

# Package ‘SMR’

May 8, 2022

**Title** Externally Studentized Midrange Distribution

**Version** 2.0.2

**Description** Computes the studentized midrange distribution (pdf, cdf and quantile) and generates random numbers.

**License** GPL (>= 2)

**URL** <https://bendeivide.github.io/SMR/>,  
<https://github.com/bendeivide/SMR>

**BugReports** <https://github.com/bendeivide/SMR/issues>

**NeedsCompilation** no

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**Repository** CRAN

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SMR	<i>The externally studentized normal midrange distribution</i>
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### Description

Computes the probability density, the cumulative distribution function and the quantile function and generates random samples for the externally studentized normal midrange distribution with the numbers means equal to size, the degrees of freedom equal to df and the number of points of the Gauss-Legendre quadrature equal to np.

**Usage**

```
dSMR(x, size, df, np=32, log = FALSE)
pSMR(q, size, df, np=32, lower.tail = TRUE, log.p = FALSE)
qSMR(p, size, df, np=32, eps = 1e-13, maxit = 5000, lower.tail = TRUE, log.p = FALSE)
rSMR(n, size, df = Inf)
```

**Arguments**

<code>x, q</code>	vector of quantiles $x \in R$ and $q \in R$ .
<code>p</code>	vector of probabilities $(0, 1)$ .
<code>size</code>	sample size. Only for $size > 1$ .
<code>n</code>	vector size to be simulated $n > 1$ .
<code>df</code>	degrees of freedom $df > 0$ .
<code>np</code>	number of points of the gaussian quadrature $np > 2$ .
<code>log, log.p</code>	logical argument; if TRUE, the probabilities $p$ are given as $\log(p)$ .
<code>lower.tail</code>	logical argument; if TRUE, the probabilities are $P[X \leq x]$ otherwise, $P[X \geq x]$ .
<code>eps</code>	stopping criterion for Newton-Raphson's iteration method.
<code>maxit</code>	maximum number of interaction in the Newton-Raphson method.

**Details**

Assumes  $np = 32$  as default value for dSMR, pSMR and qSMR. If  $df$  is not specified, it assumes the default value `Inf` in rSMR. When  $df=1$ , the convergence of the routines requires  $np > 250$  to obtain the desired result accurately. The Midrange distribution has density

$$f(\bar{q}; n, \nu) = \int_0^\infty \int_{-\infty}^{x\bar{q}} 2n(n-1)x\phi(y)\phi(2x\bar{q}-y)[\Phi(2x\bar{q}-y) - \Phi(y)]^{n-2} f(x; \nu) dy dx,$$

where,  $q$  is the quantile of externally studentized midrange distribution,  $n$  (size) is the sample size and  $\nu$  is the degrees of freedom.

The externally studentized midrange distribution function is given by

$$F(\bar{q}; n, \nu) = \int_{-\infty}^{\bar{q}} \int_0^\infty \int_{-\infty}^{x\bar{q}} 2n(n-1)x\phi(y)\phi(2xz-y)[\Phi(2xz-y) - \Phi(y)]^{n-2} f(x; \nu) dy dx dz.$$

where,  $q$  is the quantile of externally studentized midrange distribution,  $n$  (size) is the sample size and  $\nu$  is the degrees of freedom.

**Value**

dSMR gives the density, pSMR gives the cumulative distribution function, qSMR gives the quantile function, and rSMR generates random deviates.

**References**

Batista, BDO; Ferreira, DF. The externally studentized normal midrange distribution. Submitted for publications. 2012.

**Examples**

```
library(SMR)

#example 1:
x <- 2
q <- 1
p <- 0.9
n <- 30
size <- 5
df <- 3
np <- 32
dSMR(x, size, df, np)
pSMR(q, size, df, np)
qSMR(p, size, df, np)
rSMR(n, size, df)

#example 2:
x <- c(-1, 2, 1.1)
q <- c(1, 0, -1.5)
p <- c(0.9, 1, 0.8)
n <- 10
size <- 5
df <- 3
np <- 32
dSMR(x, size, df, np)
pSMR(q, size, df, np)
qSMR(p, size, df, np)
rSMR(n, size, df)
```

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