# SESSION 3: FOUNDATIONALR PROGRAMMING

## Assignment 2

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.

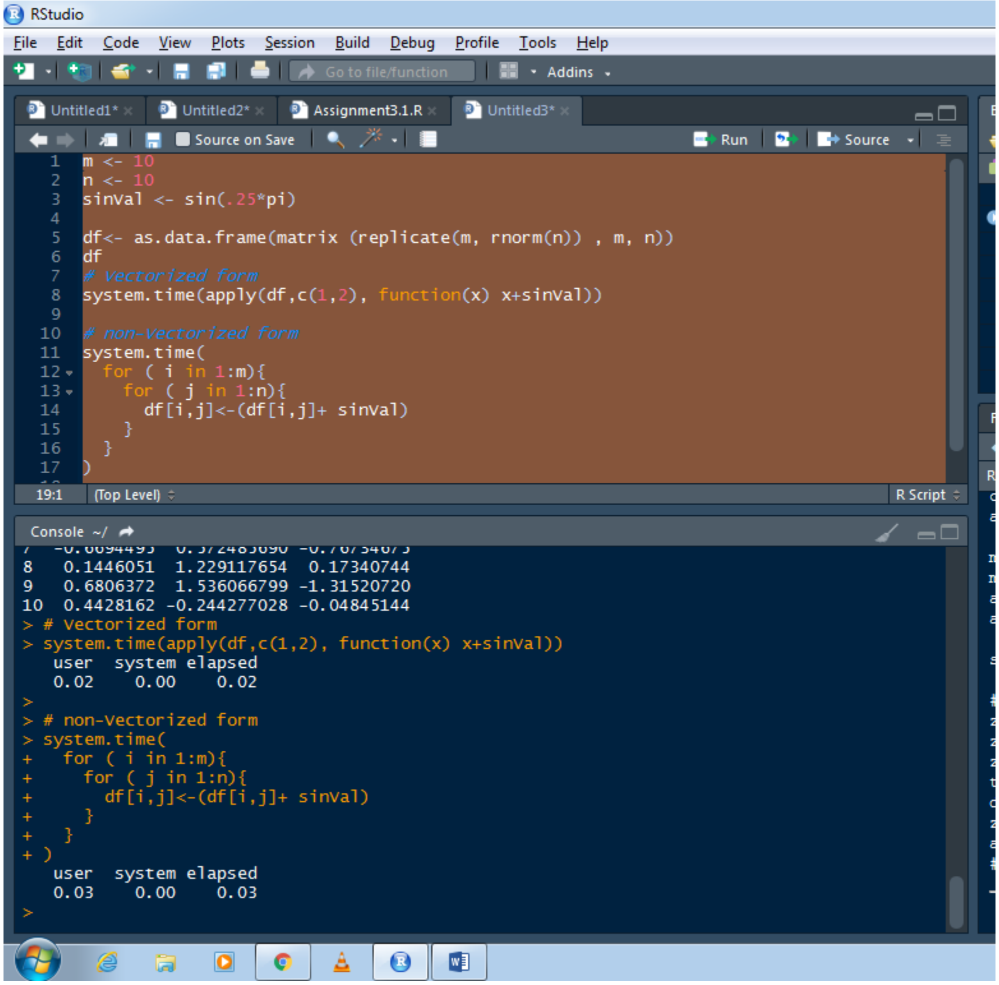
***Answer***:

```
m <- 10
n <- 10
sinVal <- sin(.25*pi)

df<- as.data.frame(matrix (replicate(m, rnorm(n)) , m, n))
df
# Vectorized form
system.time(apply( df , c(1,2), function(x) x + sinVal ) )

# non-Vectorized form
system.time(
    for ( i in 1:m){
        for ( j in 1:n){
            df[i,j]<-(df[i,j]+ sinVal)
        }
    }
)
```

**Output:**



```
m <- 10
n <- 10
sinVal <- sin(.25*pi)

df<- as.data.frame(matrix (replicate(m, rnorm(n)) , m, n))
df
# Vectorized form
system.time(apply(df,c(1,2), function(x) x+sinVal))

# non-Vectorized form
system.time(
  for ( i in 1:m){
    for ( j in 1:n){
      df[i,j]<-(df[i,j]+ sinVal)
    }
  }
)
```

```
7  -0.6094495  0.372483690 -0.76734075
8   0.1446051  1.229117654  0.17340744
9   0.6806372  1.536066799 -1.31520720
10  0.4428162 -0.244277028 -0.04845144
> # Vectorized form
> system.time(apply(df,c(1,2), function(x) x+sinVal))
   user  system elapsed 
   0.02    0.00    0.02 
> 
> # non-Vectorized form
> system.time(
+   for ( i in 1:m){
+     for ( j in 1:n){
+       df[i,j]<-(df[i,j]+ sinVal)
+     }
+   }
+ )
   user  system elapsed 
   0.03    0.00    0.03 
> 
```