Prof. Dr. F. Sadlo, D. Aumiller *Heidelberg, November 02, 2016*

Exercise Sheet 2

Assignment 2.1 Preprocessor [2 Points]

Both C and C++ use a so-called preprocessor which executes actions before the actual compilation process starts. The preprocessor can be controlled by using preprocessing directives which start with a `'#'`. Given is a preprocessor macro `#define SQUARE(a) a*a`, which should square a specific value a.

1. Given the macro, write a program that calculates the following function values for $f(x) = x^2$, $g(x) = (1 - x)^2$ and $h(x) = 1/x^2$ with input values $x = 1, ..., 10$. [*1 Point*]
2. Why do you get correct results for the function f, but not for g and h? [*0.5 Points*]
3. Alter the macro in a way that all functions return the correct result. [*0.5 Points*]

Assignment 2.2 Pointers, Arrays, and All the Rest [6 Points]

In this task, we want to multiply matrices using the given source code. A program sketch is provided on the course webpage. The two input matrices should be read from two separate input files, while the resulting matrix should be stored in a third file.

1. Why does the `Matrix` parameter of the function `loadMatrix` require the double asterisk `**`? [*1 Point*]
2. Complete the given functions `loadMatrix`, `multiplyMatrix` and `multiplyVectors`, such that the matrix multiplication does work. [*5 Points*]

Assignment 2.3 Output Devices [1 Points]

Assume a display with the resolution of 1000×1000 pixels should reach a refresh rate of 50 Hz. How much time can be used to generate a single pixel? (For the sake of the calculation ignore any potential overhead.)

Assignment 2.4 Lighting Models [3 Points]

Explain in your own words:

- What roles do the three different parts in the Phong shading model play (ambient, diffuse, specular)? [*1 Point*]
- The role of the exponent for the specular component. [*1 Point*]
- Why do we sometimes use multiple face normals per vertex, and sometimes not? [*1 Point*]

Submission: November 09, 2016, 6:00 pm via Moodle