Computer Laboratory - lab sheet 7

Task 1

Copy the program given below. Save (as `maxArray.cpp`), compile and run it.

```
// Determine the maximum value in an array
#include <iostream>
using namespace std;

int main ()
{
  const int n = 5; // number of elements in the array
  double x[n], max;

  // get the elements of the array
  cout << "input " << n << " numbers" << endl;
  for(int i=0; i<n; ++i)
     cin >> x[i];

  // first element is assumed to be maximum
  max = x[0];

  for (int i=1; i<n; i++) {
    if ( x[i] > max ) max = x[i];
  }

  cout << "maximum is " << max << endl;

  return 0;
}
```

Task 2

Modify the program given in Task 2 in order to find also the minimum element of the array.

Task 3

Write a C++ function named `double maxPos(double x[], int size);` that returns the position of the maximum element of an array x of given size. Use this function in a main program.

Task 4

Write a C++ program that reads components of two vectors **A** = (a_1, a_2, a_3) and **B** = (b_1, b_2, b_3) and outputs the dot (scalar) product and the angle in degrees between the vectors.

Task 5

Write a program that reads the elements of two square matrix of size nxn, (say **A** and **B**) and calculates the matrix multiplication of them, and then assigns the result to the matrix **C** = **A** x **B**.

Hint: If the matrices are given by $\mathbf{A} = [a_{ij}]_{nxn}$ and $\mathbf{B} = [b_{ij}]_{nxn}$ then their multiplication matrix ($\mathbf{C} = [c_{ij}]_{nxn}$) is defined as:

$$c_{ij} = \sum_{k=1}^{n} a_{ik} b_{kj}$$

Test your program with the following examples:

$$\begin{pmatrix} 1 & 0 \\ -1 & 3 \end{pmatrix} \times \begin{pmatrix} 3 & 1 \\ 2 & 1 \end{pmatrix} = \begin{pmatrix} 3 & 1 \\ 3 & 2 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \cdot \begin{pmatrix} 0 & 2 & 4 \\ 1 & 3 & 5 \\ 1 & 0 & 2 \end{pmatrix} = \begin{pmatrix} 5 & 8 & 20 \\ 11 & 23 & 53 \\ 17 & 38 & 86 \end{pmatrix}$$