ACADGILD

SESSION 3: FOUNDATIONAL R PROGRAMMING

Assignment 2

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1. Introduction

This assignment will help you understand the concepts learnt in the session.

2. Objective

This assignment will test your skills on Data Structures in R.

3. Prerequisites

Not applicable.

4. Associated Data Files

Not applicable.

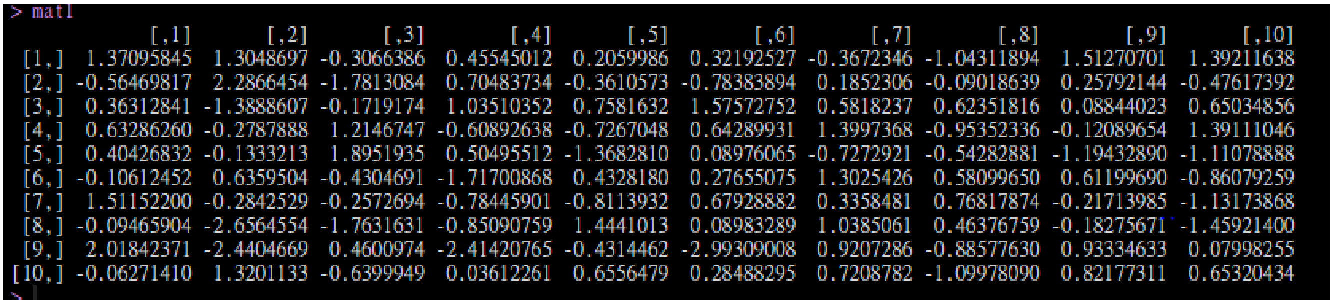
5. Problem Statement

1. Create an m x n matrix with replicate(m, rnorm(n)) with m=10 column vectors of n=10 elements each, constructed with rnorm(n), which creates random normal numbers.

    - Then we transform it into a dataframe (thus 10 observations of 10 variables) and perform an algebraic operation on each element using a nested for loop: at each iteration, every element referred by the two indexes is incremented by a sinusoidal function, compare the vectorized and non-vectorized form of creating the solution and report the system time differences.

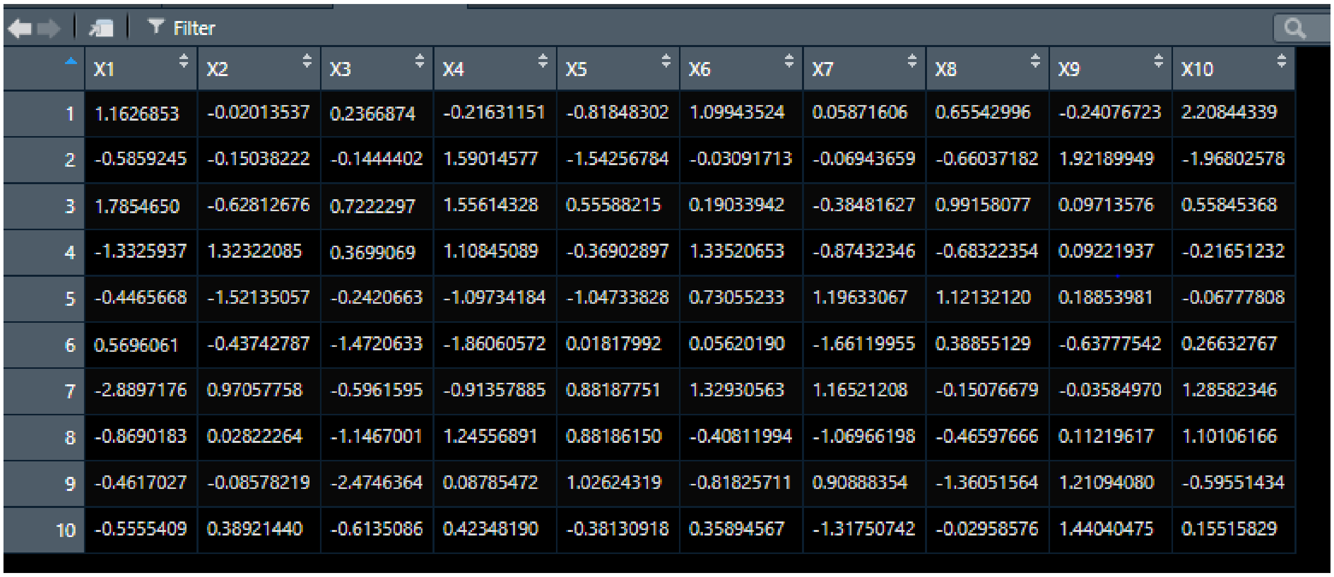
```
ANS: #Vectorized form
set.seed(42)

#create matrix
mat1<- replicate(10,rnorm(10))
mat1
```



```
> mat1
             [,1]       [,2]       [,3]        [,4]       [,5]        [,6]       [,7]        [,8]        [,9]       [,10]
 [1,]  1.37095845  1.3048697 -0.3066386  0.45545012  0.2059986  0.32192527 -0.3672346 -1.04311894  1.51270701  1.39211638
 [2,] -0.56469817  2.2866454 -1.7813084  0.70483734 -0.3610573 -0.78383894  0.1852306 -0.09018639  0.25792144 -0.47617392
 [3,]  0.36312841 -1.3888607 -0.1719174  1.03510352  0.7581632  1.57572752  0.5818237  0.62351816  0.08844023  0.65034856
 [4,]  0.63286260 -0.2787888  1.2146747 -0.60892638 -0.7267048  0.64289931  1.3997368 -0.95352336 -0.12089654  1.39111046
 [5,]  0.40426832 -0.1333213  1.8951935  0.50495512 -1.3682810  0.08976065 -0.7272921 -0.54282881 -1.19432890 -1.11078888
 [6,] -0.10612452  0.6359504 -0.4304691 -1.71700868  0.4328180  0.27655075  1.3025426  0.58099650  0.61199690 -0.86079259
 [7,]  1.51152200 -0.2842529 -0.2572694 -0.78445901 -0.8113932  0.67928882  0.3358481  0.76817874 -0.21713985 -1.13173868
 [8,] -0.09465904 -2.6564554 -1.7631631 -0.85090759  1.4441013  0.08983289  1.0385061  0.46376759 -0.18275671 -1.45921400
 [9,]  2.01842371 -2.4404669  0.4600974 -2.41420765 -0.4314462 -2.99309008  0.9207286 -0.88577630  0.93334633  0.07998255
[10,] -0.06271410  1.3201133 -0.6399949  0.03612261  0.6556479  0.28488295  0.7208782 -1.09978090  0.82177311  0.65320434
>
```

```
#transform into data frame
frames= data.frame(mat_1)
frames<- df_1 + 10*sin(0.75*pi)
```



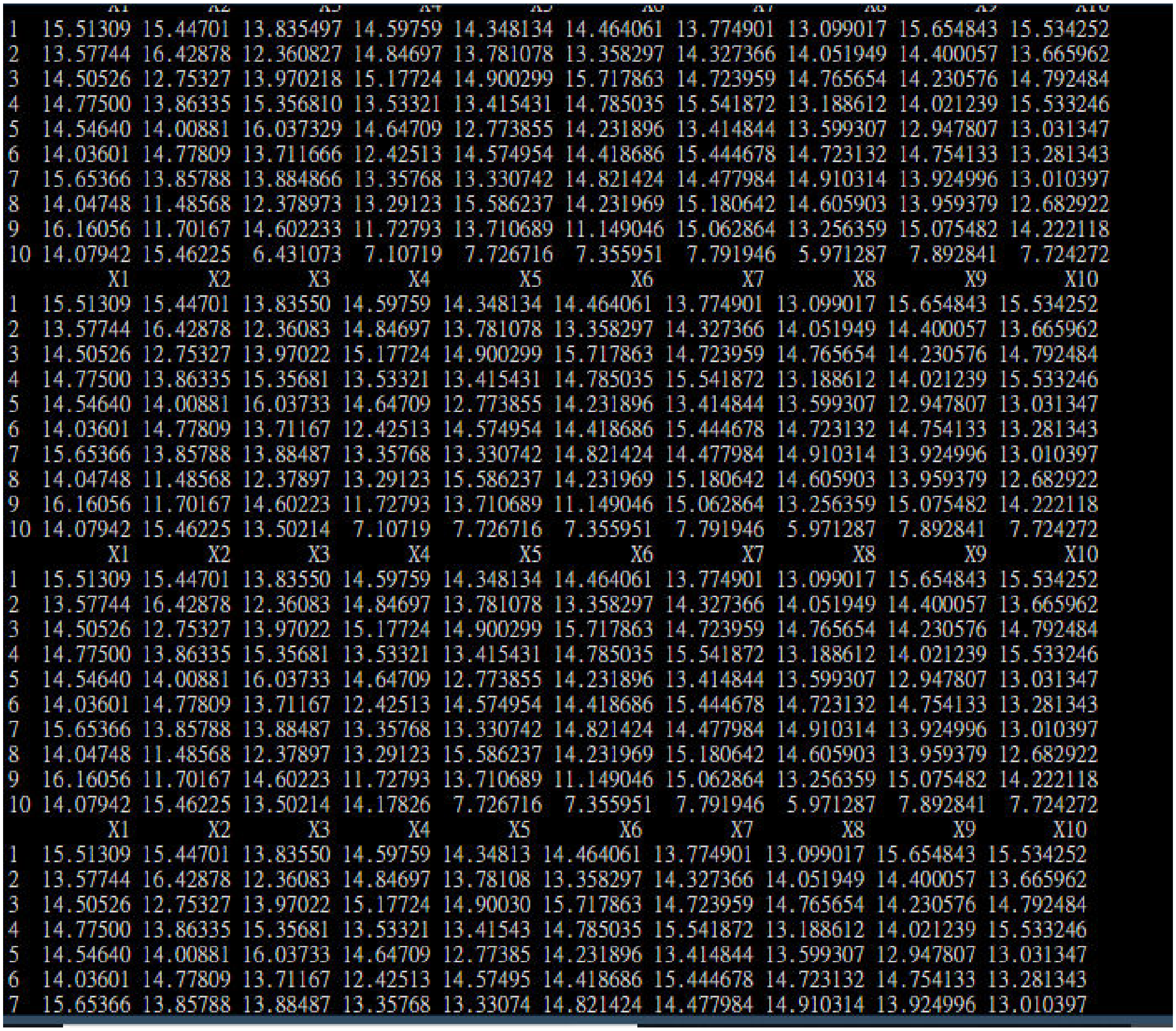
	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
1	1.1626853	-0.02013537	0.2366874	-0.21631151	-0.81848302	1.09943524	0.05871606	0.65542996	-0.24076723	2.20844339
2	-0.5859245	-0.15038222	-0.1444402	1.59014577	-1.54256784	-0.03091713	-0.06943659	-0.66037182	1.92189949	-1.96802578
3	1.7854650	-0.62812676	0.7222297	1.55614328	0.55588215	0.19033942	-0.38481627	0.99158077	0.09713576	0.55845368
4	-1.3325937	1.32322085	0.3699069	1.10845089	-0.36902897	1.33520653	-0.87432346	-0.68322354	0.09221937	-0.21651232
5	-0.4465668	-1.52135057	-0.2420663	-1.09734184	-1.04733828	0.73055233	1.19633067	1.12132120	0.18853981	-0.06777808
6	0.5696061	-0.43742787	-1.4720633	-1.86060572	0.01817992	0.05620190	-1.66119955	0.38855129	-0.63777542	0.26632767
7	-2.8897176	0.97057758	-0.5961595	-0.91357885	0.88187751	1.32930563	1.16521208	-0.15076679	-0.03584970	1.28582346
8	-0.8690183	0.02822264	-1.1467001	1.24556891	0.88186150	-0.40811994	-1.06966198	-0.46597666	0.11219617	1.10106166
9	-0.4617027	-0.08578219	-2.4746364	0.08785472	1.02624319	-0.81825711	0.90888354	-1.36051564	1.21094080	-0.59551434
10	-0.5555409	0.38921440	-0.6135086	0.42348190	-0.38130918	0.35894567	-1.31750742	-0.02958576	1.44040475	0.15515829

```
for(i in 1:10){
  for(j in 1:10){
    df_1[i,j]<- df_1[i,j] + 10*sin(0.75*pi)
    print(df_1)
  }
}

#time difference

system.time(
  df_1[i,j]<- df_1[i,j] + 10*sin(0.75*pi)
)

system.time(
  for(i in 1:10){
    for(j in 1:10){
      df_1[i,j]<- df_1[i,j] + 10*sin(0.75*pi)
    }
  })
```



```
         X1       X2        X3       X4        X5        X6        X7        X8        X9       X10
1  15.51309 15.44701 13.835497 14.59759 14.348134 14.464061 13.774901 13.099017 15.654843 15.534252
2  13.57744 16.42878 12.360827 14.84697 13.781078 13.358297 14.327366 14.051949 14.400057 13.665962
3  14.50526 12.75327 13.970218 15.17724 14.900299 15.717863 14.723959 14.765654 14.230576 14.792484
4  14.77500 13.86335 15.356810 13.53321 13.415431 14.785035 15.541872 13.188612 14.021239 15.533246
5  14.54640 14.00881 16.037329 14.64709 12.773855 14.231896 13.414844 13.599307 12.947807 13.031347
6  14.03601 14.77809 13.711666 12.42513 14.574954 14.418686 15.444678 14.723132 14.754133 13.281343
7  15.65366 13.85788 13.884866 13.35768 13.330742 14.821424 14.477984 14.910314 13.924996 13.010397
8  14.04748 11.48568 12.378973 13.29123 15.586237 14.231969 15.180642 14.605903 13.959379 12.682922
9  16.16056 11.70167 14.602233 11.72793 13.710689 11.149046 15.062864 13.256359 15.075482 14.222118
10 14.07942 15.46225  6.431073  7.10719  7.726716  7.355951  7.791946  5.971287  7.892841  7.724272
         X1       X2       X3       X4        X5        X6        X7        X8        X9       X10
1  15.51309 15.44701 13.83550 14.59759 14.348134 14.464061 13.774901 13.099017 15.654843 15.534252
2  13.57744 16.42878 12.36083 14.84697 13.781078 13.358297 14.327366 14.051949 14.400057 13.665962
3  14.50526 12.75327 13.97022 15.17724 14.900299 15.717863 14.723959 14.765654 14.230576 14.792484
4  14.77500 13.86335 15.35681 13.53321 13.415431 14.785035 15.541872 13.188612 14.021239 15.533246
5  14.54640 14.00881 16.03733 14.64709 12.773855 14.231896 13.414844 13.599307 12.947807 13.031347
6  14.03601 14.77809 13.71167 12.42513 14.574954 14.418686 15.444678 14.723132 14.754133 13.281343
7  15.65366 13.85788 13.88487 13.35768 13.330742 14.821424 14.477984 14.910314 13.924996 13.010397
8  14.04748 11.48568 12.37897 13.29123 15.586237 14.231969 15.180642 14.605903 13.959379 12.682922
9  16.16056 11.70167 14.60223 11.72793 13.710689 11.149046 15.062864 13.256359 15.075482 14.222118
10 14.07942 15.46225 13.50214  7.10719  7.726716  7.355951  7.791946  5.971287  7.892841  7.724272
         X1       X2       X3       X4        X5        X6        X7        X8        X9       X10
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3  14.50526 12.75327 13.97022 15.17724 14.900299 15.717863 14.723959 14.765654 14.230576 14.792484
4  14.77500 13.86335 15.35681 13.53321 13.415431 14.785035 15.541872 13.188612 14.021239 15.533246
5  14.54640 14.00881 16.03733 14.64709 12.773855 14.231896 13.414844 13.599307 12.947807 13.031347
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8  14.04748 11.48568 12.37897 13.29123 15.586237 14.231969 15.180642 14.605903 13.959379 12.682922
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2  13.57744 16.42878 12.36083 14.84697 13.78108 13.358297 14.327366 14.051949 14.400057 13.665962
3  14.50526 12.75327 13.97022 15.17724 14.90030 15.717863 14.723959 14.765654 14.230576 14.792484
4  14.77500 13.86335 15.35681 13.53321 13.41543 14.785035 15.541872 13.188612 14.021239 15.533246
5  14.54640 14.00881 16.03733 14.64709 12.77385 14.231896 13.414844 13.599307 12.947807 13.031347
6  14.03601 14.77809 13.71167 12.42513 14.57495 14.418686 15.444678 14.723132 14.754133 13.281343
7  15.65366 13.85788 13.88487 13.35768 13.33074 14.821424 14.477984 14.910314 13.924996 13.010397
```

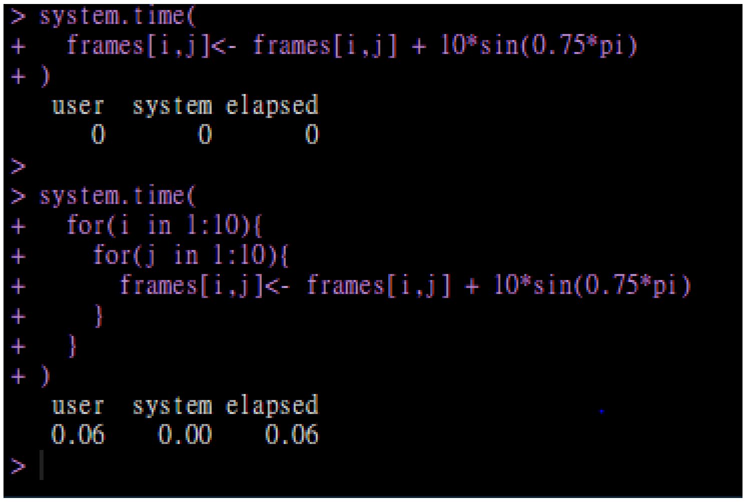

```
> system.time(
+   frames[i,j]<- frames[i,j] + 10*sin(0.75*pi)
+ )
   user  system elapsed 
      0       0       0 
>
> system.time(
+   for(i in 1:10){
+     for(j in 1:10){
+       frames[i,j]<- frames[i,j] + 10*sin(0.75*pi)
+     }
+   }
+ )
   user  system elapsed 
   0.06    0.00    0.06 
> 
```