Scientific Computing 16/17, Homework #1

Please return this assignment by Monday, Nov. 7. Either provide a paper copy or send a pdf by e-mail to juergen.fuhrmann@wias-berlin.de. Please do not forget to indicate your name and your Matrikelnummer.

1. First program

Set up a C++ compiler and write a program which prints "Hello world". For writing the program, you will need a text editor.

- Linux: `g++` and `clang++` can be installed using the package manager of the system
- MacOSX: you will need the Xcode development environment
- Windows: The best option seems to set up the MINGW (http://www.mingw.org/) environment which provides g++, python etc.

2. Machine epsilon

Write a program in C++ which calculates the smallest positive number ϵ such that $1+\epsilon > 1$. Print out the program and report this value for the types `float`, `double` and `long double`.

- When using `printf`, take care to use the proper format specifications for the different data types
- When printing the values, please use format specfications resp. io manipulators which guarantee that you print enough digits to represent the calculated value:

```
double d;
printf("d= %22.17e\n",d);
std::cout << "d="<<std::setprecision(20) << d << std::endl;
```

3. Summation

Write a C++ program which calculates $\sum_{n=1}^{K} \frac{1}{n^2}$ for $K = 10, 100, 1000, 10000, 100000$ and report the values.

Compare the results to the value of $\sum_{n=1}^{\infty} \frac{1}{n^2}$ (hint: look it up under "Basel problem").

What can be done in order to improve the accuracy of the calculation ?