# Quiz 1 Answer Key

**Question 1**

a) Please fill in the blanks.

I) Vectors in R are created by using ** c() ** command.

II) Both ** matrix()** and ** c() ** commands are used to create a matrix in R.

III) Vectors are combined with **data.frame()** command to create a data frame in R.

b) Use the command line in R to get help on the following commands. Briefly describe the purpose of each command.

I) which

```
help(which)
## starting httpd help server ... done
```

It gives the TRUE indices of a logical object, allowing for array indices.

II) sort()

```
help(sort)
```

It orders a vector or factor (partially) into ascending or descending order.

**Question 2**

**a)**

```
seq(1,9,2)
## [1] 1 3 5 7 9
```

**b)**

```
seq(8,20,2.4)
## [1]  8.0 10.4 12.8 15.2 17.6 20.0
```

**c)**

```
rep(seq(1,4),3)
##  [1] 1 2 3 4 1 2 3 4 1 2 3 4
```

**d)**

```
rep(seq(1,4),each=3)
##  [1] 1 1 1 2 2 2 3 3 3 4 4 4
```

**Question 3**

**a)**

```
height<-c(180,165,160,193,175,156)
weight<-c(87,58,65,100,80,60)
```

**b)**

```
mean(height)
## [1] 171.5
```

The average value of height is 171.5 cm.

```
sd(height)
## [1] 13.86723
```

The deviation value is 13.86 which can be considered as high.

```
mean(weight)
## [1] 75
```

The average value of weight is 75 kg.

```
sd(weight)
## [1] 16.78094
```

The deviation value is 16.78 which can be considered as high.

**d)**

```
length(which(height>mean(height)))
## [1] 3
```

There are three people whose heights are above the average.

Ozdemir, O.

Room No: 234

e-mail: ozancan@metu.edu.tr

**e)**

```
length(which(weight<mean(weight)))
## [1] 3
```

There are three people whose weights are below the average.

**f)**

```
maxweight<-max(weight)
minweight<-min(weight)
cbind(maxweight,minweight)
##      maxweight minweight
## [1,]       100        58
```

**g)**

```
maxheight<-max(height)
minheight<-min(height)
cbind(maxheight,minheight)
##      maxheight minheight
## [1,]       193       156
```

**h)**

In this question you have be careful about the unit of height. The observations are recorded in terms of cm. However, the calculation of BMI requires height values in terms of m. So, you have to convert your observations from cm to m.

```
height_m<-height/100
height_m
## [1] 1.80 1.65 1.60 1.93 1.75 1.56
BMI<-weight/(height_m^2)
BMI
## [1] 26.85185 21.30395 25.39062 26.84636 26.12245 24.65483
logBMI<-log(BMI)
logBMI
## [1] 3.290335 3.058892 3.234380 3.290130 3.262795 3.204973
BMInew<-BMI[which(BMI>25)]
BMInew
## [1] 26.85185 25.39062 26.84636 26.12245
```

**Question 4**

```
X<-matrix(c(3,-1,2,1),2,2)
X
##      [,1] [,2]
## [1,]    3    2
## [2,]   -1    1
Y<-matrix(c(1,0,4,1,0,-1),2,3)
Y
##      [,1] [,2] [,3]
## [1,]    1    4    0
## [2,]    0    1   -1
2*X #multiplying matrix X with 2
##      [,1] [,2]
## [1,]    6    4
## [2,]   -2    2
X*X #multiplying matrix X with itself as component-wise
```

```
##      [,1] [,2]
## [1,]    9    4
## [2,]    1    1
X%*%X #multiplying matrix X with itself
##      [,1] [,2]
## [1,]    7    8
## [2,]   -4   -1
X%*%Y #multiplying matrix X with matrix Y
##      [,1] [,2] [,3]
## [1,]    3   14   -2
## [2,]   -1   -3   -1
t(Y) #taking the transpose of matrix Y
##      [,1] [,2]
## [1,]    1    0
## [2,]    4    1
## [3,]    0   -1
solve(X) #Taking the inverse of matrix X
##      [,1] [,2]
## [1,]  0.2 -0.4
## [2,]  0.2  0.6
```

**Question 5**

```
A<-matrix(c(6,1,1,1,5,8,9,9,9,8,2,3,1,1,3,8),4,4)
A
##      [,1] [,2] [,3] [,4]
## [1,]    6    5    9    1
## [2,]    1    8    8    1
## [3,]    1    9    2    3
## [4,]    1    9    3    8
```

**a)**

```
t(A)
##      [,1] [,2] [,3] [,4]
## [1,]    6    1    1    1
## [2,]    5    8    9    9
## [3,]    9    8    2    3
## [4,]    1    1    3    8
```

**b)**

```
A[,c(1,3)]
##      [,1] [,2]
## [1,]    6    9
## [2,]    1    8
## [3,]    1    2
## [4,]    1    3
```

**c)**

```
A[c(2,4),]
##      [,1] [,2] [,3] [,4]
## [1,]    1    8    8    1
## [2,]    1    9    3    8
```

**d)**

```
det(A)
```

```
## [1] -1566
```

**e)**

```
A[2,1]
## [1] 1
```

**f)**

```
A[1:2,3:4]
##      [,1] [,2]
## [1,]    9    1
## [2,]    8    1
```

**Question 6**

```
name<-c("bldg1","bldg2","bldg3","bldg4","bldg5","bldg6")
survey<-c(1,1,1,2,2,2)
location<-c(1,2,3,2,3,1)
floors<-c(5,10,10,11,8,12)
efficiency<-c(51,64,70,71,80,58)
data<-data.frame(name,survey,location,floors,efficiency)
data
##    name survey location floors efficiency
## 1 bldg1      1        1      5         51
## 2 bldg2      1        2     10         64
## 3 bldg3      1        3     10         70
## 4 bldg4      2        2     11         71
## 5 bldg5      2        3      8         80
## 6 bldg6      2        1     12         58
```

**a)**

```
dim(data)
## [1] 6 5
```

**b)**

```
data[,-1]
##   survey location floors efficiency
## 1      1        1      5         51
## 2      1        2     10         64
## 3      1        3     10         70
## 4      2        2     11         71
## 5      2        3      8         80
## 6      2        1     12         58
```

**c)**

```
data[,3:5]
##   location floors efficiency
## 1        1      5         51
## 2        2     10         64
## 3        3     10         70
## 4        2     11         71
## 5        3      8         80
## 6        1     12         58
```

**d)**

```
data$name[data$efficiency>50]
## [1] "bldg1" "bldg2" "bldg3" "bldg4" "bldg5" "bldg6"
```

**e)**

```
data$name[data$floors>=10]
## [1] "bldg2" "bldg3" "bldg4" "bldg6"
```

**f)**

```
data$efficiency[6]<-78
data
##    name survey location floors efficiency
## 1 bldg1      1        1      5         51
## 2 bldg2      1        2     10         64
## 3 bldg3      1        3     10         70
## 4 bldg4      2        2     11         71
## 5 bldg5      2        3      8         80
## 6 bldg6      2        1     12         78
```

**g)**

```
write.table(data,"data.txt")
```

**Question 7**

```
sum<-0
for (i in 1:30){ sum<-sum+(i^2) }
sum
## [1] 9455
```

**Question 8**

```
fibo<-c()
for (i in 1:12){
  fibo[1]=1
  fibo[2]=2
  fibo[i+2]=fibo[i+1]+fibo[i]
  }

fibo
##  [1]   1   2   3   5   8  13  21  34  55  89 144 233 377 610
```

**Question 9**

```
n<-6
mymat<-matrix(0,n,n)

for ( i in 1:nrow(mymat))   {
for ( j in 1:ncol(mymat))  {
if ( i==j)  {mymat[i,j]<-1}
else { mymat[i,j]<-i+j }

}
}
mymat
##      [,1] [,2] [,3] [,4] [,5] [,6]
## [1,]    1    3    4    5    6    7
## [2,]    3    1    5    6    7    8
## [3,]    4    5    1    7    8    9
## [4,]    5    6    7    1    9   10
## [5,]    6    7    8    9    1   11
## [6,]    7    8    9   10   11    1
```


Room No: 234
e-mail: ozancan@metu.edu.tr

**Question 10**

```
math_function<-function(x){
  if(x<=3){y = (3*x)+2 }
  else{y = (2*x)-(0.5*x^2)}
  return(y)
}
math_function(2)
## [1] 8
math_function(6)
## [1] -6
```

**Question 11**

```
fact = function(n)
{
if(n<=1) 1
else n*fact(n-1)
}

fact(4)
## [1] 24
```