

**BLG221E - DATA STRUCTURES**  
**HOMEWORK 1**  
**STARTING DATE: 27.02.2013 DURATION: 2 WEEKS**

In this homework, you will write a program to solve linear equations given in upper triangular form. There are N equations, and N unknowns.

<p>Upper Triangular Form:</p> $a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + \dots + a_{1n}x_n = b_1$ $a_{22}x_2 + a_{23}x_3 + \dots + a_{2n}x_n = b_2$ $a_{33}x_3 + \dots + a_{3n}x_n = b_3$ $\dots\dots\dots$ $a_{nn}x_n = b_n$	<p>Example:</p> $2x_1 + 5x_2 - 6x_3 + x_4 = 18$ $4x_2 + x_3 - 2x_4 = -15$ $7x_3 - 9x_4 = 20$ $5x_4 = -10$
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This is equivalent to the following matrix multiplication, where A is a square matrix (N by N), X and B are vectors with size N.

$$\begin{bmatrix} A \end{bmatrix} * \begin{bmatrix} X \end{bmatrix} = \begin{bmatrix} B \end{bmatrix}$$

**Back Substitution:**

- First, find the last unknown ( $X_n$ ) in the last equation.
- Then substitute its value in the equation just above it and find  $X_{n-1}$ .
- Repeat back substitution until all X's are found.

**EXAMPLE INPUT FILE**

- Your program should read A and B values from a text file named **"DATA.TXT"** which should be organized as the following example.
- First row in file should contain only one number which is N.
- Other rows should contain A values, in which the last number in a row is the corresponding B value.

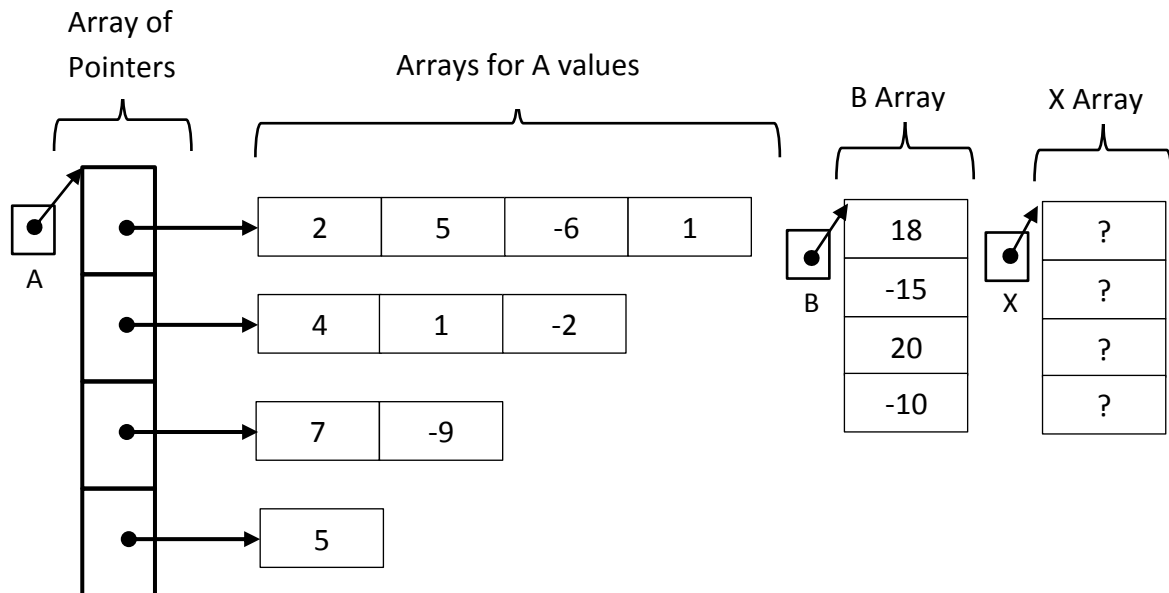
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4
2  5  -6  1  18
4  1  -2  -15
7  -9  20
5  -10

```

## PROGRAM IMPLEMENTATION

Your program should **dynamically** allocate memory for the data structures as shown in the following example. A is pointer to array of pointers , B and X are pointers to float arrays.



You should implement the following functions, and call them from main.

Function Prototype	Explanation
<pre>void solve_1(float * A[], int N,              float * B, float * X);</pre>	<b>PARAMETER METHOD:</b> The resulting X values will be sent from function to the main thru the parameter passing mechanism.
<pre>float * solve_2(float * A[], int N,                 float * B);</pre>	<b>RETURN METHOD:</b> The resulting X values will be sent from function to the main thru the return command mechanism.
<pre>void verify(float * A[], int N,             float * X);</pre>	For verification of correctness of the X results, this function recalculates and displays the B values, by using A and X values.

## EXAMPLE SCREEN OUTPUT

### INPUT DATA :

A(1,1)= 2	A(1,2)= 5	A(1,3)= -6	A(1,4)= 1	B(1) = 18
	A(2,2)= 4	A(2,3)= 1	A(2,4)= -2	B(2) = -15
		A(3,3)= 7	A(3,4)= -9	B(3) = 20
			A(4,4)= 5	B(4) = -10

### X VALUE RESULTS (WITH PARAMETER METHOD):

X(1) = 22.910713

X(2) = -4.821428

X(3) = 0.285714

X(4) = -2.000000

### X VALUE RESULTS (WITH RETURN METHOD):

XALT(1) = 22.910713

XALT(2) = -4.821428

XALT(3) = 0.285714

XALT(4) = -2.000000

### VERIFICATION RESULTS :

BVERIFY(1) = 18

BVERIFY(2) = -15

BVERIFY(3) = 20

BVERIFY(4) = -10

Devam etmek için bir tuşa basın . . .