

RStudio

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```

1 N=10
2 M=10
3 set.seed(Sys.time())
4 matrix = matrix(rnorm(N), N, M)
5 df = data.frame(matrix)
6 df1 = sin(df) + df #vectorized
7
8
9
10- for (i in 1:N){
11-   for (j in 1:M){
12-     df[i,j] = df[i,j] + sin(df[i,j])
13-   }
14- }
15 df
16
17 df-df1
18
19 # System time difference
20 system.time(sin(df) + df)
21
22- system.time(for (i in 1:N){
23-   for (j in 1:M){
24-     df[i,j] = df[i,j] + sin(df[i,j])
25-   }
26- })
27

```

Environment History Connections

Global Environment +

Data

- df 10 obs. of 10 variables
- df1 10 obs. of 10 variables
- matrix num [1:10, 1:10] 0.209 -0.266 -0.96 -0.418 0.959 ...

Values

	10L
i	10L
j	10L
M	10
N	10

Console

```

10 1.2822448 1.2822448 1.2822448 1.2822448
> df-df1
  x1 x2 x3 x4 x5 x6 x7 x8 x9 x10
1  0  0  0  0  0  0  0  0  0  0
2  0  0  0  0  0  0  0  0  0  0
3  0  0  0  0  0  0  0  0  0  0
4  0  0  0  0  0  0  0  0  0  0
5  0  0  0  0  0  0  0  0  0  0
6  0  0  0  0  0  0  0  0  0  0
7  0  0  0  0  0  0  0  0  0  0
8  0  0  0  0  0  0  0  0  0  0
9  0  0  0  0  0  0  0  0  0  0
10 0  0  0  0  0  0  0  0  0  0
> # System time difference
> system.time(sin(df) + df)
user system elapsed
0 0 0
> system.time(for (i in 1:N){
+   for (j in 1:M){
+     df[i,j] = df[i,j] + sin(df[i,j])
+   }
+ })
user system elapsed
0 0 0
>

```

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- matrix num [1:10, 1:10] 0.209 -0.266 -0.96 -0.418 0.959 ...

Values

	10L
i	10L
j	10L
M	10
N	10

Console

```

+ }
+ }
> df
  x1      x2      x3      x4      x5      x6
1  0.4160570 0.4160570 0.4160570 0.4160570 0.4160570 0.4160570
2 -0.5291049 -0.5291049 -0.5291049 -0.5291049 -0.5291049 -0.5291049
3 -1.7792151 -1.7792151 -1.7792151 -1.7792151 -1.7792151 -1.7792151
4 -0.8244916 -0.8244916 -0.8244916 -0.8244916 -0.8244916 -0.8244916
5  1.7776944 1.7776944 1.7776944 1.7776944 1.7776944 1.7776944
6 -1.5258252 -1.5258252 -1.5258252 -1.5258252 -1.5258252 -1.5258252
7 -2.1704333 -2.1704333 -2.1704333 -2.1704333 -2.1704333 -2.1704333
8 -0.5007963 -0.5007963 -0.5007963 -0.5007963 -0.5007963 -0.5007963
9  0.7027715 0.7027715 0.7027715 0.7027715 0.7027715 0.7027715
10 1.2822448 1.2822448 1.2822448 1.2822448 1.2822448 1.2822448
  x7      x8      x9      x10
1  0.4160570 0.4160570 0.4160570 0.4160570
2 -0.5291049 -0.5291049 -0.5291049 -0.5291049
3 -1.7792151 -1.7792151 -1.7792151 -1.7792151
4 -0.8244916 -0.8244916 -0.8244916 -0.8244916
5  1.7776944 1.7776944 1.7776944 1.7776944
6 -1.5258252 -1.5258252 -1.5258252 -1.5258252
7 -2.1704333 -2.1704333 -2.1704333 -2.1704333
8 -0.5007963 -0.5007963 -0.5007963 -0.5007963
9  0.7027715 0.7027715 0.7027715 0.7027715
10 1.2822448 1.2822448 1.2822448 1.2822448
> df-df1

```

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