Exercise

Computational Optoelectronics and Photonics

Dr. M. Reichelt SS 2016

PROBLEM SHEET I
Please prepare by next exercise.

1. **Beginner**

   The bachelor student Matthew Richold is trying to compile his first c++ program. It has the the general structure

   ```
   #include <iostream>
   using namespace std;
   int main(void){
     B L O C K  (a), (b), (c), or (d)
     return 0;
   }
   ```

   where BLOCK is one of the following four pieces of code:

   (a)
   ```
   const double pi = 3.14159265
   double radius = 2, circum = 2*pi*radius;
   cout << "umfaenglicher umfang = " << circum << "\n";
   ```

   (b)
   ```
   int i; double x = 0;
   for (i=1, i<10, i++)
     x = X + i; \\ add up
   cout << "result = " << x << "\n";
   ```

   (c)
   ```
   int new = 1; a = 1; b = 2;
   if (new > 5)
     a -= new; new = a;
   else
     b += new; new = b;
   cout << "a = " << a << ", b = " << b << "\n";
   ```

   (d)
   ```
   double y = 1, y_max = 50*50;
   while (0 < y <= y_max)
     y *= 2;
   cout << "y = " << y << "\n";
   ```

   Find all errors in the code and correct them to build a working program. A source text *hello.cxx* is uploaded at http://homepages.uni-paderborn.de/mreich/teaching.html

- please turn over -

2. **Warm up**

   Write two functions in c++

   ```
   double deg2rad(double deg);
   double rad2deg(double rad);
   ```

   which can convert degrees into radian measure and vice versa. With the help of these functions

   (a) generate a table which maps the interval $[0°, 360°]$ to the corresponding radian measure. (Choose a step width of $dg = 1°$.)

   (b) generate a table which maps the interval $[0, 2\pi]$ to the corresponding degress. (Choose a step width of $dr = 2\pi/360$.)

   (c) generate a table $x \to \sin(x)$ for 20 periods and plot it with *gnuplot* .

   (d) integrate the function $\sin^2(x)$ (choose dr appropriately) over 20 periods and compare with the analytic result.

   Hint: Include the file

   ```
   #include <math.h>
   ```

   to make use of the sin function and the double constant M_PI.