$$\begin{vmatrix} 1 & 2 & 3 & ^8 4 & -- & - \\ 3 & & & & & \\ 4 & & & & & \\ 1 & & & & & \\ 2 & -- & -- & -- & & \end{vmatrix}^{n \times n}$$

$$\Longrightarrow \sum_{j} (-1)^{(1+j)} \cdot |M[-1, -j]| \cdot$$

$$M[i, j]$$

$M \longrightarrow \boxed{} \xrightarrow{\;\partial\;}$

$dim \longrightarrow 10 \quad 10$

$nrow \;/\; ncol$

$$\begin{pmatrix} 1 & 2 \\ 3 & "a" \end{pmatrix} \longrightarrow \begin{pmatrix} "1" & "2" \\ "3" & "a" \end{pmatrix} \longrightarrow M[1,1]$$

matrix(c(1, 2, 3, "a"),

    nrow = 2 , ncol = 2 ,

       byrow =

  T   F (или не указано)

1   2   1   3
3   "a"   2   "a"

1, 2, "a" $\longrightarrow$ "1" "2" "a"

1, 2, T $\longrightarrow$ 1, 2, 1

1, 2, F $\longrightarrow$ 1, 2, 0

---

matrix(c(T, 1, 2, F) ...

$$\begin{pmatrix} 1 & 1 \\ 2 & 0 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 2 \\ NA & 3 \end{pmatrix}$$

$$\text{is.na} \begin{pmatrix} 1 & 2 \\ NA & 3 \end{pmatrix} \longrightarrow \begin{pmatrix} F & F \\ T & F \end{pmatrix}$$
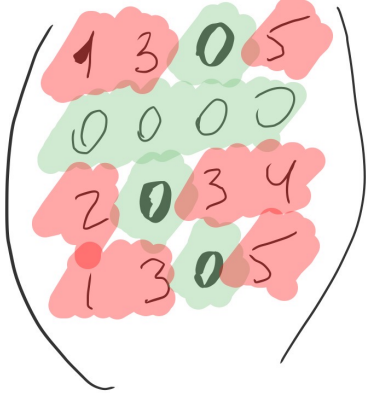
$$\boxed{\text{is.na}(1, 2, NA) \Rightarrow FFT}$$

~~as numeric~~

$\Sigma(0\ 0\ 1) \rightarrow 1$

$\text{sum}(FFT) \longrightarrow 1$

$$X = \text{sum} \begin{pmatrix} F & F \\ T & F \end{pmatrix} \longrightarrow 1$$

stop (paste (

"В местиuse", X, "про.

stenenии")

$$\begin{pmatrix} 1 & 3 & 0 & 5 \\ 0 & 0 & 0 & 0 \\ 2 & 0 & 3 & 4 \\ 1 & 3 & 0 & 5 \end{pmatrix}$$

$M\{i, j\}$

$$\Rightarrow M == 0 \longrightarrow \begin{array}{l} apply(\\ M == 0, \\ 1, \\ all) \end{array} \rightarrow$$

вектор

$$\begin{pmatrix} F \\ T \\ F \\ F \end{pmatrix}$$

$\longrightarrow any(FTFF) \longrightarrow T$

$any(apply(M == 0, 1, all))$

$any(apply(M, 1, function(x)\{all(x == 0)\}))$

$any(\underline{apply(M == 0, 1, sum)} == ncol(M)) = T$

$\qquad 1\ 4\ 1\ 1 \longrightarrow FTFF$

	X = F T T T F	X = T T T
sum(x) = length(x)	3 =/= 5	3 = 3
any	T	T
all	F	T

x = 0 1 2 3

any(x==0)   any(T F F F) → T

all(x::0)   all(T F F F) → F

$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ 1 & 0 & 0 & 0 \\ 1 & 2 & 3 & 4 \\ 1 & 2 & 3 & 5 \end{pmatrix} \Rightarrow$$

apply(M,

1,

function(x)f

sum (apply(M, 1,

function(x)f

all (y == x)j))j)

$x = 1234$

T
F
T
F $\Rightarrow 2$

x   1 2 3 4

y   1 2 3 5

———————
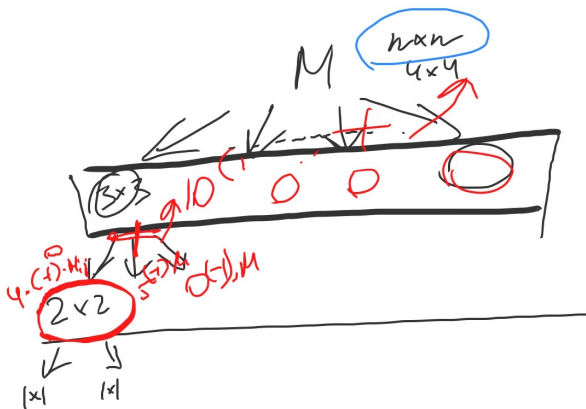
TTT F

any(

sum([2 , 1 , 2 , 1] > 1)

TFTF   == 0

deter $\rightarrow$ function (M)

0) Проверки

1) Частные случаи   1×1, 2×2, 3×3 $\Longrightarrow$ ЮОР

3) через миноры $\rightarrow$ for

$$\Sigma \quad \text{------} \quad deter (\dots)$$

M $\boxed{\begin{array}{c} n \times n \\ 4 \times 4 \end{array}}$

ЮОР
3×3

n-3

$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 3 & 4 \\ 7 & 8 & 3 & 4 \\ 1 & 2 & 4 & 3 \end{pmatrix}$$

3×3

10 (1 0 0 0 0

2×2

4·(1)·M₁₁   5·(1)×M   (-1),M

|×| |×|