Solution of Homework Set 3

1. Create a new matrix represented by array $C[1..n, 1..n+1]$ as the hint suggests.Since matrix A remains in the same position in the new matrix C, $A[i,j] = C[i,j]$. For matrix B, element $B[i,j]$ is transformed first into $B^T[j,i]$ and then $B^T[j,i]$ is shifted 1 column to the right in the new matrix C, which is in position $[j, i+1]$. Hence, $B[i,j] = C[j, i+1]$.

To conclude it, The algorithm is:

For matrix A:
if $(j > i)$ $A[i,j] = 0$;
else $A[i,j] = C[i,j]$;
For matrix B:
if $(j > i)$ $B[i,j] = 0$;
else $B[i,j] = C[j, i+1]$;

An example is the following:

matrix A:
1 0 0
2 3 0
4 5 6
matrix B:
11 0 0
12 13 0
14 15 16
$B[3,2] = 15$
matrix B^T:
11 12 14
0 13 15
0 0 16
$B^T[2,3] = 15$
matrix C:
1 11 12 14
2 3 13 15
4 5 6 16
$C[2,4] = 15$

2. The algorithm is the following:
First, make sure that the index i, j of A is in the range $[1...n]$. If not,output error message. Then

if $(|i - j| > 1)$
$A[i, j] = 0;$
else if $(i == 1)$
$A[i, j] = B[j];$
else
$A[i, j] = B[2 + (i - 2) * 3 + ((j - i) + 2)] = B[2i + j - 2];$

NOTE: In $A[i, j] = B[2 + (i - 2) * 3 + ((j - i) + 2)]$, The first 2 indicates the number of non-zero elements in the first row of A. $2 + (i - 2) * 3$ indicates the number of non-zero elements from 1 to $i - 1$ rows in A. $((j - i) + 2)$ indicates that if $i = j$, add 2; if $i = j + 1$, add 1; and if $i = j - 1$, add 3.