ACADGILD

SESSION 3:
FOUNDATIONAL R PROGRAMMING

Assignment 1

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1. Problem Statement

1. Define an m x n matrix of zeros and then enters a nested-for loop to fill the locations of the matrix, only if the two indexes differ.

- The purpose is to create a lower triangular matrix, that is a matrix whose elements below the main diagonal are non-zero, the others are left untouched to their initialized zero value.

- When the indexes are equal (if condition in the inner loop, which runs over j, the column index), a break is executed and the innermost loop is interrupted with a direct jump to the instruction following the inner loop, which is a print; then control gets to the outer for condition (over the rows, index i), which is evaluated again.

- If the indexes differ, the assignment is performed and the counter is incremented by 1.

- At the end, the program prints the counter ctr, which contains the #number of elements that were assigned.

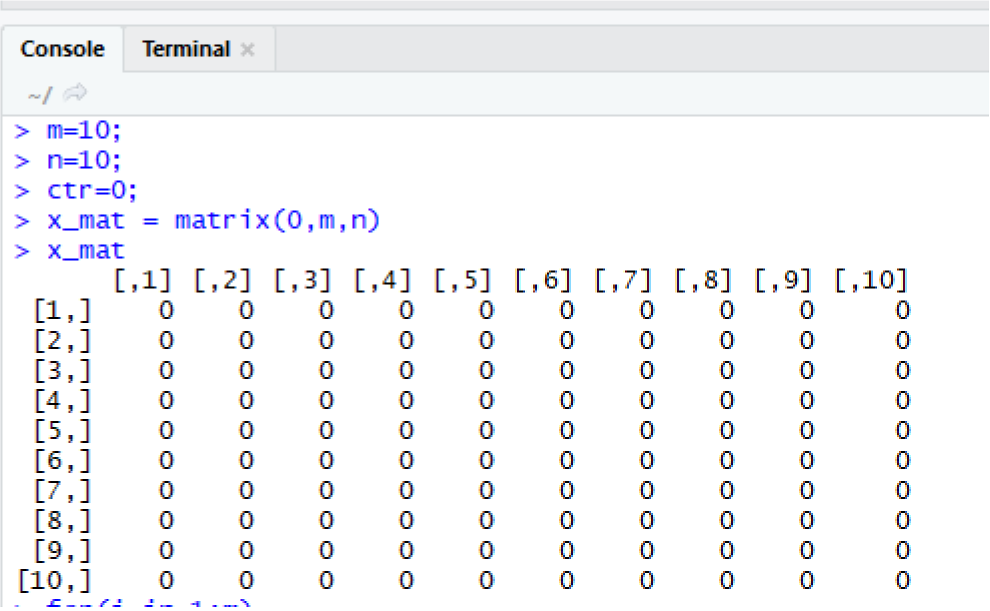
2. Solution

The R-script for the given problem is as follows:

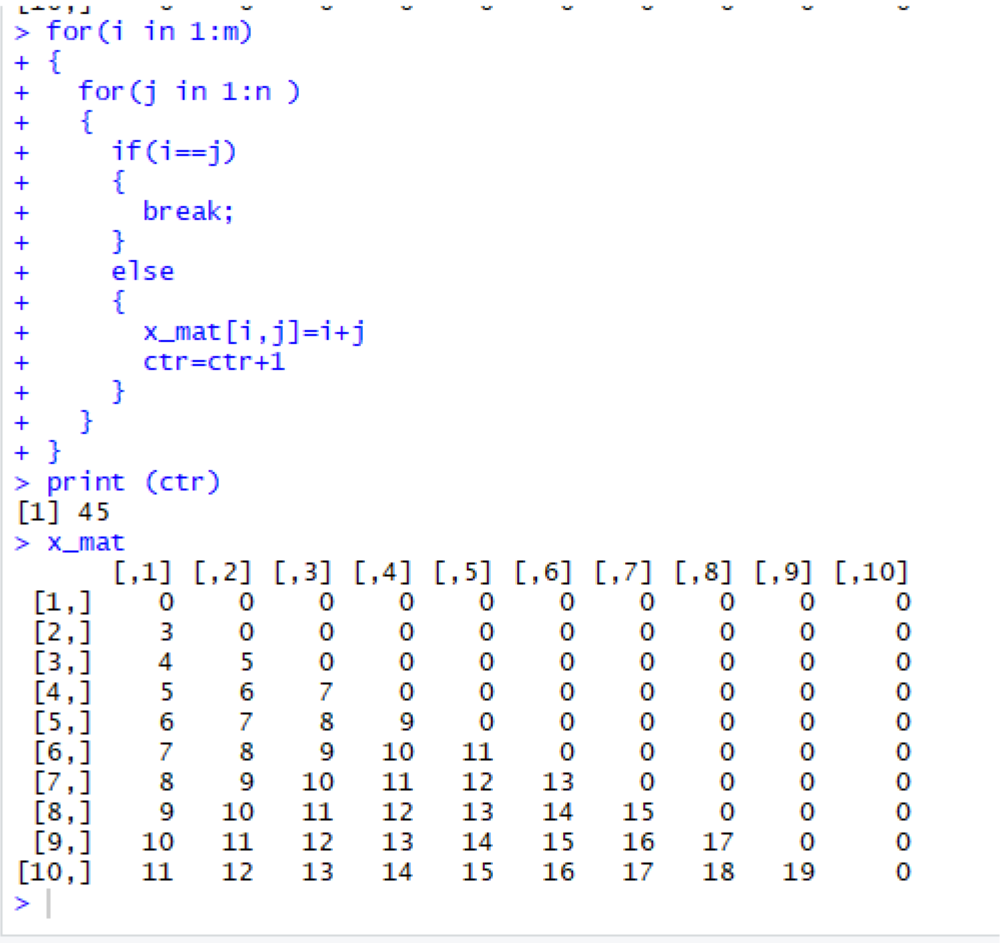
```
m=10;
n=10;
ctr=0;
xmat = matrix(0,m,n)
xmat
for(i in 1:m)
{
 for(j in 1:n )
 {
  if(i==j)
  {
   break;
  }
  else
  {
   x_mat[i,j]=i+j
   ctr=ctr+1
  }
 }
}
print (ctr)
xmat
```

Here m x n matrix of zeros is created using matrix(0,m,n); where m=10 and n=10

The output of the R-Script is given as follows:



```
> m=10;
> n=10;
> ctr=0;
> x_mat = matrix(0,m,n)
> x_mat
      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10]
 [1,]    0    0    0    0    0    0    0    0    0     0
 [2,]    0    0    0    0    0    0    0    0    0     0
 [3,]    0    0    0    0    0    0    0    0    0     0
 [4,]    0    0    0    0    0    0    0    0    0     0
 [5,]    0    0    0    0    0    0    0    0    0     0
 [6,]    0    0    0    0    0    0    0    0    0     0
 [7,]    0    0    0    0    0    0    0    0    0     0
 [8,]    0    0    0    0    0    0    0    0    0     0
 [9,]    0    0    0    0    0    0    0    0    0     0
[10,]    0    0    0    0    0    0    0    0    0     0
```



```
> for(i in 1:m)
+ {
+   for(j in 1:n )
+   {
+     if(i==j)
+     {
+       break;
+     }
+     else
+     {
+       x_mat[i,j]=i+j
+       ctr=ctr+1
+     }
+   }
+ }
> print (ctr)
[1] 45
> x_mat
      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10]
 [1,]    0    0    0    0    0    0    0    0    0     0
 [2,]    3    0    0    0    0    0    0    0    0     0
 [3,]    4    5    0    0    0    0    0    0    0     0
 [4,]    5    6    7    0    0    0    0    0    0     0
 [5,]    6    7    8    9    0    0    0    0    0     0
 [6,]    7    8    9   10   11    0    0    0    0     0
 [7,]    8    9   10   11   12   13    0    0    0     0
 [8,]    9   10   11   12   13   14   15    0    0     0
 [9,]   10   11   12   13   14   15   16   17    0     0
[10,]   11   12   13   14   15   16   17   18   19     0
> 
```

- Hence, 10X10 lower triangular matrix is created whose elements below the main diagonal are non-zero, the others are left untouched to their initialized zero value.

- When the indexes are equal (i = = j), a break is executed and the innermost loop is interrupted with a direct jump to the instruction following the inner loop, which is a print; then control gets to the outer for condition (over the rows, index i), which is evaluated again.

- If the indexes differ (I is not equal to j), the assignment is performed and the counter (ctr)is incremented by 1.

- The program prints the counter ctr = 45 (in given sample matrix of order 10X10), which contains the number of elements that were assigned.

- The final value of x_mat gives the lower triangular matrix.