

Tutorial I++

October 31

Exercise 1 [*Basic algebra*] In this exercise we will perform very basic algebraic manipulations to illustrate the usage of different type of variables and basic numerical operations in C.

We will use `printf`, `scanf` and arithmetic operators.

Write a program which reads three floating point numbers and stores them in the variables `x`, `y` and `z`. Check that it works properly, both with data input from the keyboard and reading from a file.

Extend the program in the following ways:

- (i) Print `x` to the screen
 - (a) in decimal form with 3 digits after the decimal point;
 - (b) in decimal form with 4 digits after the decimal point and with a mandatory sign (always `+` or `-`);
 - (c) in exponential form with 2 digits in the mantissa (e.g. 1.2345 would be `1.23e+00`).
- (ii) Print out the matrix

$$\begin{pmatrix} x & y & z \\ x + 1 & y + 2 & z + 3 \\ x - 1 & y - 2 & z - 3 \end{pmatrix}$$

to the screen such that for $x = 1.0$, $y = 1.1$ and $z = 1.2$ the output looks like

```
| +1.00  +1.10  +1.20 |
| +2.00  +3.10  +4.20 |
| +0.00  -0.90  -1.80 |
```

- (iii) Compute the determinant of the matrix and its trace. Print out the result in exponential form with 10 digits in the mantissa.
- (iv) Write yet another similar program which reads nine integer numbers and stores them in the variables called `a00`, `a01`, `a02`, `a10`, `a11`, `a12`, `a20`, `a21` and `a22`. Check it with input from the keyboard and from a text file. Repeat (ii) and (iii) for the matrix

$$A = \begin{pmatrix} a_{00} & a_{01} & a_{02} \\ a_{10} & a_{11} & a_{12} \\ a_{20} & a_{21} & a_{22} \end{pmatrix}.$$

Extend the program in the following ways:

- (a) Compute $(A \cdot A)_{00}$, i.e. the element in the first row and first column of the product of the matrix A with itself. Print out the result.
- (b) Compute $\text{tr}(A \cdot A)$ and print out the result.