C for Science - Practical Exercise #1

1. Open Visual Studio (or similar) and set up as per the handout.
   Type in the following program:

```
#include <stdio.h>
int main(void)
{
   printf("Hello World!");
   return 0;
}
```

   Compile and run it.

   (a) Replace the space between `"Hello` and `World!"` in turn with each of the 7 characters: `\n`, `\t`, `\b`, `\f`, `\\`, `\"` and `\'`. For each case, re-compile and run the program. What happens?

2. Type in the following program:

```
#include <stdio.h>
int main(void) {
   int i1=1, i2=2222, i3=333333333;
   float x1=1.0, x2=3.1415926, x3 = -1.e-10;
   printf("i1, i2, i3 = %d %d %d\n", i1, i2, i3);
   printf("x1, x2, x3 = %f %f %f\n", x1, x2, x3);
   return 0;
}
```

   Compile and run it. How does the output differ to what is expected? What do you notice when making the following changes:

   (a) Change `%d %d %d` in line 6 to `%6d %6d %6d`.

   (b) Change `%f %f %f` in line 7 to `%e %e %e`.

   (c) Change `%f %f %f` in line 7 to `%g %g %g`.

   (d) Change `%f %f %f` in line 7 to `%10.2g %10.4g %10.6g` (A warning: the exact output generated from the format descriptor `%g` can vary from compiler to compiler!)

3. **Integer Arithmetic:** Type in the following program:

```
#include <stdio.h>
int main(void) {
   short i1=11, i2=22, i3, i4, i5, i6;
   i3 = i1 + i2;
   i4 = i1 * i2;
   i5 = i1 / i2;
   i6 = i2 / i1;
   printf("i3 to i6 = %d %d %d %d\n", i3, i4, i5, i6);
   return 0;
}
```

   Compile and run it. If you change line 4 such that `i1=11111` and `i2=22222`, does the program produce what you expect? (Hint: what is $33333 - 2^{16}$)?

4. **Floating Point Arithmetic:** Type in the following program:

```
#include <stdio.h>
int main(void)
{
   float x1=1.0e5, x2=3.1415926, x3, x4, x5, x6;
   x3 = x1 + x2;
   x4 = x1 * x2;
   x5 = x1 / x2;
   x6 = x2 / x1;
   printf("x3 - x6 = %f %f %f %f\n", x3, x4, x5, x6);
   return 0;
}
```

Compile and run it.

(a) Change line 4 such that `x1=1.0e25` and `x2=3.0e10`. Does this give the result you expect?

(b) Change the operator in line 5 such that `x3=x1 % x2`, why does this not compile? (In C `%` is the modulo operator).

5. Type in the following program:

```
#include <stdio.h>
int main(void)
{
   int low = -40, high = 140, step = 5, f, c = low;
   while (c <= high)
   {
      f = 32+9*c/5;
      printf("%6d \t %6d\n", c, f);
      c = c + step;
   }
   return 0;
}
```

Compile and run it. Edit the program so that it calculated `f` correctly for `c` ranging from -40 to 140 in steps of 2. (*What type do the numbers have to be?*). Amend the `printf` so that no decimal places are printed for `c` and one decimal place is printed for the values of `f`. Add a line of code to print a heading at the beginning of the printed table.

6. The code fragment

```
#include <stdio.h>
int main(void)
{
   double a0, a1;
   printf("Enter coefficients of Linear Equation a1*x + a0 = 0\n"
          "in the order a1, a0, separated by spaces:");
   scanf("%lf %lf", &a1, &a0);
}
```

will prompt the user for two numbers and read them into the variables `a1` and `a0`. Finish the program by adding code to solve the linear equation and display the result on screen. Ensure that the case `a1 == 0.0` is dealt with properly.