Part – A

1. **Write a program to create a 3 X 3 matrices A and B and perform the following operations.**
   a. AT .B
   b. BT .(A.AT)
   c. (A.AT).BT
   d. [(B.BT)+(A.AT)-100I3] -1

```
cat("Create a 3 * 3 matrices A and B\n")
A <- matrix(data = 1:9, nrow = 3, ncol = 3)
B <- matrix(data = 4:12, nrow = 3, ncol = 3)

cat("\nMatrix A\n")
print(A)

cat("\nMatrix B\n")
print(B)

cat("\na. First Operation\n")
print(t(A) %*% B)

cat("\nb.Second operation\n")
print(t(B) %*% (A %*% t(A)))

cat("\nc.Third operation\n")
print((A %*% t(A)) %*% t(B))

cat("\nd. Fourth Operation\n")
print(solve((B %*% t(B)) + (A %*% t(A)) - (100 * diag(3))))
```

Output:

```
Create a 3 * 3 matrices A and B

Matrix A
     [,1] [,2] [,3]
[1,]    1    4    7
[2,]    2    5    8
[3,]    3    6    9

Matrix B
     [,1] [,2] [,3]
[1,]    4    7   10
[2,]    5    8   11
[3,]    6    9   12

a. First Operation
     [,1] [,2] [,3]
[1,]   32   50   68
[2,]   77  122  167
[3,]  122  194  266

b.Second operation
     [,1] [,2] [,3]
[1,] 1194 1425 1656
[2,] 1896 2262 2628
[3,] 2598 3099 3600

c.Third operation
     [,1] [,2] [,3]
[1,] 1710 1944 2178
[2,] 2043 2322 2601
[3,] 2376 2700 3024

d. Fourth Operation
              [,1]         [,2]         [,3]
[1,] -0.007308822  0.003212978  0.003734779
[2,]  0.003212978 -0.006301452  0.004184118
[3,]  0.003734779  0.004184118 -0.005366543
>
```

2. **Write an R program to find roots of quadratic equations using user defined functions. Test the program user supplied values for all possible cases.**

```
QE <- function(a, b, c) {
D <- (b * b) - (4 * a * c)
if (D > 0) # in the case of (D>0o
{
Root1 <- (-b + sqrt(D)) / (2 * a)
Root2 <- (-b - sqrt(D)) / (2 * a)
cat("\nRoots are real and Different\n")
cat("Root1:", Root1)
cat("\nRoot2:", Root2)
} else if (D == 0) # in the case of (D=0)
{
Root1 <- -b / (2 * a)
Root2 <- Root1
cat("\nRoots are Equal\n")
cat("Root1:", Root1)
cat("\nRoot2:", Root2)
} else # in the case of (D<0)
{
cat("\nRoots are Imaginary")
}
}
cat("Find Roots of Quadratic equation\n")
a <- as.numeric(readline("Enter value of a number: "))
b <- as.numeric(readline("Enter value of b number: "))
c <- as.numeric(readline("Enter value of c number: "))
QE(a, b, c)
```

Output:

```
> source("~/.active-rstudio-document")
Find Roots of Quadratic equation
Enter value of a number: 1
Enter value of b number: -3
Enter value of c number: 2

Roots are real and Different
Root1: 2
Root2: 1
> source("~/.active-rstudio-document")
Find Roots of Quadratic equation
Enter value of a number: 1
Enter value of b number: -2
Enter value of c number: 1

Roots are Equal
Root1: 1
Root2: 1
> source("~/.active-rstudio-document")
Find Roots of Quadratic equation
Enter value of a number: 1
Enter value of b number: 2
Enter value of c number: 5

Roots are Imaginary
>
```

3. **Write an R script to generate prime numbers between two numbers using loops.**

```
a <- as.numeric(readline("Enter any number : "))
b <- as.numeric(readline("Enter any number : "))
cat("\nprime num between a and b: \n")
for (i in a:b) {
flag <- 0
if (i > 1) {
flag <- 1
for (j in 2:(i - 1)) {
if ((i %% j) == 0) {
flag <- 0
break
}
}
}
if (i == 2) flag <- 1
if (flag == 1) {
cat(" ", i)
}
}
```

Output:

```
Enter any number : 23
Enter any number : 80

prime num between a and b:
  23  29  31  37  41  43  47  53  59  61  67  71  73  79
>
```