

8 Arrays I

8.1 While-loops

A while-loop is like a for-loop except that it does not incorporate initialisation nor between-step actions. The format is

```
while ( condition holds )
{
    statement or group;
}
```

For example

```
#include <stdio.h>

main()
{
    int n;
    int x;

    n = 0;
    while ( scanf ( "%d", &x ) == 1 )
    {
        ++n; // count the number input
    }
    printf("%d numbers were input\n", n);
}

% gcc while.c
% a.out
3 1 4 1
5 9
<CTRL-D>
6 numbers were input
%
```

8.2 arrays

An array is declared using square brackets

```
int a[100], b[10];
double c[1000];
char d[4];
```

Initialisation is possible with arrays and often useful

```

int a[3] = {2,3,4};           // I don't know of shortcuts for initialising
                               // long arrays
double b[3] = {2,3,4};

char d[4] = {'a','b','c','\0'};
char e[4] = "abc";
        // d and e are identical

```

ARRAY INDEXING BEGINS at 0. The first element in the array `c` is `c[0]` and the last is `c[999]`.

8.3 Euclid's algorithm

Here is a version of Euclid's algorithm using arrays.

```

#include <stdio.h>
#include <stdlib.h>

main()
{
    int m = 165, n = 39;
    int x[100], q[100], r[100], s[100], i;

    x[0] = abs(m); x[1] = abs(n);
        // keep everything nonnegative
    r[0] = 1; r[1] = 0;
    s[0] = 0; s[1] = 1;

    for (i = 0; x[i+1] > 0; ++i)
    {
        x[i+2] = x[i] % x[i+1];
        q[i+2] = x[i] / x[i+1];
        r[i+2] = r[i] - q[i+2] * r[i+1];
        s[i+2] = s[i] - q[i+2] * s[i+1];
    }

    printf("i %d gcd %d %d*%d+%d*%d=%d\n",
        i, x[i], r[i], m, s[i], n, r[i]*m + s[i]*n );
}

Running:
i 3 gcd 3 -4*165+17*39=3

```

Question: is this program safe? Of course, there is no need to use arrays. The following more economical version produces the same results.

```

#include <stdio.h>
#include <stdlib.h>

main()
{
    int m = 165, n = 39;
    int x, y;

    x = abs(m); y = abs(n);
        // keep everything nonnegative
    int r, s, t, u;
    r = 1; t = 0;
    s = 0; u = 1;

    while ( y > 0 )
    {
        int z  = x % y;
        int q = x/y;
        int v = r - q * t;
        int w = s - q * u;

        x = y; y = z;
        r = t; t = v;
        s = u; u = w;
    }

    printf("gcd %d %d*%d+%d*%d=%d\n",
        x, r, m, s, n, r*m+s*n);
}

```

This is another example of a while loop.