Task 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 sinusoidal function, compare the vectorized and non-vectorized form of creating the solution and report the system time difference.

Ans:-

```
#vectorized form
matrix <- replicate(10,rnorm(10))

#transform into data frame
df = data.frame(matrix)
df[i,j] <- df[i,j]+10*sin(0.75*pi)
df

#non-vectorized form
matrix<- replicate(10,rnorm(10))

#transform into data frame
df= data.frame(matrix)

for(m in 1:10){
  for(n in 1:10){
        df1 <- lapply(df, function(x) x +10*sin(0.75*pi))
        print(df1)
  }
}

#time difference

system.time(df)

system.time(
  for(i in 10){
    for(j in 10){
      df1 <- lapply(df, function(x) x + 10*sin(0.75*pi))
      df1
    }
  }
)
```

Task 2:

Define matrix mymat by replicating the sequence 1:5 for 4 times and transforming into a matrix, sum over rows and columns

Ans:-

```
mymat <- replicate(4, seq(1:5))

mymat
```

```
     [,1] [,2] [,3] [,4]
[1,]    1    1    1    1
[2,]    2    2    2    2
[3,]    3    3    3    3
[4,]    4    4    4    4
[5,]    5    5    5    5
```

```
apply(mymat,1,sum)
```

```
[1]  4  8 12 16 20
```

```
apply(mymat,2,sum)
```

```
[1] 15 15 15 15
```