Examples

`cec2005benchmark20(runif(10, -5, 5))`
Function Number 21

Description

Rotated Hybrid Composition Function

- \( x \in [-5, 5]^D \)
- Global optimum \( F(x^*) = 360 \)

Usage

```
cec2005benchmark21(x)
```

Arguments

- \( x \)

Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of \( x \)

References


See Also

- `cec2005benchmark`

Examples

```
cec2005benchmark21(runif(10, -5, 5))
```
Function Number 22

Description
Rotated Hybrid Composition Function with High Condition Number Matrix

- $x \in [-5, 5]^D$
- Global optimum $F(x^*) = 360$

Usage

`cec2005benchmark22(x)`

Arguments

$x$ Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of $x$

References


See Also

`cec2005benchmark`

Examples

`cec2005benchmark22(runif(10, -5, 5))`
**Description**

Non-Continuous Rotated Hybrid Composition Function

- $x \in [-5, 5]^D$
- Global optimum $F(x^*) = 360$

**Usage**

`cec2005benchmark23(x)`

**Arguments**

- `x` Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

**Value**

A vector with the evaluation of the function for each row of `x`

**References**


**See Also**

`cec2005benchmark`

**Examples**

`cec2005benchmark23(runif(10, -5, 5))`
Function Number 24

Description

Rotated Hybrid Composition Function

- $x \in [-5, 5]^D$
- Global optimum $F(x^*) = 260$

Usage

`cec2005benchmark24(x)`

Arguments

- `x` Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of `x`

References


See Also

`cec2005benchmark`

Examples

`cec2005benchmark24(runif(10, -5, 5))`
Description

Rotated Hybrid Composition Function without bounds

- \( x \in [2, 5]^D \)
- Global optimum \( F(x^*) = 260 \)

Usage

\( \text{cec2005benchmark25}(x) \)

Arguments

\( x \)  
Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of \( x \)

References


See Also

\( \text{cec2005benchmark} \)

Examples

\( \text{cec2005benchmark25}(\text{runif}(10, -5, 5)) \)
Description

Shifted Rotated High Conditioned Elliptic Function

- \( x \in [-100, 100]^D \)
- Global optimum \( F(x^*) = -450 \)

Usage

\[
\text{cec2005benchmark3}(x)
\]

Arguments

- \( x \) Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of \( x \)

References


See Also

\texttt{cec2005benchmark}

Examples

\[
\text{cec2005benchmark3}(\text{runif}(10, -100, 100))
\]
**Description**

Shifted Schwefel’s Problem 1.2 with Noise in Fitness

- \( x \in [-100, 100]^D \)
- Global optimum \( F(x^*) = -450 \)

**Usage**

\[ \text{cec2005benchmark4}(x) \]

**Arguments**

- **x**: Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

**Value**

A vector with the evaluation of the function for each row of \( x \)

**References**


**See Also**

- cec2005benchmark

**Examples**

\[ \text{cec2005benchmark4}(\text{runif}(10, -100, 100)) \]
Function Number 5

Description
Schwefel’s Problem 2.6 with Global Optimum on Bounds

- \( x \in [-100, 100]^D \)
- Global optimum \( F(x^*) = -310 \)

Usage
\( \text{cec2005benchmark5}(x) \)

Arguments
\( x \) Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value
A vector with the evaluation of the function for each row of \( x \)

References

See Also
\textit{cec2005benchmark}

Examples
\( \text{cec2005benchmark5}(\text{runif}(100, -100, 100)) \)
cep2005benchmark6 Function Number 6

Description

Shifted Rosenbrock’s Function

- \( x \in [-100, 100]^D \)
- Global optimum \( F(x^*) = 390 \)

Usage

cep2005benchmark6(x)

Arguments

\( x \)

Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of \( x \)

References


See Also

cep2005benchmark

Examples

cep2005benchmark6(runif(10, -100, 100))
Function Number 7

Description

Shifted Rotated Griewank’s Function without Bounds

- $x \in [0, 600]^D$
- Global optimum $F(x^*) = -180$

Usage

cec2005benchmark7(x)

Arguments

x Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of x

References


See Also

cec2005benchmark

Examples

cec2005benchmark7(runif(10, 0, 600))
Description

Shifted Rotated Ackley's Function with Global Optimum on Bounds

\[ x \in [-32, 32]^D \]

\[ \text{Global optimum } F(x^*) = -140 \]

Usage

`cec2005benchmark8(x)`

Arguments

\( x \) Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

Value

A vector with the evaluation of the function for each row of \( x \)

References


See Also

`cec2005benchmark`

Examples

`cec2005benchmark8(runif(10, -32, 32))`
**cec2005benchmark9 Function Number 9**

**Description**

Shifted Rastrigin’s Function

- \( x \in [-5, 5]^D \)
- Global optimum \( F(x^*) = -330 \)

**Usage**

`cec2005benchmark9(x)`

**Arguments**

\( x \)

Either a vector with 2, 10, 30 or 50 elements or a matrix with the same number of columns and one row for each vector to be evaluated

**Value**

A vector with the evaluation of the function for each row of \( x \)

**References**


**See Also**

`cec2005benchmark`

**Examples**

`cec2005benchmark9(runif(10, -5, 5))`
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