

# R documentation

of 'ldemax.Rd'

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ldemax

*Locally D-optimal designs for 3-parameter Emax model*

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## Description

Finds Locally D-optimal designs for Emax regression model which is defined as  $E(y) = a + bx/(x + c)$  with  $Var(y) = \sigma^2$ , where  $a$ ,  $b$  and  $\sigma$  are unknown parameters.

## Usage

```
ldemax(a, b, c, lb, ub, user.points = NULL, user.weights = NULL, ...,  
       n.restarts = 1, n.sim = 1, tol = 1e-8, prec = 53)
```

## Arguments

<code>a</code>	initial value for parameter $a$ , must be greater than 0.
<code>b</code>	initial value for parameter $b$ , must be greater than 0.
<code>c</code>	initial value for parameter $c$ , must be greater than 0.
<code>lb</code>	lower bound of design interval, must be greater than or equal to 0.
<code>ub</code>	upper bound of design interval.
<code>user.points</code>	(optional) vector of user design points which calculation of its D-efficiency is aimed. Each element of <code>user.points</code> must be within the design interval.
<code>user.weights</code>	(optional) vector of weights which its elements correspond to <code>user.points</code> elements. The sum of weights should be 1; otherwise they will be normalized.
<code>...</code>	(optional) additional parameters will be passed to function <a href="#">curve</a> .
<code>prec</code>	(optional) a number, the maximal precision to be used for D-efficiency calculation, in bite. Must be at least 2 (default 53), see 'Details'.
<code>n.restarts</code>	(optional optimization parameter) number of solver restarts required in optimization process (default 1), see 'Details'.
<code>n.sim</code>	(optional optimization parameter) number of random parameters to generate for every restart of solver in optimization process (default 1), see 'Details'.
<code>tol</code>	(optional optimization parameter) relative tolerance on feasibility and optimality in optimization process (default $1e - 8$ ).

## Details

While D-efficiency is NaN, an increase in prec can be beneficial to achieve a numeric value, however, it can slow down the calculation speed.

Values of `n.restarts` and `n.sim` should be chosen according to the length of design interval.

## Value

plot of derivative function, see 'Note'.

a list containing the following values:

<code>points</code>	obtained design points
<code>weights</code>	corresponding weights to the obtained design points
<code>det.value</code>	value of Fisher information matrix determinant at the obtained design
<code>user.eff</code>	D-efficiency of user design, if <code>user.design</code> and <code>user.weights</code> are not NULL.

## Note

To verify optimality of obtained design, derivative function (symmetry of Frechet derivative with respect to the x-axis) will be plotted on the design interval. Based on the equivalence theorem (Kiefer, 1974), a design is optimal if and only if its derivative function are equal or less than 0 on the design interval. The equality must be achieved just at the obtained points.

## Author(s)

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## References

- Masoudi, E., Sarmad, M. and Talebi, H. 2012, An Almost General Code in R to Find Optimal Design, In Proceedings of the 1st ISM International Statistical Conference 2012, 292-297.
- Dette, H., Kiss, C., Bevanda, M. and Bretz, F. (2010), Optimal designs for the emax, log-linear and exponential models. *Biometrika*, 97 513-518.
- Kiefer, J. C. (1974), General equivalence theory for optimum designs (approximate theory). *Ann. Statist.*, 2, 849-879.

## See Also

[cfisher](#), [cfderiv](#) and [eff](#).

## Examples

```
ldemax(a = 1, b = 2, c = 3, lb = 0, ub = 9) ## $points: 0.0 1.8 9.0

## D-efficiency computation:
ldemax(a = 1, b = 2, c = 3, lb = 0, ub = 9, user.points = c(1, 5, 4),
user.weights = rep(.33, 3)) ## $user.eff: 0.15379
```

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