261: 15th November
C Programming

Arrays

Arrays are a way of giving several variables the same name. We distinguish one from another by putting a number in brackets, after the variable name. They are extremely useful because we can include them in 'for' loops and use the control variable of the 'for' loop (i on the last tutorial sheet) to address each one in turn. Common applications include the components of a vector and the elements of a matrix.

We declare arrays in the same way as we do normal variables, except that we include a pair of square brackets on the end of the variable name and put the number of such variables, between the brackets.

So instead of

```
int x;
```

we use

```
int x[3];
```

This declares three variables x[0], x[1] and x[2], each of which are separate.

We can also declare two dimensional arrays with the command

```
int x[3][3];
```

This would give us nine integers, $x[0][0]$ to $x[2][2]$.

Question

Write a program that defines two vectors, x and y, and a matrix A. Defining each vector as a 4 component array of doubles and the matrix as a $4 * 4$, two dimensional array of doubles, give A and x the following values.

$$A = \begin{pmatrix} 1.2 & 2.3 & 3.4 & 4.3 \\ 4.1 & 5.0 & 6.0 & 3.4 \\ 7.1 & 8.1 & 9.9 & 5.7 \\ 3.2 & 2.6 & 2.6 & 2.8 \end{pmatrix} \quad x = \begin{pmatrix} 1.5 \\ 4.3 \\ 2.8 \\ 3.6 \end{pmatrix}$$

Now, using two 'for' loops, to loop over the two dimensions of the matrix A, write a program that calculates $y = Ax$ and prints out each component of y on the screen.