Package ‘SPSL’

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Title Site Percolation on Square Lattices (SPSL)

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Description Provides basic functionality for labeling iso- & anisotropic percolation clusters on 2D & 3D square lattices with various lattice sizes, occupation probabilities, von Neumann & Moore (1,d)-neighborhoods, and random variables weighting the percolation lattice sites.

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Contents

`SPSL-package` *Site Percolation on Square Lattices (SPSL)*

Description

Provides basic functionality for labeling iso- & anisotropic percolation clusters on 2D & 3D square lattices with various lattice sizes, occupation probabilities, von Neumann & Moore (1,d)-neighborhoods, and random variables weighting the percolation lattice sites.

Details

Package:	SPSL
Type:	Package
Version:	0.1-9
Date:	2019-03-17
License:	GPL-3
LazyLoad:	yes

`ssi20()` and `ssi30()` functions provide sites labeling of the isotropic cluster on 2D & 3D square lattice with von Neumann (1,0)-neighborhood.
`ssa20()` and `ssa30()` functions provide sites labeling of the anisotropic cluster on 2D & 3D square lattice with von Neumann (1,0)-neighborhood.
`ssi2d()` and `ssi3d()` functions provide sites labeling of the isotropic cluster on 2D & 3D square lattice with Moore (1,d)-neighborhood.
`ssa2d()` and `ssa3d()` functions provide sites labeling of the anisotropic cluster on 2D & 3D square lattice with Moore (1,d)-neighborhood.
`fssi20()` and `fssi30()` functions calculates the relative frequency distribution of isotropic clusters on 2D & 3D square lattice with von Neumann (1,0)-neighborhood.
`fssa20()` and `fssa30()` functions calculates the relative frequency distribution of anisotropic clusters on 2D & 3D square lattice with von Neumann (1,0)-neighborhood.
`fssi2d()` and `fssi3d()` functions calculates the relative frequency distribution of isotropic clusters on 2D & 3D square lattice with Moore (1,d)-neighborhood.
`fssa2d()` and `fssa3d()` functions calculates the relative frequency distribution of anisotropic clusters on 2D & 3D square lattice with Moore (1,d)-neighborhood.

Author(s)

Pavel V. Moskalev <moskalefff@gmail.com>

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.
[2] Moskalev, P.V. (2014) Estimates of threshold and strength of percolation clusters on square lattices with (1,d)-neighborhood. *Computer Research and Modeling*, Vol.6, No.3, pp.405–414; in Russian.
[3] Moskalev, P.V. (2013) The structure of site percolation models on three-dimensional square lattices. *Computer Research and Modeling*, Vol.5, No.4, pp.607–622; in Russian.

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fssa20 — *Frequency of Sites on a Square Anisotropic 2D lattice with (1,0)-neighborhood*

Description

`fssa20()` function calculates the relative frequency distribution of anisotropic clusters on 2D square lattice with von Neumann (1,0)-neighborhood.

Usage

```
fssa20(n=1000, x=33, p=runif(4, max=0.9),
       set=(x^2+1)/2, all=TRUE, shape=c(1,1))
```

Arguments

`n`	a sample size.
`x`	a linear dimension of 2D square percolation lattice.
`p`	a vector of relative fractions `(0<p)&(p<1)` of accessible sites (occupation probability) for lattice directions: `(-x,+x,-y,+y)`.
`set`	a vector of linear indexes of a starting sites subset.
`all`	logical; if `all=TRUE`, mark all sites from a starting subset; if `all=FALSE`, mark only accessible sites from a starting subset.
`shape`	a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 2D square lattice with uniformly weighted sites and the vector `p`, distributed over the lattice directions.

The anisotropic cluster is formed from the accessible sites connected with the initial subset `set`, and depends on the direction in 2D square lattice.

Von Neumann (1,0)-neighborhood on 2D square lattice consists of sites, only one coordinate of which is different from the current site by one: `e=c(-1, 1, -x, x)`.

Each element of the matrix `frq` is equal to the relative frequency with which the 2D square lattice site belongs to a cluster sample of size `n`.

Value

`rfq` a 2D matrix of relative sampling frequencies for sites of the percolation lattice.

Author(s)

Pavel V. Moskalev <moskalefff@gmail.com>

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.

See Also

ssa20, fssa30, fssi20, fssi30, fssa2d, fssa3d

Examples

```
x <- y <- seq(33)
image(x, y, rfq <- fssa20(n=200, p=c(.3,.4,.75,.5)), cex.main=1,
main="Frequencies of anisotropic (1,0)-clusters")
contour(x, y, rfq, levels=seq(.2,.3,.05), add=TRUE)
abline(h=17, lty=2); abline(v=17, lty=2)
```

`fssa2d` *Frequency of Sites on a Square Anisotropic 2D lattice with (1,d)-neighborhood*

Description

`fssa2d()` function calculates the relative frequency distribution of anisotropic clusters on 2D square lattice with Moore (1,d)-neighborhood.

Usage

```
fssa2d(n=1000, x=33,
       p0=runif(4, max=0.8),
       p1=colMeans(matrix(p0[c(1,3, 2,3, 1,4, 2,4)], nrow=2))/2,
       set=(x^2+1)/2, all=TRUE, shape=c(1,1))
```

Arguments

`n`	a sample size.
`x`	a linear dimension of 2D square percolation lattice.
`p0`	a vector of relative fractions `(0<p0)&(p0<1)` of accessible sites (occupation probability) for lattice directions: `(-x,+x,-y,+y)`.
`p1`	averaged double combinations of `p0`-components weighted by Minkowski distance: `p1=colMeans(matrix(p0[c(1,3,...)], nrow=2))/rhoMe1`.
`set`	a vector of linear indexes of a starting sites subset.
`all`	logical; if `all=TRUE`, mark all sites from a starting subset; if `all=FALSE`, mark only accessible sites from a starting subset.
`shape`	a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 2D square lattice with uniformly weighted sites and the vectors `p0` and `p1`, distributed over the lattice directions, and their combinations.

The anisotropic cluster is formed from the accessible sites connected with the initial subset `set`, and depends on the direction in 2D square lattice.

Moore (1,d)-neighborhood on 2D square lattice consists of sites, at least one coordinate of which is different from the current site by one: `e=c(e0,e1)`, where
`e0=c(-1, 1, -x, x);`
`e1=colSums(matrix(e0[c(1,3, 2,3, 1,4, 2,4)], nrow=2))`.

Minkowski distance between sites `a` and `b` depends on the exponent `d`:
`rhoM <- function(a, b, d=1)`
`if (is.infinite(d)) return(apply(abs(b-a), 2, max))`
`else return(apply(abs(b-a)^d, 2, sum)^(1/d))`.

Minkowski distance for sites from `e1` subset with the exponent `d=1` is equal to `rhoMe1=2`.

Each element of the matrix `frq` is equal to the relative frequency with which the 2D square lattice site belongs to a cluster sample of size `n`.

Value

`rfq`	a 2D matrix of relative sampling frequencies for sites of the percolation lattice.

Author(s)

Pavel V. Moskalev <moskalefff@gmail.com>

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.

See Also

ssa2d, fssa3d, fssa20, fssa30, fssi2d, fssi3d

Examples

```
x <- y <- seq(33)
image(x, y, rfq <- fssa2d(n=200, p0=c(.3,.4,.75,.5)), cex.main=1,
main="Frequencies of anisotropic (1,1)-clusters")
contour(x, y, rfq, levels=seq(.2,.3,.05), add=TRUE)
abline(h=17, lty=2); abline(v=17, lty=2)
```

---

fssa30 *Frequency of Sites on a Square Anisotropic 3D lattice with (1,0)-neighborhood*

Description

`fssa30()` function calculates the relative frequency distribution of anisotropic clusters on 3D square lattice with von Neumann (1,0)-neighborhood.

Usage

```
fssa30(n=1000, x=33, p=runif(6, max=0.6),
       set=(x^3+1)/2, all=TRUE, shape=c(1,1))
```

Arguments

`n`	a sample size.
`x`	a linear dimension of 3D square percolation lattice.
`p`	a vector of relative fractions `(0<p)&(p<1)` of accessible sites (occupation probability) for lattice directions: `(-x,+x,-y,+y,-z,+z)`.
`set`	a vector of linear indexes of a starting sites subset.
`all`	logical; if `all=TRUE`, mark all sites from a starting subset; if `all=FALSE`, mark only accessible sites from a starting subset.
`shape`	a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 3D square lattice with uniformly weighted sites and the vector `p`, distributed over the lattice directions.

The anisotropic cluster is formed from the accessible sites connected with the initial subset `set`, and depends on the direction in 3D square lattice.

Von Neumann (1,0)-neighborhood on 3D square lattice consists of sites, only one coordinate of which is different from the current site by one: `e=c(-1, 1, -x, x, -x^2, x^2)`.

Each element of the 3D matrix `frq` is equal to the relative frequency with which the 3D square lattice site belongs to a cluster sample of size `n`.

Value

`rfq` a 3D matrix of relative sampling frequencies for sites of the percolation lattice.

Author(s)

Pavel V. Moskalev <moskalefff@gmail.com>

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.

See Also

ssa30, fssa20, fssi20, fssi30, fssa2d, fssa3d

Examples

```
x <- y <- seq(33)
rfq <- fssa30(n=200, p=.17*c(.5,3,.5,1.5,1,.5))
image(x, y, rfq[,,17], cex.main=1,
main="Frequencies in z=17 slice of anisotropic (1,0)-clusters")
contour(x, y, rfq[,,17], levels=seq(.05,.3,.05), add=TRUE)
abline(h=17, lty=2); abline(v=17, lty=2)
```

`fssa3d` *Frequency of Sites on a Square Anisotropic 3D lattice with (1,d)-neighborhood*

Description

`fssa3d()` function calculates the relative frequency distribution of anisotropic clusters on 3D square lattice with Moore (1,d)-neighborhood.

Usage

```
fssa3d(n=1000, x=33,
       p0=runif(6, max=0.4),
       p1=colMeans(matrix(p0[c(
          1,3, 2,3, 1,4, 2,4,
          1,5, 2,5, 1,6, 2,6,
          3,5, 4,5, 3,6, 4,6)], nrow=2))/2,
       p2=colMeans(matrix(p0[c(
          1,3,5, 2,3,5, 1,4,5, 2,4,5,
          1,3,6, 2,3,6, 1,4,6, 2,4,6)], nrow=3))/3,
       set=(x^3+1)/2, all=TRUE, shape=c(1,1))
```

Arguments

`n`	a sample size.
`x`	a linear dimension of 2D square percolation lattice.
`p0`	a vector of relative fractions `(0<p0)&(p0<1)` of accessible sites (occupation probability) for lattice directions: `(-x,+x,-y,+y,-z,+z)`.
`p1`	averaged double combinations of `p0`-components weighted by Minkowski distance: `p1=colMeans(matrix(p0[c(1,3,...)], nrow=2))/rhoMe1`.
`p2`	averaged triple combinations of `p0`-components weighted by Minkowski distance: `p2=colMeans(matrix(p0[c(1,3,5,...)], nrow=3))/rhoMe2`.
`set`	a vector of linear indexes of a starting sites subset.
`all`	logical; if `all=TRUE`, mark all sites from a starting subset; if `all=FALSE`, mark only accessible sites from a starting subset.
`shape`	a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 3D square lattice with uniformly weighted sites `acc` and the vectors `p0`, `p1`, and `p2`, distributed over the lattice directions, and their combinations.

The anisotropic cluster is formed from the accessible sites connected with the initial subset `set`, and depends on the direction in 3D square lattice.

Moore (1,d)-neighborhood on 3D square lattice consists of sites, at least one coordinate of which is different from the current site by one: `e=c(e0,e1,e2)`, where
`e0=c(-1, 1, -x, x, -x^2, x^2)`;
`e1=colSums(matrix(e0[c(1,3, 2,3, 1,4, 2,4, 1,5, 2,5, 1,6, 2,6, 3,5, 4,5, 3,6, 4,6)], nrow=2))`;
`e2=colMeans(matrix(p0[c(1,3,5, 2,3,5, 1,4,5, 2,4,5, 1,3,6, 2,3,6, 1,4,6, 2,4,6)], nrow=3))`.

Minkowski distance between sites `a` and `b` depends on the exponent `d`:

```
rhoM <- function(a, b, d=1)
if (is.infinite(d)) return(apply(abs(b-a), 2, max))
else return(apply(abs(b-a)^d, 2, sum)^(1/d)).
```

Minkowski distance for sites from e1 and e2 subsets with the exponent d=1 is equal to rhoMe1=2 and rhoMe2=3.

Each element of the matrix frq is equal to the relative frequency with which the 3D square lattice site belongs to a cluster sample of size n.

Value

rfq a 3D matrix of relative sampling frequencies for sites of the percolation lattice.

Author(s)

Pavel V. Moskalev <moskalefff@gmail.com>

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.

See Also

ssa3d, fssa2d, fssa20, fssa30, fssi2d, fssi3d

Examples

```
x <- y <- seq(33)
rfq <- fssa3d(n=200, p0=.17*c(.5,3,.5,1.5,1,.5))
image(x, y, rfq[,,17], cex.main=1,
main="Frequencies in z=17 slice of anisotropic (1,1)-clusters")
contour(x, y, rfq[,,17], levels=seq(.05,.3,.05), add=TRUE)
abline(h=17, lty=2); abline(v=17, lty=2)
```

---

fssi20 *Frequency of Sites on a Square Isotropic 2D lattice with (1,0)-neighborhood*

Description

fssi20() function calculates the relative frequency distribution of isotropic clusters on 2D square lattice with von Neumann (1,0)-neighborhood.

Usage

```
fssi20(n=1000, x=33, p=0.592746,
       set=(x^2+1)/2, all=TRUE, shape=c(1,1))
```

Arguments

n	a sample size.
x	a linear dimension of 2D square percolation lattice.
p	the relative fractions `(0<p)&(p<1)` of accessible sites (occupation probability) for percolation lattice.
set	a vector of linear indexes of a starting sites subset.
all	logical; if `all=TRUE`, mark all sites from a starting subset; if `all=FALSE`, mark only accessible sites from a starting subset.
shape	a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 2D square lattice with uniformly weighted sites and the constant parameter `p`.

The isotropic cluster is formed from the accessible sites connected with initial sites subset `set`.

Von Neumann (1,0)-neighborhood on 2D square lattice consists of sites, only one coordinate of which is different from the current site by one: `e=c(-1, 1, -x, x)`.

Each element of the matrix `frq` is equal to the relative frequency with which the 2D square lattice site belongs to a cluster sample of size `n`.

Value

rfq	a 2D matrix of relative sampling frequencies for sites of the percolation lattice.

Author(s)

Pavel V. Moskalev

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.
[2] Moskalev, P.V. (2014) Estimates of threshold and strength of percolation clusters on square lattices with (1,d)-neighborhood. *Computer Research and Modeling*, Vol.6, No.3, pp.405–414; in Russian.

See Also

ssi20, fssi30, fssa20, fssa30, fssi2d, fssi3d

Examples

```
x <- y <- seq(33)
image(x, y, rfq <- fssi20(n=200), cex.main=1,
main="Frequencies of isotropic (1,0)-clusters")
contour(x, y, rfq, levels=seq(.2,.3,.05), add=TRUE)
abline(h=17, lty=2); abline(v=17, lty=2)
```

---

fssi2d — *Frequency of Sites on a Square Isotropic 2D lattice with (1,d)-neighborhood*

Description

`fssi2d()` function calculates the relative frequency distribution of isotropic clusters on 2D square lattice with Moore (1,d)-neighborhood.

Usage

```
fssi2d(n=1000, x=33, p0=0.5, p1=p0/2,
       set=(x^2+1)/2, all=TRUE, shape=c(1,1))
```

Arguments

`n`	a sample size.
`x`	a linear dimension of 2D square percolation lattice.
`p0`	a relative fraction `(0<p0)&(p0<1)` of accessible sites (occupation probability) for percolation lattice.
`p1`	`p0` value, weighted by Minkowski distance: `p1=p0/rhoMe1`.
`set`	a vector of linear indexes of a starting sites subset.
`all`	logical; if `all=TRUE`, mark all sites from a starting subset; if `all=FALSE`, mark only accessible sites from a starting subset.
`shape`	a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 2D square lattice with uniformly weighted sites and the constant parameters `p0` and `p1`.

The isotropic cluster is formed from the accessible sites connected with initial sites subset `set`.

Moore (1,d)-neighborhood on 2D square lattice consists of sites, at least one coordinate of which is different from the current site by one: `e=c(e0,e1)`, where
`e0=c(-1, 1, -x, x, -x^2, x^2);`
`e1=colSums(matrix(e0[c(1,3, 2,3, 1,4, 2,4)], nrow=2)).`

Minkowski distance between sites `a` and `b` depends on the exponent `d`:
`rhoM <- function(a, b, d=1)`
`if (is.infinite(d)) return(apply(abs(b-a), 2, max))`
`else return(apply(abs(b-a)^d, 2, sum)^(1/d)).`

Minkowski distance for sites from `e1` subset with the exponent `d=1` is equal to `rhoMe1=2`.

Each element of the matrix `frq` is equal to the relative frequency with which the 2D square lattice site belongs to a cluster sample of size `n`.

Value

`rfq` a 2D matrix of relative sampling frequencies for sites of the percolation lattice.

Author(s)

Pavel V. Moskalev <moskalefff@gmail.com>

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.
[2] Moskalev, P.V. (2014) Estimates of threshold and strength of percolation clusters on square lattices with (1,d)-neighborhood. *Computer Research and Modeling*, Vol.6, No.3, pp.405–414; in Russian.

See Also

ssi2d, fssi3d, fssi20, fssi30, fssa2d, fssa3d

Examples

```
x <- y <- seq(33)
image(x, y, rfq <- fssi2d(n=200), cex.main=1,
main="Frequencies of isotropic (1,1)-clusters")
contour(x, y, rfq, levels=seq(.2,.3,.05), add=TRUE)
abline(h=17, lty=2); abline(v=17, lty=2)
```

---

fssi30 — *Frequency of Sites on a Square Isotropic 3D lattice with (1,0)-neighborhood*

Description

`fssi30()` function calculates the relative frequency distribution of isotropic clusters on 3D square lattice with von Neumann (1,0)-neighborhood.

Usage

```
fssi30(n=1000, x=33, p=0.311608,
       set=(x^3+1)/2, all=TRUE, shape=c(1,1))
```

Arguments

`n`	a sample size.
`x`	a linear dimension of 3D square percolation lattice.
`p`	the relative fractions `(0<p)&(p<1)` of accessible sites (occupation probability) for percolation lattice.

`set`	a vector of linear indexes of a starting sites subset.
`all`	logical; if `all=TRUE`, mark all sites from a starting subset; if `all=FALSE`, mark only accessible sites from a starting subset.
`shape`	a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 3D square lattice with uniformly weighted sites and the constant parameter `p`.

The isotropic cluster is formed from the accessible sites connected with initial sites subset `set`.

Von Neumann (1,0)-neighborhood on 3D square lattice consists of sites, only one coordinate of which is different from the current site by one: `e=c(-1, 1, -x, x, -x^2, x^2)`.

Each element of the matrix `frq` is equal to the relative frequency with which the 3D square lattice site belongs to a cluster sample of size `n`.

Value

`rfq`	a 3D matrix of relative sampling frequencies for sites of the percolation lattice.

Author(s)

Pavel V. Moskalev <moskalefff@gmail.com>

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.

See Also

ssi30, fssi20, fssa20, fssa30, fssi2d, fssi3d

Examples

```
x <- y <- seq(33)
rfq <- fssi30(n=200, p=0.37)
image(x, y, rfq[,,17], cex.main=1,
main="Frequencies in the z=17 slice of isotropic (1,0)-clusters")
contour(x, y, rfq[,,17], levels=c(0.2,0.25,0.3), add=TRUE)
abline(h=17, lty=2); abline(v=17, lty=2)
```

fssi3d	*Frequency of Sites on a Square Isotropic 3D lattice with (1,d)-neighborhood*

Description

`fssi3d()` function calculates the relative frequency distribution of isotropic clusters on 3D square lattice with Moore (1,d)-neighborhood.

Usage

```
fssi3d(n=1000, x=33, p0=0.2, p1=p0/2, p2=p0/3,
       set=(x^3+1)/2, all=TRUE, shape=c(1,1))
```

Arguments

`n`	a sample size.
`x`	a linear dimension of 3D square percolation lattice.
`p0`	a relative fraction `(0<p0)&(p0<1)` of accessible sites (occupation probability) for percolation lattice.
`p1`	`p0` value, weighted by Minkowski distance: `p1=p0/rhoMe1`.
`p2`	`p0` value, weighted by Minkowski distance: `p2=p0/rhoMe2`.
`set`	a vector of linear indexes of a starting sites subset.
`all`	logical; if `all=TRUE`, mark all sites from a starting subset; if `all=FALSE`, mark only accessible sites from a starting subset.
`shape`	a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 3D square lattice with uniformly weighted sites and the constant parameters `p0`, `p1`, and `p2`.

The isotropic cluster is formed from the accessible sites connected with initial sites subset `set`.

Moore (1,d)-neighborhood on 3D square lattice consists of sites, at least one coordinate of which is different from the current site by one: `e=c(e0,e1,e2)`, where
`e0=c(-1, 1, -x, x, -x^2, x^2);`
`e1=colSums(matrix(e0[c(1,3, 2,3, 1,4, 2,4, 1,5, 2,5, 1,6, 2,6, 3,5, 4,5, 3,6, 4,6)], nrow=2));`
`e2=colMeans(matrix(p0[c(1,3,5, 2,3,5, 1,4,5, 2,4,5, 1,3,6, 2,3,6, 1,4,6, 2,4,6)], nrow=3)).`

Minkowski distance between sites `a` and `b` depends on the exponent `d`:

```
rhoM <- function(a, b, d=1)
if (is.infinite(d)) return(apply(abs(b-a), 2, max))
else return(apply(abs(b-a)^d, 2, sum)^(1/d)).
```

Minkowski distance for sites from e1 and e2 subsets with the exponent d=1 is equal to rhoMe1=2 and rhoMe2=3.

Each element of the matrix frq is equal to the relative frequency with which the 3D square lattice site belongs to a cluster sample of size n.

Value

rfq a 3D matrix of relative sampling frequencies for sites of the percolation lattice.

Author(s)

Pavel V. Moskalev <moskalefff@gmail.com>

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.

See Also

ssi3d, fssi2d, fssi20, fssi30, fssa2d, fssa3d

Examples

```
x <- y <- seq(33)
rfq <- fssi3d(n=200, p0=.285)
image(x, y, rfq[,,17], cex.main=1,
main="Frequencies in the z=17 slice of isotropic (1,1)-clusters")
contour(x, y, rfq[,,17], levels=c(0.2,0.25,0.3), add=TRUE)
abline(h=17, lty=2); abline(v=17, lty=2)
```

---

ssa20 *Site cluster on Square Anisotropic 2D lattice with (1,0)-neighborhood*

Description

ssa20() function provides sites labeling of the anisotropic cluster on 2D square lattice with von Neumann (1,0)-neighborhood.

Usage

```
ssa20(x=33, p=runif(4, max=0.9),
      set=(x^2+1)/2, all=TRUE, shape=c(1,1))
```

Arguments

- `x` — a linear dimension of 2D square percolation lattice.
- `p` — a vector of relative fractions `(0<p)&(p<1)` of accessible sites (occupation probability) for lattice directions: `(-x,+x,-y,+y)`.
- `set` — a vector of linear indexes of a starting sites subset.
- `all` — logical; if `all=TRUE`, mark all sites from a starting subset; if `all=FALSE`, mark only accessible sites from a starting subset.
- `shape` — a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 2D square lattice with uniformly weighted sites `acc` and the vector `p`, distributed over the lattice directions.

The anisotropic cluster is formed from the accessible sites connected with the initial subset, and depends on the direction in 2D square lattice.

To form the cluster the condition `acc[set+e[n]]<p[n]` is iteratively tested for sites of the von Neumann (1,0)-neighborhood `e` for the current cluster perimeter `set`, where `n` is equal to direction in 2D square lattice.

Von Neumann (1,0)-neighborhood on 2D square lattice consists of sites, only one coordinate of which is different from the current site by one: `e=c(-1, 1, -x, x)`.

Forming cluster ends with the exhaustion of accessible sites in von Neumann (1,0)-neighborhood of the current cluster perimeter.

Value

`acc` — an accessibility matrix for 2D square percolation lattice:
if `acc[e]<p[n]` then `acc[e]` is accessible site;
if `acc[e]==1` then `acc[e]` is non-accessible site;
if `acc[e]==2` then `acc[e]` belongs to a sites cluster.

Author(s)

Pavel V. Moskalev

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.

See Also

fssa20, ssa30, ssi20, ssi30, ssa2d, ssa3d

Examples

```
set.seed(20120507)
x <- y <- seq(33)
image(x, y, ssa20(), zlim=c(0,2),
main="Anisotropic (1,0)-cluster")
abline(h=17, lty=2); abline(v=17, lty=2)
```

---

ssa2d *Site cluster on Square Anisotropic 2D lattice with (1,d)-neighborhood*

Description

ssa2d() function provides sites labeling of the anisotropic cluster on 2D square lattice with Moore (1,d)-neighborhood.

Usage

```
ssa2d(x=33, p0=runif(4, max=0.8),
            p1=colMeans(matrix(p0[c(
               1,3, 2,3, 1,4, 2,4)], nrow=2))/2,
            set=(x^2+1)/2, all=TRUE, shape=c(1,1))
```

Arguments

x	a linear dimension of 2D square percolation lattice.
p0	a vector of relative fractions (0<p0)&(p0<1) of accessible sites (occupation probability) for lattice directions: (-x,+x,-y,+y).
p1	averaged double combinations of p0-components weighted by Minkowski distance: p1=colMeans(matrix(p0[c(1,3,...)], nrow=2))/rhoMe1.
set	a vector of linear indexes of a starting sites subset.
all	logical; if all=TRUE, mark all sites from a starting subset; if all=FALSE, mark only accessible sites from a starting subset.
shape	a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 2D square lattice with uniformly weighted sites acc and the vectors p0 and p1, distributed over the lattice directions, and their combinations.

The anisotropic cluster is formed from the accessible sites connected with the initial subset set, and depends on the direction in 2D square lattice.

To form the cluster the condition acc[set+eN[n]]<pN[n] is iteratively tested for sites of the Moore (1,d)-neighborhood eN for the current cluster perimeter set, where eN is equal to e0 or e1 vector; pN is equal to p0 or p1 vector; n is equal to direction in 2D square lattice.

Moore (1,d)-neighborhood on 2D square lattice consists of sites, at least one coordinate of which is different from the current site by one: `e=c(e0,e1)`, where
`e0=c(-1, 1, -x, x);`
`e1=colSums(matrix(e0[c(1,3, 2,3, 1,4, 2,4)], nrow=2)).`

Minkowski distance between sites `a` and `b` depends on the exponent `d`:
`rhoM <- function(a, b, d=1)`
`if (is.infinite(d)) return(apply(abs(b-a), 2, max))`
`else return(apply(abs(b-a)^d, 2, sum)^(1/d)).`

Minkowski distance for sites from `e1` subset with the exponent `d=1` is equal to `rhoMe1=2`.

Forming cluster ends with the exhaustion of accessible sites in Moore (1,d)-neighborhood of the current cluster perimeter.

Value

`acc` an accessibility matrix for 2D square percolation lattice:
if `acc[e]<pN[n]` then `acc[e]` is accessible site;
if `acc[e]==1` then `acc[e]` is non-accessible site;
if `acc[e]==2` then `acc[e]` belongs to a sites cluster.

Author(s)

Pavel V. Moskalev

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.

See Also

fssa2d, ssa3d, ssa20, ssa30, ssi2d, ssi3d

Examples

```
set.seed(20120507)
x <- y <- seq(33)
image(x, y, ssa2d(), zlim=c(0,2),
main="Anisotropic (1,1)-cluster")
abline(h=17, lty=2); abline(v=17, lty=2)
```

`ssa30` *Site cluster on Square Anisotropic 3D lattice with (1,0)-neighborhood*

Description

`ssa30()` function provides sites labeling of the anisotropic cluster on 3D square lattice with von Neumann (1,0)-neighborhood.

Usage

```
ssa30(x=33, p=runif(6, max=0.6),
      set=(x^3+1)/2, all=TRUE, shape=c(1,1))
```

Arguments

`x`	a linear dimension of 3D square percolation lattice.
`p`	a vector of relative fractions `(0<p)&(p<1)` of accessible sites (occupation probability) for lattice directions: `(-x,+x,-y,+y,-z,+z)`.
`set`	a vector of linear indexes of a starting sites subset.
`all`	logical; if `all=TRUE`, mark all sites from a starting subset; if `all=FALSE`, mark only accessible sites from a starting subset.
`shape`	a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 3D square lattice with uniformly weighted sites `acc` and the vector `p`, distributed over the lattice directions.

The anisotropic cluster is formed from the accessible sites connected with the initial subset `set`, and depends on the direction in 3D square lattice.

To form the cluster the condition `acc[set+e[n]]<p[n]` is iteratively tested for sites of the von Neumann (1,0)-neighborhood `e` for the current cluster perimeter `set`, where `n` is equal to direction in 3D square lattice.

Von Neumann (1,0)-neighborhood on 3D square lattice consists of sites, only one coordinate of which is different from the current site by one: `e=c(-1, 1, -x, x, -x^2, x^2)`.

Forming cluster ends with the exhaustion of accessible sites in von Neumann (1,0)-neighborhood of the current cluster perimeter.

Value

`acc`	an accessibility matrix for 3D square percolation lattice: if `acc[e]<p[n]` then `acc[e]` is accessible site; if `acc[e]==1` then `acc[e]` is non-accessible site; if `acc[e]==2` then `acc[e]` belongs to a sites cluster.

Author(s)

Pavel V. Moskalev

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.
[2] Moskalev, P.V. (2013) The structure of site percolation models on three-dimensional square lattices. *Computer Research and Modeling*, Vol.5, No.4, pp.607–622; in Russian.

See Also

fssa30, ssa20, ssi20, ssi30, ssa2d, ssa3d

Examples

```
# Example No.1. Axonometric projection of 3D cluster
require(lattice)
set.seed(20120521)
x <- y <- z <- seq(33)
cls <- which(ssa30(p=.09*c(1,6,1,3,2,1))>1, arr.ind=TRUE)
cloud(cls[,3] ~ cls[,1]*cls[,2],
xlim=range(x), ylim=range(y), zlim=range(z),
col=rgb(1,0,0,0.4), xlab="x", ylab="y", zlab="z", main.cex=1,
main="Anisotropic (1,0)-cluster")

# Example No.2. Z=17 slice of 3D cluster
set.seed(20120521)
x <- y <- z <- seq(33)
cls <- ssa30(p=.09*c(1,6,1,3,2,1))
image(x, y, cls[,,17], zlim=c(0,2), cex.main=1,
main="Z=17 slice of an anisotropic (1,0)-cluster")
abline(h=17, lty=2); abline(v=17, lty=2)
```

---

ssa3d *Site cluster on Square Anisotropic 3D lattice with (1,d)-neighborhood*

Description

ssa3d() function provides sites labeling of the anisotropic cluster on 3D square lattice with Moore (1,d)-neighborhood.

Usage

```
ssa3d(x=33, p0=runif(6, max=0.4),
            p1=colMeans(matrix(p0[c(
               1,3, 2,3, 1,4, 2,4,
               1,5, 2,5, 1,6, 2,6,
               3,5, 4,5, 3,6, 4,6)], nrow=2))/2,
            p2=colMeans(matrix(p0[c(
               1,3,5, 2,3,5, 1,4,5, 2,4,5,
               1,3,6, 2,3,6, 1,4,6, 2,4,6)], nrow=3))/3,
            set=(x^3+1)/2, all=TRUE,
            shape=c(1,1))
```

Arguments

x	a linear dimension of 3D square percolation lattice.

p0 — a vector of relative fractions (0<p0)&(p0<1) of accessible sites (occupation probability) for lattice directions: (-x,+x,-y,+y,-z,+z).

p1 — averaged double combinations of p0-components weighted by Minkowski distance: p1=colMeans(matrix(p0[c(1,3,...)], nrow=2))/rhoMe1.

p2 — averaged triple combinations of p0-components weighted by Minkowski distance: p2=colMeans(matrix(p0[c(1,3,5,...)], nrow=3))/rhoMe2.

set — a vector of linear indexes of a starting sites subset.

all — logical; if all=TRUE, mark all sites from a starting subset; if all=FALSE, mark only accessible sites from a starting subset.

shape — a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 3D square lattice with uniformly weighted sites acc and the vectors p0, p1, and p2, distributed over the lattice directions, and their combinations.

The anisotropic cluster is formed from the accessible sites connected with the initial subset set, and depends on the direction in 3D square lattice.

To form the cluster the condition acc[set+eN[n]]<pN[n] is iteratively tested for sites of the Moore (1,d)-neighborhood eN for the current cluster perimeter set, where eN is equal to e0, e1, or e2 vector; pN is equal to p0, p1, or p2 vector; n is equal to direction in 3D square lattice.

Moore (1,d)-neighborhood on 3D square lattice consists of sites, at least one coordinate of which is different from the current site by one: e=c(e0,e1,e2), where
e0=c(-1, 1, -x, x, -x^2, x^2);
e1=colSums(matrix(e0[c(1,3, 2,3, 1,4, 2,4, 1,5, 2,5, 1,6, 2,6, 3,5, 4,5, 3,6, 4,6)], nrow=2));
e2=colMeans(matrix(p0[c(1,3,5, 2,3,5, 1,4,5, 2,4,5, 1,3,6, 2,3,6, 1,4,6, 2,4,6)], nrow=3)).

Minkowski distance between sites a and b depends on the exponent d:
rho.mink <- function(a, b, d=1)
if (is.infinite(d)) return(apply(abs(b-a), 2, max))
else return(apply(abs(b-a)^d, 2, sum)^(1/d)).

Minkowski distance for sites from e1 and e2 subsets with the exponent d=1 is equal to rhoMe1=2 and rhoMe2=3.

Forming cluster ends with the exhaustion of accessible sites in Moore (1,d)-neighborhood of the current cluster perimeter.

Value

acc — an accessibility matrix for 3D square percolation lattice:
if acc[e]<pN[n] then acc[e] is accessible site;
if acc[e]==1 then acc[e] is non-accessible site;
if acc[e]==2 then acc[e] belongs to a sites cluster.

Author(s)

Pavel V. Moskalev

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.
[2] Moskalev, P.V. (2013) The structure of site percolation models on three-dimensional square lattices. *Computer Research and Modeling*, Vol.5, No.4, pp.607–622; in Russian.

See Also

fssa3d, ssa2d, ssa20, ssa30, ssi2d, ssi3d

Examples

```
# Example No.1. Axonometric projection of 3D cluster
require(lattice)
set.seed(20120521)
x <- y <- z <- seq(33)
cls <- which(ssa3d(p0=.09*c(1,6,1,3,2,1))>1, arr.ind=TRUE)
cloud(cls[,3] ~ cls[,1]*cls[,2],
xlim=range(x), ylim=range(y), zlim=range(z),
col=rgb(1,0,0,0.4), xlab="x", ylab="y", zlab="z", main.cex=1,
main="Anisotropic (1,1)-cluster")

# Example No.2. Z=17 slice of 3D cluster
set.seed(20120521)
x <- y <- z <- seq(33)
cls <- ssa3d(p0=.09*c(1,6,1,3,2,1))
image(x, y, cls[,,17], zlim=c(0,2), cex.main=1,
main="Z=17 slice of an anisotropic (1,1)-cluster")
abline(h=17, lty=2); abline(v=17, lty=2)
```

---

ssi20 — *Site cluster on Square Isotropic 2D lattice with (1,0)-neighborhood*

Description

`ssi20()` function provides sites labeling of the isotropic cluster on 2D square lattice with von Neumann (1,0)-neighborhood.

Usage

```
ssi20(x=33, p=0.592746,
      set=(x^2+1)/2, all=TRUE, shape=c(1,1))
```

Arguments

x	a linear dimension of 2D square percolation lattice.
p	the relative fractions `(0<p)&(p<1)` of accessible sites (occupation probability) for percolation lattice.

set	a vector of linear indexes of a starting sites subset.
all	logical; if all=TRUE, mark all sites from a starting subset; if all=FALSE, mark only accessible sites from a starting subset.
shape	a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 2D square lattice with uniformly weighted sites acc and the constant parameter p.

The isotropic cluster is formed from the accessible sites connected with initial sites subset.

To form the cluster the condition acc[set+e]<p is iteratively tested for sites of the von Neumann (1,0)-neighborhood e for the current cluster perimeter set.

Von Neumann (1,0)-neighborhood on 2D square lattice consists of sites, only one coordinate of which is different from the current site by one: e=c(-1, 1, -x, x).

Forming cluster ends with the exhaustion of accessible sites in von Neumann (1,0)-neighborhood of the current cluster perimeter.

Value

acc	an accessiblity matrix for 2D square percolation lattice: if acc[e]<p then acc[e] is accessible site; if acc[e]==1 then acc[e] is non-accessible site; if acc[e]==2 then acc[e] belongs to a sites cluster.

Author(s)

Pavel V. Moskalev

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.
[2] Moskalev, P.V. (2014) Estimates of threshold and strength of percolation clusters on square lattices with (1,d)-neighborhood. *Computer Research and Modeling*, Vol.6, No.3, pp.405–414; in Russian.

See Also

fssi20, ssi30, ssa20, ssa30, ssi2d, ssi3d

Examples

```
set.seed(20120507)
x <- y <- seq(33)
image(x, y, ssi20(), zlim=c(0,2),
main="Isotropic (1,0)-cluster")
abline(h=17, lty=2); abline(v=17, lty=2)
```

ssi2d *Site cluster on Square Isotropic 2D lattice with (1,d)-neighborhood*

Description

`ssi2d()` function provides sites labeling of the isotropic cluster on 2D square lattice with Moore (1,d)-neighborhood.

Usage

```
ssi2d(x=33, p0=0.5, p1=p0/2,
      set=(x^2+1)/2, all=TRUE, shape=c(1,1))
```

Arguments

`x`	a linear dimension of 2D square percolation lattice.
`p0`	a relative fraction `(0<p0)&(p0<1)` of accessible sites (occupation probability) for percolation lattice.
`p1`	`p0` value, weighted by Minkowski distance: `p1=p0/rhoMe1`.
`set`	a vector of linear indexes of a starting sites subset.
`all`	logical; if `all=TRUE`, mark all sites from a starting subset; if `all=FALSE`, mark only accessible sites from a starting subset.
`shape`	a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 2D square lattice with uniformly weighted sites `acc` and the constant parameters `p0` and `p1`.

The isotropic cluster is formed from the accessible sites connected with initial sites subset `set`.

To form the cluster the condition `acc[set+eN]<pN` is iteratively tested for sites of the Moore (1,d)-neighborhood `eN` for the current cluster perimeter `set`, where `eN` is equal to `e0` or `e1` vector; `pN` is equal to `p0` or `p1` value.

Moore (1,d)-neighborhood on 2D square lattice consists of sites, at least one coordinate of which is different from the current site by one: `e=c(e0,e1)`, where
`e0=c(-1, 1, -x, x, -x^2, x^2);`
`e1=colSums(matrix(e0[c(1,3, 2,3, 1,4, 2,4)], nrow=2)).`

Minkowski distance between sites `a` and `b` depends on the exponent `d`:
`rhoM <- function(a, b, d=1)`
`if (is.infinite(d)) return(apply(abs(b-a), 2, max))`
`else return(apply(abs(b-a)^d, 2, sum)^(1/d)).`

Minkowski distance for sites from `e1` subset with the exponent `d=1` is equal to `rhoMe1=2`.

Forming cluster ends with the exhaustion of accessible sites in Moore (1,d)-neighborhood of the current cluster perimeter.

Value

acc   an accessibility matrix for 2D square percolation lattice:
if `acc[e]<pN` then `acc[e]` is accessible site;
if `acc[e]==1` then `acc[e]` is non-accessible site;
if `acc[e]==2` then `acc[e]` belongs to a sites cluster.

Author(s)

Pavel V. Moskalev <moskalefff@gmail.com>

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.
[2] Moskalev, P.V. (2014) Estimates of threshold and strength of percolation clusters on square lattices with (1,d)-neighborhood. *Computer Research and Modeling*, Vol.6, No.3, pp.405–414; in Russian.

See Also

fssi2d, ssi3d, ssi20, ssi30, ssa2d, ssa3d

Examples

```
set.seed(20120507)
x <- y <- seq(33)
image(x, y, ssi2d(), zlim=c(0,2),
main="Isotropic (1,1)-cluster")
abline(h=17, lty=2); abline(v=17, lty=2)
```

---

ssi30   *Site cluster on Square Isotropic 3D lattice with (1,0)-neighborhood*

Description

`ssi30()` function provides sites labeling of the isotropic cluster on 3D square lattice with von Neumann (1,0)-neighborhood.

Usage

```
ssi30(x=33, p=0.311608,
      set=(x^3+1)/2, all=TRUE, shape=c(1,1))
```

Arguments

- `x` — a linear dimension of 3D square percolation lattice.
- `p` — the relative fractions `(0<p)&(p<1)` of accessible sites (occupation probability) for percolation lattice.
- `set` — a vector of linear indexes of a starting sites subset.
- `all` — logical; if `all=TRUE`, mark all sites from a starting subset; if `all=FALSE`, mark only accessible sites from a starting subset.
- `shape` — a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 3D square lattice with uniformly weighted sites `acc` and the constant parameter `p`.

The isotropic cluster is formed from the accessible sites connected with initial sites subset `set`.

To form the cluster the condition `acc[set+e]<p` is iteratively tested for sites of the von Neumann (1,0)-neighborhood `e` for the current cluster perimeter `set`.

Von Neumann (1,0)-neighborhood on 3D square lattice consists of sites, only one coordinate of which is different from the current site by one: `e=c(-1, 1, -x, x, -x^2, x^2)`.

Forming cluster ends with the exhaustion of accessible sites in von Neumann (1,0)-neighborhood of the current cluster perimeter.

Value

`acc` — an accessiblity matrix for 3D square percolation lattice:
if `acc[e]<p` then `acc[e]` is accessible site;
if `acc[e]==1` then `acc[e]` is non-accessible site;
if `acc[e]==2` then `acc[e]` belongs to a sites cluster.

Author(s)

Pavel V. Moskalev

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.
[2] Moskalev, P.V. (2013) The structure of site percolation models on three-dimensional square lattices. *Computer Research and Modeling*, Vol.5, No.4, pp.607–622; in Russian.

See Also

fssi30, ssi20, ssa20, ssa30, ssi2d, ssi3d

Examples

```
# Example No.1. Axonometric projection of 3D cluster
require(lattice)
set.seed(20120507)
x <- y <- z <- seq(33)
cls <- which(ssi30(p=.285)>1, arr.ind=TRUE)
cloud(cls[,3] ~ cls[,1]*cls[,2],
xlim=range(x), ylim=range(y), zlim=range(z),
col=rgb(1,0,0,0.4), xlab="x", ylab="y", zlab="z", main.cex=1,
main="Isotropic (1,0)-cluster")

# Example No.2. Z=17 slice of 3D cluster
set.seed(20120507)
cls <- ssi30(p=.285)
x <- y <- z <- seq(33)
image(x, y, cls[,,17], zlim=c(0,2), cex.main=1,
main="Z=17 slice of an isotropic (1,0)-cluster")
abline(h=17, lty=2); abline(v=17, lty=2)
```

---

ssi3d *Site cluster on Square Isotropic 3D lattice with (1,d)-neighborhood*

Description

ssi3d() function provides sites labeling of the isotropic cluster on 3D square lattice with Moore (1,d)-neighborhood.

Usage

```
ssi3d(x=33, p0=0.2, p1=p0/2, p2=p0/3,
      set=(x^3+1)/2, all=TRUE, shape=c(1,1))
```

Arguments

x	a linear dimension of 3D square percolation lattice.
p0	a relative fraction (0<p0)&(p0<1) of accessible sites (occupation probability) for percolation lattice.
p1	p0 value, weighted by Minkowski distance: p1=p0/rhoMe1.
p2	p0 value, weighted by Minkowski distance: p2=p0/rhoMe2.
set	a vector of linear indexes of a starting sites subset.
all	logical; if all=TRUE, mark all sites from a starting subset; if all=FALSE, mark only accessible sites from a starting subset.
shape	a vector with two shape parameters of beta-distributed random variables, weighting the percolation lattice sites.

Details

The percolation is simulated on 3D square lattice with uniformly weighted sites `acc` and the constant parameters `p0`, `p1`, and `p2`.

The isotropic cluster is formed from the accessible sites connected with initial sites subset `set`.

To form the cluster the condition `acc[set+eN]<pN` is iteratively tested for sites of the Moore (1,d)-neighborhood `eN` for the current cluster perimeter `set`, where `eN` is equal to `e0`, `e1` or `e2` vector; `pN` is equal to `p0`, `p1` or `p2` value.

Moore (1,d)-neighborhood on 3D square lattice consists of sites, at least one coordinate of which is different from the current site by one: `e=c(e0,e1,e2)`, where

```
e0=c(-1, 1, -x, x, -x^2, x^2);
e1=colSums(matrix(e0[c(1,3, 2,3, 1,4, 2,4, 1,5, 2,5, 1,6, 2,6, 3,5, 4,5, 3,6, 4,6)],
nrow=2));
e2=colMeans(matrix(p0[c(1,3,5, 2,3,5, 1,4,5, 2,4,5, 1,3,6, 2,3,6, 1,4,6, 2,4,6)],
nrow=3)).
```

Minkowski distance between sites `a` and `b` depends on the exponent `d`:

```
rhoM <- function(a, b, d=1)
if (is.infinite(d)) return(apply(abs(b-a), 2, max))
else return(apply(abs(b-a)^d, 2, sum)^(1/d)).
```

Minkowski distance for sites from `e1` and `e2` subsets with the exponent `d=1` is equal to `rhoMe1=2` and `rhoMe2=3`.

Forming cluster ends with the exhaustion of accessible sites in Moore (1,d)-neighborhood of the current cluster perimeter.

Value

`acc`	an accessibility matrix for 3D square percolation lattice: if `acc[e]<pN` then `acc[e]` is accessible site; if `acc[e]==1` then `acc[e]` is non-accessible site; if `acc[e]==2` then `acc[e]` belongs to a sites cluster.

Author(s)

Pavel V. Moskalev

References

[1] Moskalev, P.V. Percolation modeling of porous structures. Moscow: URSS, 2018. 240 pp; in Russian.
[2] Moskalev, P.V. (2013) The structure of site percolation models on three-dimensional square lattices. *Computer Research and Modeling*, Vol.5, No.4, pp.607–622; in Russian.

See Also

fssi3d, ssi2d, ssi20, ssi30, ssa2d, ssa3d

Examples

```
# Example No.1. Axonometric projection of 3D cluster
require(lattice)
set.seed(20120507)
x <- y <- z <- seq(33)
cls <- which(ssi3d(p0=.285)>1, arr.ind=TRUE)
cloud(cls[,3] ~ cls[,1]*cls[,2],
xlim=range(x), ylim=range(y), zlim=range(z),
col=rgb(1,0,0,0.4), xlab="x", ylab="y", zlab="z", main.cex=1,
main="Isotropic (1,1)-cluster")

# Example No.2. Z=17 slice of 3D cluster
set.seed(20120507)
cls <- ssi3d(p0=.285)
x <- y <- z <- seq(33)
image(x, y, cls[,,17], zlim=c(0,2), cex.main=1,
main="Z=17 slice of an isotropic (1,1)-cluster")
abline(h=17, lty=2); abline(v=17, lty=2)
```

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