

Problem Statement

1. Define an $m \times n$ 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.

Answer :

```
m=10;
n=10;
ctr=0;
x_mat = matrix(0,m,n) # 10X10 matrix of zeros is created
x_mat
for(i in 1:m)
{
  for(j in 1:n )
  {
    if(i==j) # if the indexes are equal
    {
      break;
    }
    else # if the indexes are not equal
    {
      x_mat[i,j]=i+j
      ctr=ctr+1
    }
  }
}
print (ctr)
x_mat
```

Here $m \times n$ matrix of zeros is created using `matrix(0,m,n)`; where $m=10$ and $n=10$

- 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.